

# Impact Assessment of Chitetezo Mbaula

## Improved Household Firewood Stove in Rural Malawi



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March-July 2008

On behalf of

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH  
Programme for Basic Energy and Conservation (ProBEC) - Malawi



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## **Abbreviations**

CBO	Community-based organisation
CU	Concern Universal
GTZ	Gesellschaft für Technische Zusammenarbeit
HERA	Households Energy Programme (GTZ)
HEDON	Household Energy Development Organisations Network
HH	Household(s)
IFSP	Integrated food security Programme
MDGs	Millennium Development Goals (United Nations)
ProBEC	Program for Basic Energy and Conservation in Southern Africa

## 1 Executive summary

The present study examines the progress of the ProBEC dissemination of improved firewood stoves (Chitetezo Mbaula) in rural Malawi to assess the project's outcomes and the impacts resulting from stove usage. A household survey was conducted in March and April 2008, covering 327 households in six villages in Mulanje, Ntcheu and Thyolo District. Furthermore, in each village stove producers have been interviewed to gather information about their business. The analysis of the results shows that the user rate in Ligomba and Matanya (Mulanje) rose by a factor of three since the previous impact assessment in 2004. This indicates that commercial stove promotion has been established successfully. The raise of the user rate has furthermore accelerated since the commercialisation of the approach (chapter 4.1.1).

In the surveyed villages in Ntcheu and Thyolo District more progress in terms of adoption could be made in the first years of commercial stove promotion than it has been made in the first years of self-made stove dissemination in Ligomba and Matanya. But due to the short period of stove promotion in these villages, improved stove adoption is generally lower than in the Mulanje villages (chapter 4.1.1).

The adoption of the fuel saving stove can be considered as a long term transition that leads to the entire replacement of the traditional fire. This is reflected in the share of Chitetezo Mbaula owners that do also use the three stone fire every day, which is smaller in the Mulanje villages (10%), where stove promotion started first, than in Ntcheu's (25%) and Thyolo's (37%), (chapter 4.1.1). In general, the Chitetezo Mbaula serves the same functions as the three stone fire. Hence, it has the potential to replace the three stone fire (chapter 4.1.2).

Using the Chitetezo Mbaula does not influence the frequency of cooking, but the respective households more often use additional cooking facilities, either improved or traditional. A share of users even always cooks its usual meals on two facilities simultaneously. This is observed more often in the newer implementation areas in Ntcheu and Thyolo and may therefore also indicate the process of transition between the traditional fire and Chitetezo Mbaula (chapter 4.1.2).

In the surveyed Mulanje villages, people with Chitetezo Mbaula are more likely to cook outside than in the main house, whereas no major impacts on the cooking place can be recognized in the other research areas.

The correct use of the improved stove has been observed in the majority of user households. Three out of the four good cooking practices achieve the project-specific indicator that targets an adoption by 50% of users. These are the use of dry and split wood as well as using a few sticks only. However, the use of a lid is not adopted properly within the surveyed sample. The correct use of the stove, and therewith the adoption of the named good cooking practices is also indicated by field observations about the smoke emission during cooking. 86% of the improved stove users were found cooking without noticeable smoke emission (chapter 4.1.2).

Firewood is mostly collected. In Mulanje and Thyolo a number of households also rely on buying fuel wood. Women are usually in charge of firewood gathering, with girls to a lesser extent. Comparison between households mainly using three stone fire and those using Chitetezo Mbaula show that the improved stove saves between 43% und 50% of the time spent in firewood collection. Users in Mulanje and Thyolo that purchase firewood have fewer expenses due to their reduced firewood consumption (chapter 4.1.3). Retrospective statements of the stove users about their habits of firewood collection and purchase before using the Chitetezo Mbaula are consistent to these results (chapter 4.1.4).

All Chitetezo Mbaula users appreciate the benefits they gain through the improved stove. The most important advantage is the reduction of firewood used for cooking. Half of the users also mention disadvantages of the stove. Households mainly get to know about the Chitetezo Mbaula through the stove producers, second through social marketing, such as neighbours friends and local leader, and third through the implementing organisation (ProBEC, Concern Universal or Africare). This distribution indicates that stove promoters developed marketing skills. Social marketing furthermore indicates that the communities are involved and support the dissemination of the stove (chapter 4.1.4).

The surveyed stove producers groups mainly consist of women. The production rates per producer differ considerably between averaged two and ten stoves per month. Stove business turns out to be only a part-time activity with potential for scaling-up. Nevertheless, it is the most important households' income of 30% of the interviewed producers and the second most important for 35%. Most producers have no expenses for stove production, as clay is available for free. In Mulanje and Thyolo a number of producers rely on firewood purchase for the kiln firing. It is common that other women assist in clay collection in return for a stove (chapter 4.2).

Producers mainly attract their costumers through own promoting activities, such as mouth to mouth advertisement or cooking demonstrations on local functions. Stove sales are not necessarily accompanied with producers' advices about the correct stove use. Unfortunately, most good cooking practices are not promoted by half of the producers. Stove production is done jointly in each group. This allows a continuous monitoring of quality. After firing, the groups examine the stoves together to rank the different grades, which define the prices. In the visited Mulanje groups, where stoves activities were based on a self-help approach in the beginning, stoves are sold for lower prices or mostly for payment in kind. In the other groups stove marketing seems to be more economical (chapter 4.2).

The results presented with this study show that the Chitetezo Mbaula contributes to the Millennium Development Goals. Stove usage comes along with economical benefits for rural households. This benefit mainly consists of time savings due to less firewood collections. A small share of households furthermore saves money on firewood purchase. These savings in time and money contribute, however on a small scale, to the households' income as well as to their food security. Contributions of the stove to poverty reduction can be observed in a higher scale on the producers' side (chapter 5.1.1).

The Chitetezo Mbaula enables cooking with less smoke emission than with three stone fire. It therefore reduces the health hazards connected to indoor air pollution and contributes to the health of household members, especially women and children (chapter 5.1.2).

As women usually are the persons in charge for firewood collection within their families, they are also the first to benefit from the stoves' impacts. Time savings as well as the reduction of smoke pollution and of the risks of burns and fire accidents are improving women's daily life and contribute to their welfare. Stove producers, which are mainly women, are respected and supported by other villagers and the local leaders. Producer groups gain voice in community matters. It can be assumed that economic impacts associated with the stove business also contribute to empower women within their families (chapter 5.1.3).

Children, especially girls, benefit from the reduced firewood consumption, as they are also involved in firewood collection. Hence, time savings bear a potential for these children to spend more time on homework and also may increase school attendance. Furthermore, economic impacts of firewood reduction allow some families to contribute more to their children's education (chapter 5.1.4).

The survey results show that the Chitetezo Mbaula reduced the firewood consumption of the user households. It is therefore plausible that the dissemination of the improved stoves contributes to the protection of natural wood sources by reducing forest degradation caused by cook fuel removal (MDG7), (chapter 5.1.5).

Prospects for sustainability are good as users appreciate the benefits of the stove and replace it after it got damaged. However, in most of the villages it is rather early to judge about aspects of sustainability. Most of the producer groups established a continuous production, adopting adequate marketing and promotion skills, so that it seems most likely that they can go on with their business without further support. However, the outreach of their stove business is small and does usually not exceed the neighbouring villages. The partner organisations Concern Universal and Africare integrated the stove dissemination into their project planning. At least Africare is planning to scale-up their stove activities (chapter 6).

## 2 Introduction

### 2.1 Biomass Energy in rural Malawi

Biomass is the major energy source in southern Africa, especially in rural areas. Most households rely on biomass energy for cooking and space heating. The resulting pressure on forests and trees leads to extensive deforestation and erosion. The traditional cooking on open fire furthermore leads to severe problems of indoor air pollution and its associated health hazards.

Malawi is a mainly rural country with 85% of the population living in rural areas. Still, it is one of the most densely populated countries in Sub-Saharan Africa and also one of the poorest worldwide. Biomass mainly firewood and charcoal, contributes over 90% of Malawi's total energy demand. Other energy sources, such as electricity, petroleum products, coal, or other renewable resources play a minor role in energy demand and only account for 7% of energy use. Fuel wood is used by 97% of the households in rural areas of Malawi; agricultural residues also play a major role. This high reliance on firewood and also on charcoal as an energy source and the high population density coupled with low per-person agricultural productivity have a high impact on the environment and on the inhabitants. Deforestation is continuing at a high rate and firewood is becoming scarce while food shortages place a burden on the villagers.

Malawi's forestry reserves declined from 47% to 28% of the country's area in the past 25 years. Amongst others, wood fuel use is one of the major reasons of forest degradation. Its high demand cannot be covered sustainably by the available supply. This deficit is increasing every year. At 2.8%, the deforestation rate in Malawi is amongst the highest in Africa. This loss of forests increasingly causes environmental problems such as erosion, flash floods and river siltation.

Women, which usually are in charge of fuel gathering, have to cover farther distances to collect their firewood. Fuel wood gathering is becoming a more and more time consuming task that keeps women from productive economic and household's activities. Due to firewood scarcity, households in some regions of rural Malawi even have to depend on firewood purchases.<sup>1</sup>



Woman gathering firewood (ProBEC)

### 2.2 Programme of Basic Energy and Conservation in Southern Africa (ProBEC)

To counteract the problems resulting from the exploitation of biomass sources, Biomass Energy Conservation (BEC) programmes try to promote efficient use of biomass for cooking as one important way to save energy, conserve biomass, stop forest degradation and reduce effort spent in connection with cooking. Since cooking is a major factor in household's daily tasks, the potential for change and improvement is high. The Integrated Food Security Programme (IFSP), a joint project of BMZ and EU – implemented by GTZ – started in 1996 for the Mulanje District of Malawi addressing these issues (pilots of stove promotion starting in 1997). After one year of EU funding the Programme became part of the Programme for Biomass Energy Conservation in Southern Africa (ProBEC). The goal

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<sup>1</sup> Cf. ProBEC 2008

is to deliver technology and knowledge about biomass energy conservation to local groups and individual households through a sustainable approach. One area of intervention was food preparation. Besides improvement in methods of cooking, recipes, and household management, fuel-efficient stoves were a component of the approach.

The traditional way of cooking is to light an open fire, placing the pot on three stones. This requires a lot of fuel wood due to inefficient combustion and furthermore it leads to a lot of smoke that is seriously affecting health.

Different types of improved stoves have been developed to reduce the amount of wood used, avoid smoke emission and improve handling.<sup>2</sup>



Chitetezo Mbaula (HEDON)

The improved households stove promoted by ProBEC in the rural areas of Malawi is the portable clay stove called Chitetezo Mbaula (protecting stove). It can be entirely produced from locally available material, namely pottery clay. The Chitetezo Mbaula is designed to be cheap to produce and can thus target low-income households. The shielded fire reduces the risk of burns and fire accidents. Furthermore a cleaner combustion reduces the emission of smoke and therewith prevents health problems arising from indoor air pollution.

Improved fuel efficiency reduces the amount of fuel required. In ideal conditions, a Chitetezo Mbaula can save up to 60% of firewood compared to the traditional three stone fire. These ideal conditions not only include using the stove, but also using dried wood, splitting the wood before use, using a lid on the pot etc. Along with the dissemination of the stove technology, these methods are promoted to achieve the full impact of fuel saving.

During the first project phase (IFSP) in the Mulanje district, the stove promotion was carried out as a self-help approach. All villagers willing to participate were trained to build their own stove. A body of selected promoters supported the building of stoves and organised stove and cooking demonstrations. The demonstrations were intended to showcase the advantage of the improved stoves over the traditional open fire and thus to convince villagers to use an improved stove.

The approach was modified in 2003 with the project focus shifting towards a commercialisation approach. Instead of training all villagers, producer groups were formed to professionally produce the Chitetezo Mbaula and be able to promote and market them in the surrounding area and on local markets. Creating a market for the stoves would mean to improve the quality of the stoves. In contrast, the earlier self-made stoves have often been of poor quality and thus were not durable.

Since 2003 stove producers are extensively trained in stove production such as clay preparation and firing and also in quality control, pricing, and marketing and promotion<sup>3</sup>. The use of kilns was promoted to fire the stoves more efficiently and at a higher quality. Today almost all producer groups built their own kiln for stove firing. Further contents of the producer trainings are the promotion of good cooking practices as well as the construction and use of a fireless cooker (food warmer).

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<sup>2</sup> Cf. HEDON 2008

<sup>3</sup> Cf. Brinkmann 2005

The commercialisation of stove promotion is expected to facilitate a sustainable stove production without steady intervention.<sup>4</sup> To achieve a further scaling-up of the promotion of fuel saving stoves, ProBEC developed a mainstreaming strategy. Partners are getting involved and targeted to integrate the fuel saving stove into their own program activities.

### **2.3 Objective of this study**

This study intends to evaluate the ProBEC approach of demand-driven dissemination and commercialisation of the fuel saving stove, Chitetezo Mbaula, to assess the impacts of stove adoption on household and producer level.

In 2004, when the original self-help approach was in process to be superseded by commercial stove promotion, an impact assessment was carried out by Verena Brinkmann. In the course of that study, four villages in Mulanje were assessed regarding the adoption rate of improved stoves as well as the benefits in the field of income, health and environment.

Three and a half years after the first impact assessment the present study was implemented to again assess the outcomes and impacts of the ProBEC interventions to find out if the new commercial approach has led to changes in the adoption. Furthermore, this study assesses the achievements towards the MDGs.

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<sup>4</sup> Cf. Msukwa/Munemo 2008

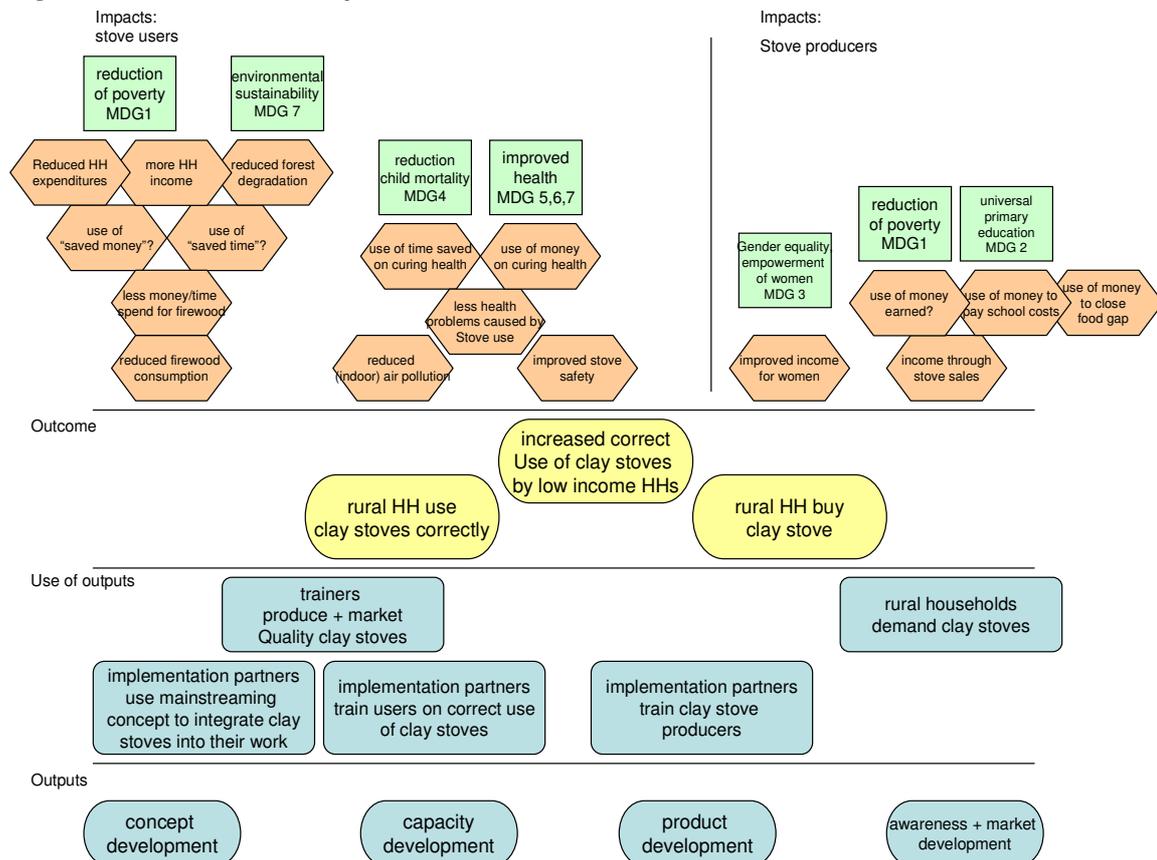
### 3 Methodology and course of the survey

#### Methods

The methods implemented in this survey included standardised households questionnaires, field observations, semi-standardised interviews with producers, intensive interviews with partner organisations, and the review of project documents.

An initial household questionnaire has been developed by HERA<sup>5</sup> for previous impact assessments in Kenya and Ethiopia. In preparation of the survey, the questionnaires have been developed further and adopted to the Malawian context by consulting the project's result chain. An abbreviated version of this impact chain, depicting the anticipated outcomes and impacts of focused project interventions, is presented in Figure 1. Due to a limited extent of the survey, not all impacts could be examined with the same intensity. Some of the surveyed outcomes lead to plausibilities concerning impacts which have to remain as reasonable hypotheses in the scope of this study. Extended surveys would be able to more fully capture relevant data and support these plausibilities which were not the main focus of this survey.

**Figure 1: Result chain - improved firewood stove Malawi**



The standardised household questionnaire targets the person in charge for cooking in the surveyed household. Questions are structured into five sections: personal information, stove information, cooking information, fuel wood information and a section about the improved stove. The questionnaire also includes field observations, e.g. the use of good cooking practices (Annex 1).

<sup>5</sup> HERA – Households Energy for sustainable Development (GTZ)

The interview developed for stove producers includes quantitative and qualitative questioning to gather information about the producers' economic background, their production, marketing and promotion activities, the structure of the producers group etc. Furthermore intensive interviews were conducted with the partner organisations to gather information about their programs and activities, about the selected producer group and the targeted village, about the future plans in stove promotion etc.

#### Course of the survey

The survey was conducted in March and April 2008. By that time 138 producer groups in 15 of the 28 districts of Malawi were trained to promote the Chitetezo Mbaula. The survey covered six villages in three of these districts, Mulanje, Ntcheu and Thyolo. A total of around 300 households were targeted for the survey, approximately 50 households per village. These interviewed households were chosen by random sample.

Due to a small number of households using the Chitetezo Mbaula in Thyolo, a small sample of selected households using the Chitetezo Mbaula was established additionally to cover at least 15 households using the stove in each village.

The table below shows details of the sample size of the survey. A total number of 327 households have been covered.

	Random sample	Selected sample with Chitetezo Mbaula
<b>Mulanje:</b>		
Ligomba	50	-
Matanya <sup>6</sup>	44	-
<b>Ntcheu:</b>		
Chiwembu <sup>7</sup>	65	-
Kanama 2	51	-
<b>Thyolo:</b>		
Kabuthu	52	7
Chamasowa	50	8
<b>Total</b>	<b>312</b>	<b>15</b>

**Table 1: Samples of the household survey**

Supplementary to the household survey, 20 interviews have been held with stove producers in the respective villages. One producers group was selected in each of the visited villages, except in Thyolo where there is only one group for both surveyed villages. Four members of each group have been selected for the interviews. One was always conducted with the respective group leader (chairlady), while the other interviewees have been chosen randomly.

<sup>6</sup> Due to the small size of Matanya (48 households), the respective person in charge for cooking activities could be found at home in only 44 households during the days of fieldwork in this village.

<sup>7</sup> The sample size was extended to 65 because Chiwembu recently split into three villages, Chiwembu, Kapire and Minjere. Hence, at least 20 households in each village have been covered. For reasons of clearness Chiwembu, Kapire and Minjere will be considered as one village in this report. The term Chiwembu always also includes the villages Kapire and Minjere.

### 3.1 Research areas

This chapter gives a brief overview of the selected research area. Sizes of the visited villages range between 48 and approximately 200 households. Hence the random sample of around 50 households provides representative results for the respective villages. But it has to be taken into consideration that the surveyed villages are not representative for the respective districts and results cannot be generalized. All villages (excluding Kabuthu) are characterized by a stove producer group, which is moulding and firing their stoves within the village. By the time of the survey, 45 producer groups had been trained in Mulanje, thereof eight in Ntcheu and five in Thyolo District. The results of this study cannot provide conclusions about villages that are not yet connected to a producers group.

#### Ligomba and Matanya (Mulanje)

Stove activities in Mulanje started in 1999/2000 in behalf of the Integrated Food Security Program (IFSP). In the first phase from 1999 to 2002 the portable clay stove (Chitetezo Mbaula) as well as a fixed mud stove with ceramic liner have been implemented through a self-help approach.

Since 2003 stove promotion in Ligomba and Matanya started to commercialise. The focus is now on the portable clay stove. ProBEC trained and supervised one producer group in each of the surveyed villages. In contrast to the project activities in the surveyed area in Ntcheu, no partner organisation was involved in the stove activities held in Ligomba and Matanya.

Both villages have been targeted in the impact assessment study of 2004. The information gathered in that study allows conclusions about the progress made in stove promotion in that particular villages in the previous three and a half years.

Families in Mulanje primarily live on subsistent farming. The household head's main occupation was stated as farming in 68.7% of the cases. About one fifth of the heads are salaried or employed. An average of 10.3% is businessman or self employed and a very small number stated part time employment (2%), (Annex 3).

#### Chiwembu and Kanama2 - Ntcheu

In the surveyed villages in Ntcheu, ProBEC has been working together with two partner organisations, Concern Universal and Africare. Based on a mainstreaming concept, ProBEC cooperated with its partners by providing technology, strategies and concepts as well as the training for the producer groups and for the extension workers (village-based trainers) to enable the partner to continue their stove activities independently.

The stove promotion in Chiwembu and Kanama2 was implemented through the commercial approach from the beginning; hence the activities base on different conditions than in Mulanje villages, where self-help stoves have already been disseminated in the first program phase.

Stove promotion in Chiwembu was implemented by Concern Universal. The producers group established here was trained latest of three groups that the organisation supervises. Production started in October 2007. Chiwembu recently split into three villages: Chiwembu, Kapire and Minjere. However, the producers group consists of members from all of the three villages. Due to these circumstances the survey was implemented not only in Chiwembu but also in Kapire and Minjere. To avoid confusion the term Chiwembu will stand for all of the three villages.

The second village surveyed in Ntcheu was Kanama2. The stove activities in this village were implemented by Africare. The organisation supports four producer groups in Ntcheu up to now, but further groups are planned. The group in Kanama2 promotes stoves since July 2006.

Farming is the main occupation of the household's heads in Ntcheu and with 87.3% it is even more common than in the other research areas. Only a small share is salaried or employed (6.2%) or businessman or self employed (4.5%), (Annex 4).

#### Kabuthu and Chamasowa - Thyolo

The villages Kabuthu and Chamasowa are members of the community-based organisation Mapanga. This CBO was founded in 2001 and has several objectives. Around 25 villages are members of the organisation and the number is still increasing. Mapanga initiated commercial stove promotion supported by ProBEC in 2006. The stove interventions in Mapanga are of particular interest, because the partner in this case is not an international organisation but the community itself initiates the intervention. Mapanga's producers group is based in Chamasowa, where a production centre and a kiln have been built, but its members are coming from different CBO villages.

Kabuthu was chosen as a second village of the CBO even if the stove production is not based there, to see how stove promotion spreads within the Mapanga villages. Furthermore two members of the stove producers group live in Kabuthu. Due to the size of its community, Mapanga has the potential and is furthermore motivated to scale-up the stove production and establish further stove groups.

An average of 65% of the interviewed households in Thyolo stated farming as the household head's main occupation. About one fourth are salaried or employed and a small number are businessmen or self employed (7.8%), (Annex 5).

## **4 Survey Results**

### **4.1 Households**

The following Chapters will present the outcomes of the household survey. Results will be structured in four chapters and presented separately for the three districts.

The distributions of the types of stoves found as well as of the three stone fire place will be analysed in the stove information chapter. Furthermore it will be outlined if and in which extend these stoves are in use to get a picture about the actual stove adoption. The progress made in stove adoption in Mulanje will be determined on the basis of comparison with data of the 2004 study.

At last the conditions of the Chitetezo Mbaula stoves, observed by the researchers, will be discussed.

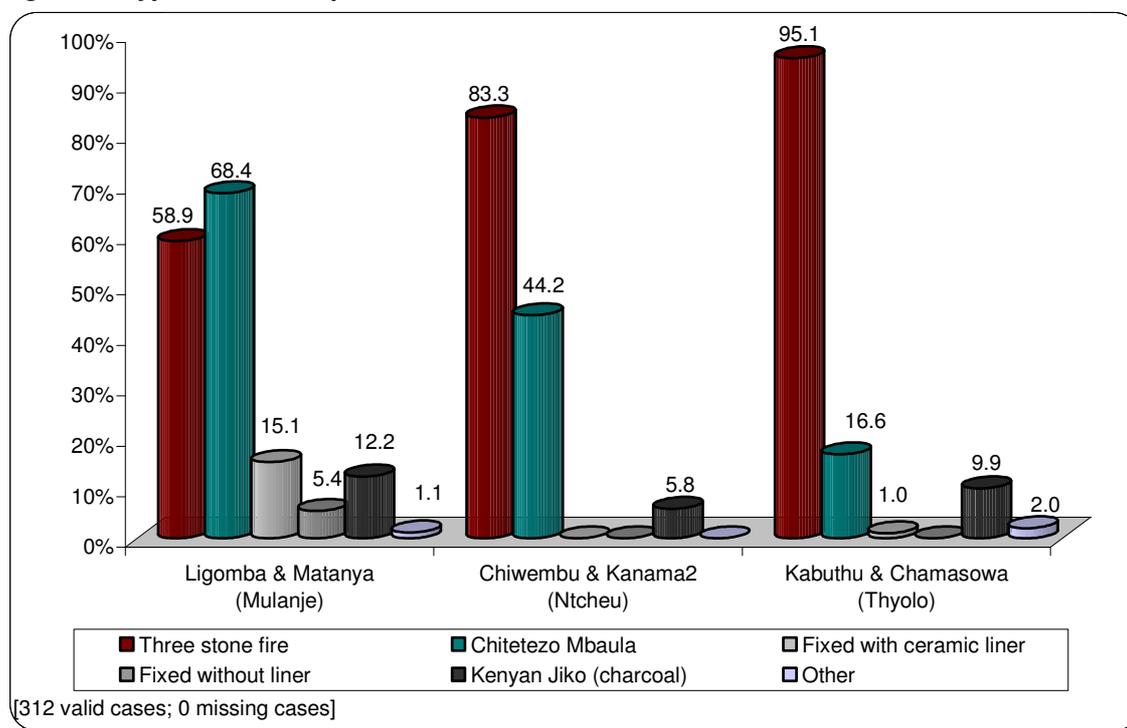
The chapter about cooking information will then present the surveyed cooking habits of households. This includes the place and the frequency of cooking as well as the number of cooking facilities used. Field observations also provide information about the correct use of the improved stoves which will be derived from the adoption of good cooking practices and the emission of smoke while cooking. To point out the impacts of the improved stove usage on cooking habits, the surveyed sample will be divided into the group of households frequently using Chitetezo Mbaula and the group of households mainly cooking on the three stone fire.

These two groups will also be used for opposing analysis of the household's firewood supply. This includes the frequency of firewood collection as well as the time spent on collection. Furthermore it will be analysed whom in the families is in charge for firewood collection.

In the last chapter on the household survey specific information collected amongst the Chitetezo Mbaula users will be provided, e.g. the users perceptions about advantages and disadvantages of the stove.

#### 4.1.1 Stove information

Figure 2: Types of stoves present in households



Other: Traditional charcoal stove (2), electric plate (1)

##### Ligomba & Matanya (Mulanje)

Results about the distribution of the three stone fireplace and the different stove types owned by the surveyed households are presented in Figure 2. For the visited Mulanje villages it highlights that the Chitetezo Mbaula is the most common cooking facility found. An average of 68.4% of the households has the portable clay stove at their homes.

Besides the Chitetezo Mbaula it is also a matter of particular interest in Ligomba and Matanya to monitor the fixed type of firewood stove with ceramic liner. These stoves have originally been promoted together with the Chitetezo Mbaula, when the implementation was still based on a self-help approach (1999-2001). Fixed stoves with ceramic liner were found in averaged 15.1% of the households in each village. See Annex 2 for disaggregated data on each village.

Overall 72.6% of the interviewed households in Mulanje possess at least one improved firewood stove, either a Chitetezo Mbaula or a fixed stove with liner. These stoves are not only present but also in use in an average of 71.5% of the surveyed households (Ligomba 68%, Matanya 75%).

Compared to the impact assessment data of 2004, where the average user rate in Ligomba (30%) and Matanya (17%) was 23.5%, the user rate was tripled. In 2004 the numbers of stove usage followed a decreasing trend<sup>8</sup>. Obviously this trend changed into the opposite as by now an average of 48% more households adopted the improved stove per village. This indicates that commercial stove production has been established successfully and increased within the last years.

A high increase of adoption is noticeable for the portable clay stove (Chitetezo Mbaula) only, but cannot be observed for the fixed stove with ceramic liner. In the study of 2004, both stove types were distributed equally amongst the improved stove users in Ligomba,

<sup>8</sup> Cf. Brinkmann 2005, p.xvi/xxiii

while in Matanya households even preferably used the fixed type. In the last years the share of households using the fixed stoves did not rise but rather decreased. This also seems to be due to the project approach focusing mainly on Chitetezo Mbaula since changing from self-help to commercial.

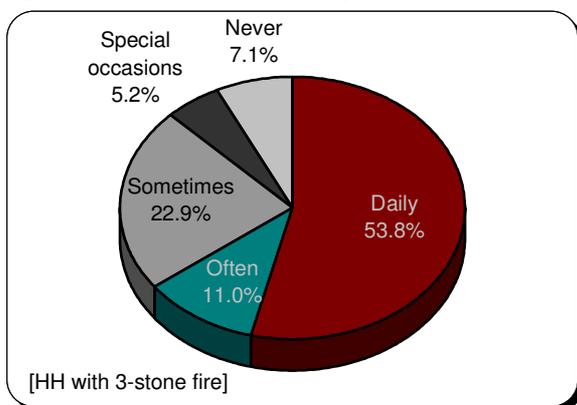
Improved stoves (portable or fixed) are used exclusively by 44.6% of the households. These households do not possess, or stated not to use, a three stone fire or any other cooking facility. The exclusive users make up 61% of all households that possess an improved firewood stove.

A three stone fire is present in an average 58.9% of the surveyed households in Ligomba and Matanya. However an outstanding difference can be found regarding the results between both villages. While in Ligomba the presence of three stone fires is very high (70%), the share in Matanya is comparably low (47.7%). Hence households in Matanya are more likely to entirely replace the three stone fire when adopting the improved technology.

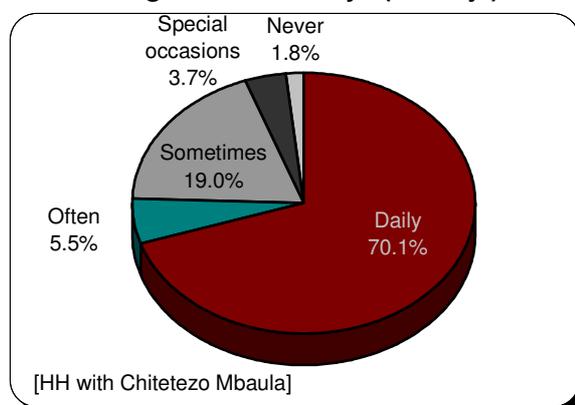
Slightly more than half of the households that own a three stone fire are using it every day, while around 7% state that they are not using it at all (Figure 3). Amongst the group of Chitetezo Mbaula owners, those households also using the traditional fire daily for cooking make up 10.3%.

For the Chitetezo Mbaula owners, daily use has been stated by 70.1%. Only one household, in Matanya, does not use the portable stove even though having one (Figure 4).

**Figure 3 Frequency of using 3-stone fire – Ligomba & Matanya (Mulanje)**



**Figure 4: Frequency of using Chitetezo Mbaula – Ligomba & Matanya (Mulanje)**



It can be summarized that the majority of households in the observed villages in Mulanje adopted the Chitetezo Mbaula and furthermore most of them are using their stove exclusively or on a daily basis. In the last 3.5 years the user rate of improved stoves rose by a factor of three. Examining the progress made with the self-help approach until 2004 with the progress made afterwards, shows that the raise of the user rate has accelerated since commercialisation (see also Figure 6).

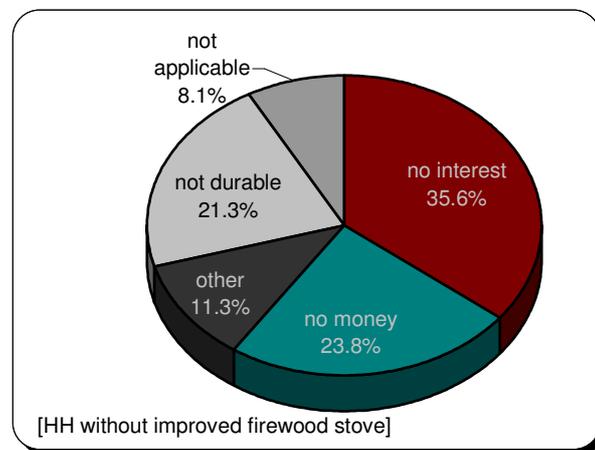
The results also show that the three stone fire is not necessarily replaced by the improved firewood stoves as almost 39% of the stove owners also use the three stone fire.

On average four to five people are usually living and eating in a household interviewed in Mulanje. Separate analyses of households which are using at least one improved firewood stove and those which are exclusively using the improved technology, lead to equal results. It can be assumed that the number of people that has to be fed in a household is not significant for the decision to acquire the stove.

All of the 27.4% of interviewees in Mulanje that do not own one of the improved firewood stove types stated that they know the portable clay stove and an average of 41.9% is also aware of the fixed mud stove with ceramic liner (Annex 6).

Asking for the main reason why these households are not using an improved stove leads to the responses presented in Figure 5. The main group of 35.6% showed a lack of interest. Another 23.8% mentioned not to have enough money to buy the Mbaula. It has to be taken into account that these two categories of answers are overlapping. Frequently it turns out to be difficult to distinguish if people really don't have a Chitetezo Mbaula because of a lack of money, or if they are just not interested to spend money for the improved technology.

**Figure 5: Stated reasons for not using improved firewood stove - Mulanje**



Another fifth of the surveyed villagers without improved firewood stove in each village explained not to use the stove because it is not durable and breaks easily. These reasons are similar to the study of 2004 which summarised arguments of non-users mainly in two categories of an inability to access (e.g. lack of money) and a disinterest to use the stove.<sup>9</sup>

Besides the distribution of the different stove types, the use of a fireless cooker is also a matter of interest in the surveyed areas. In the course of the producer trainings in Malawi the participants are trained in how to build and use a food warmer, but unfortunately its use did not spread, as it is neither common in the surveyed Mulanje villages nor in the other research areas. The user rate of the food warmer is 7.3% in Mulanje (Ligomba 10%, Matanya 4.5%). Resulting from observations in the field it can be assumed that those using fireless cookers are mainly stove producer households or households related to a member of the producer group.

#### Chiwembu & Kanama2 (Ntcheu)

The following paragraph will present the results concerning stove distribution and use in the two surveyed villages in Ntcheu (see also Figure 2 and Annex 2).

The Chitetezo Mbaula is present in an average of 44.2% of households per village, with 35.4% in Chiwembu and 51% in Kanama2. This considerable difference between the two villages can be traced to the fact that stove dissemination in Chiwembu just started six months before the survey was held, whereas stove production in Kanama2 already ran for two years.

Besides the portable clay stove, no other improved type of wood stove is used in the examined areas.

The Chitetezo Mbaula is in actual use by an average of 43.2% of each village. It is exclusively used for cooking by an average of 16.7% of the households per village, which is equivalent to 37.7% of the stove owners. In contrast to that the number of households owning a three stone fire is very high (83.4%).

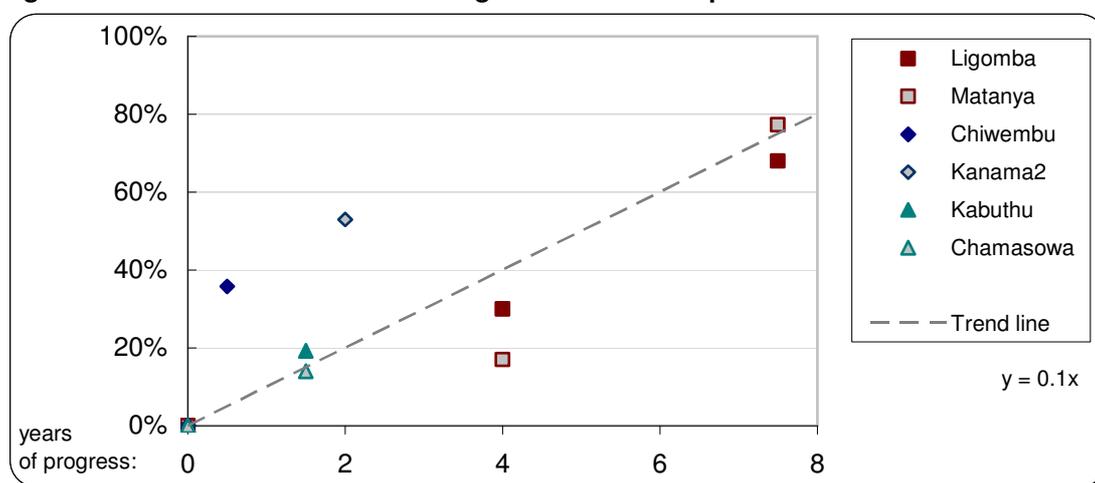
<sup>9</sup> Cf. Brinkmann (2005), p.16

Stove distribution in Ntcheu shows remarkable differences to Mulanje. The user rate in the surveyed Ntcheu villages is considerably lower and on the other hand the three stone fire is more widespread.

Due to the fact that the stove production in Mulanje started long before the production in the visited villages in Ntcheu, it is difficult to conclude about the progress by only comparing the current numbers of stove usage. Furthermore, the approaches of stove dissemination differ between Mulanje and Ntcheu. While the improved firewood stoves in Mulanje were disseminated through a self-help approach in the first years and later shifted into a commercial strategy, implementation in the Ntcheu villages was on a commercial basis from the beginning.

Taking these conditions into account changes the perspective on the user rate of Chiwembu and Kanama2, with the progress turning out to be rather successful. In Figure 6 the data of user rates is plotted against a time line of the duration of stove implementation. The data is taken from the impact assessment in 2004 as well as the present data from 2008.

**Figure 6: Stove dissemination rates against duration of promotion**



Comparing the progresses, made in the surveyed villages, the dissemination rate of Chitetezo Mbaulas in Kanama2 and Chiwembu<sup>10</sup> is high. The figure shows that the rate of stoves was lower in Mulanje villages even after four years of stove activities than it is in Kanama2 after two years of stove promotion. This may be traced back to the differences in approach, as the stove promotion in Ntcheu's villages has been commercial from the beginning. It can be concluded that more progress in adoption could be made through the first years of commercial approach in Kanama2 than in the first years of self-made stove dissemination in Ligomba and Matanya.

An average of 83.4% of the households in the Ntcheu villages has a three stone fire. Four fifths of these fireplaces are used daily, the rest only sometimes (Figure 7).

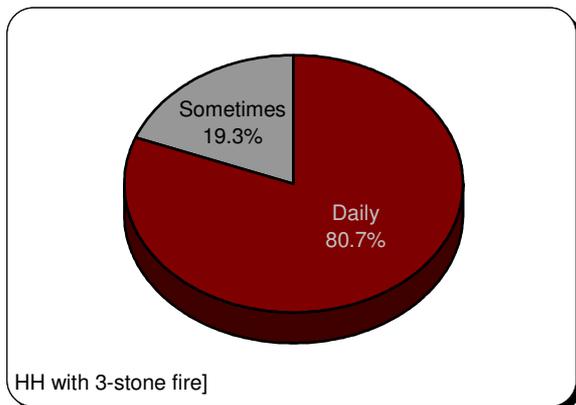
Amongst those households with improved stove, an average of 25% is still also using the three stone fire daily for cooking. Compared to the surveyed households with improved stove in Mulanje this rate is rather high (Mulanje 10.3%). This indicates that the adoption of the improved stove is a long term process of transition in which the three stone fire

<sup>10</sup> The progress in Chiwembu should be handled carefully, as producers did not yet start to promote the improved stoves on their own. The disseminated stoves all resulted from the first firing that was held in the course of the training (see chapter 4.2.1).

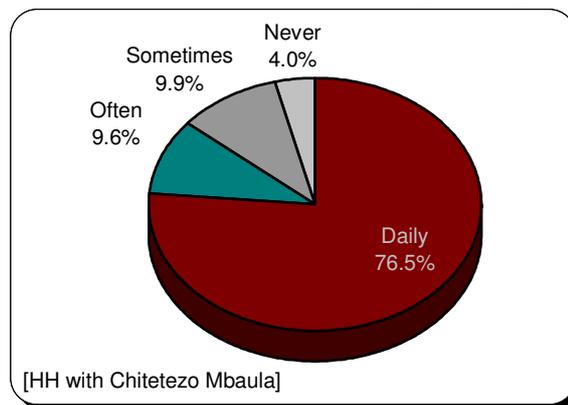
looses importance. Evidently in Ligomba and Matanya, where stoves are in use for eight years, this transition is progressed further than in Ntcheu's villages. A follow-up study in a few years' time should be able to prove this assumption.

The Chitetezo Mbaula is used daily for cooking in an average of 76.5% of the surveyed owner-households in Ntcheu. 4% have an improved stove, but do not use it (Figure 8).

**Figure 7: Frequency of using 3-stone fire – Chiwembu & Kanama2 (Ntcheu)**



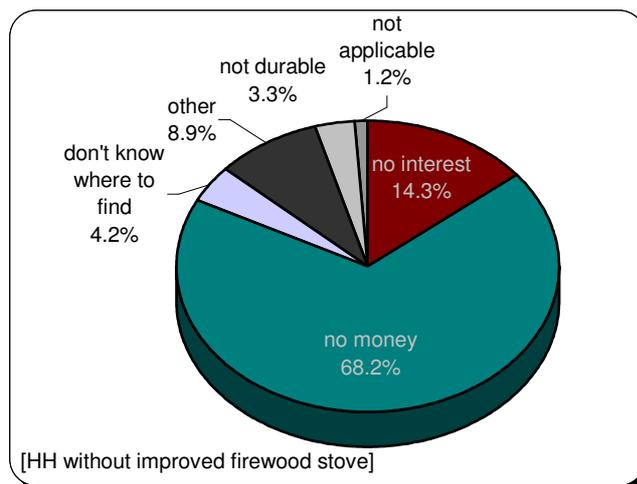
**Figure 8: Frequency of using Chitetezo Mbaula – Chiwembu & Kanama2 (Ntcheu)**



Five persons are living and eating in an average household of Ntcheu. As in Mulanje, no significant difference in household size can be noticed compared to those households using the improved stove.

According to the lower user rate of the Chitetezo Mbaula in Chiwembu and Kanama2, the average number of households not using an improved wood stove (55.9%) is significantly higher than in Mulanje. All of these interviewees were able to describe the portable clay stove, when asked what kind of improved firewood stove they know. None of the households stated to know the fixed mud type. Questions about the reason for not using the Mbaula lead to the following categories of responses (Figure 9): A majority of 68.2% of the respective interviewees stated not to have enough money to buy the stove. Statements expressing disinterest in using the Mbaula were given by 14.3% of the households. As mentioned above, it turned out to be difficult for the researchers to define if money or lack of interest is the prior obstacle for stove adoption. Nevertheless it is notable that the share of those being deterred by the price of the Mbaula is thrice as high as in Mulanje. Actually the price ranges paid to acquire a stove are higher in Ntcheu compared to those in Mulanje (chapter 4.1.4). While the reasons concerning the limited lifespan of the stove are mentioned by a fifth of the households in Mulanje, the durability was only mentioned in a few cases in Ntcheu. This difference may result from the fact that the stove

**Figure 9: Stated reasons for not using Chitetezo Mbaula - Ntcheu**



production in both villages is young compared to Ligomba and Matanya. In Chiwembu, stoves were available for only six months by the time of the survey and in Kanama-2 for two years. Hence problems with durability did not yet appear often. Furthermore, the stoves produced in the first project phase in Mulanje have not been fired professionally in a kiln but in a self-made fire pit. That reduced the quality of stoves and lead to more problems with durability (sometimes only a few months).

A reason stated by some of the interviewees in Ntcheu, but never in Mulanje, is that households don't know where the Chitetezo Mbaula is sold. This shows that the improved stoves are not yet as common and integrated into the daily village life as they are in Mulanje.

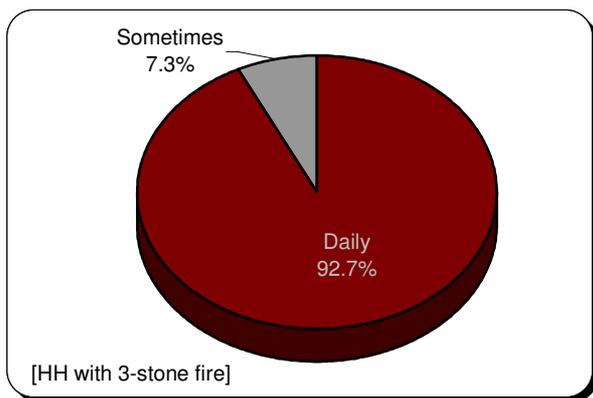
Fireless cookers are, similar to the other research areas, not common in Ntcheu. An average of 7.6% of households is using one (Chiwembu: 3.4%, Kanama2: 11.8%). As in Ligomba and Matanya, field observations show that those using food warmers are mainly stove producer households or households related to a member of the producer group.

Kabuthu & Chamasowa (Thyolo)

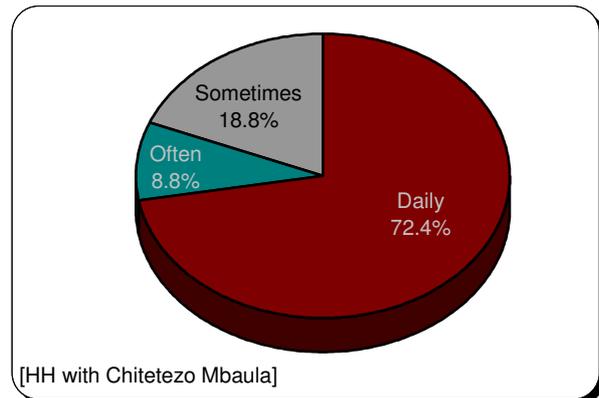
The distribution of the Chitetezo Mbaula in Kabuthu and Chamasowa is on a comparably low level. Figure 2 shows that the improved stove is present in an average of 16.6% of households per village (see also Annex 2). Like in Ntcheu, the Chitetezo Mbaula is the only improved firewood stove used in the surveyed area. It is actually used by all households that own one. An average of 4.9% of households in each village has no three stone fireplace and the Chitetezo is therewith the only improved firewood stove used. These exclusive users make up 29% of all Chitetezo Mbaula owners.

Analysis of the frequencies of usage of the different cooking facilities show that over 90% of those households that have a traditional fire are using it daily (Figure 10). Amongst the Chitetezo Mbaula users, the daily usage of three stone fires makes up 37%. 72.4% of the group with improved stoves stated to cook with it daily (Figure 11).

**Figure 10: Frequency of using 3-stone fire – Kabuthu & Chamasowa (Thyolo)**



**Figure 11: Frequency of using Chitetezo Mbaula – Kabuthu & Chamasowa (Thyolo)**



Compared to the Ntcheu villages, where stove promotion also began within the previous two years, the progress in Kabuthu and Chamasowa in terms of stove dissemination is quite small (Figure 6). Field observations lead to the impression that stoves are only used in stove producer households and households of CBO<sup>11</sup> members. This small adoption

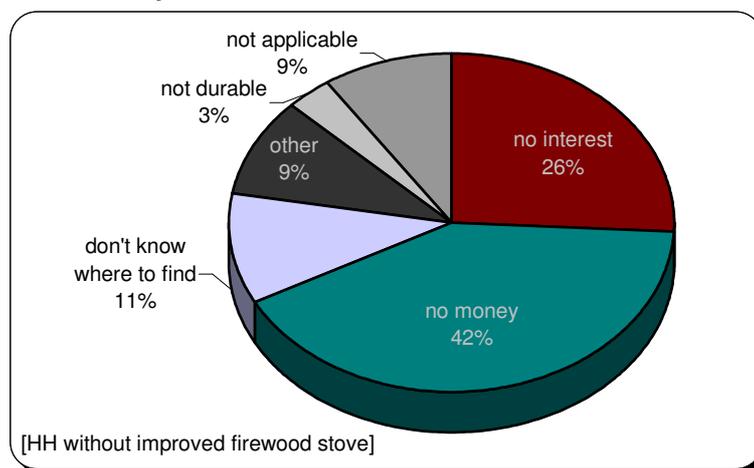
<sup>11</sup> Chamasowa and Kabuthu are members of the community based organisation Mapanga, which initiated the stove production in that area.

rate results from the promotion strategy of the respective producers group that targets a market outside their villages, but does not promote the stove amongst the villagers (see chapter 4.2). Hence, even if the Mapanga group is successfully producing and selling stoves, the population of the CBO's villages are still in the early stages of stove adoption. This is not only reflected in the small number of Chitetezo Mbaula users, but also in a high share of three stone fires amongst the improved stove users (71%) as well as in the habits of daily using the traditional fireplace in these households (37%).

As in the other villages, the surveyed households in Ntcheu that do not use a firewood saving stove have been asked for the main reason of not using it (Figure 12). Similar to Ntcheu's villages, the main reason stated by the respective households is a lack of money. This corresponds to the price of the Chitetezo Mbaula, which is the highest within the surveyed areas (chapter 4.1.4).

A lack of interest has been expressed by a quarter of interviewees. A share of 11% of the non-users stated that they don't know where to acquire a Chitetezo Mbaula and 9.4% did not even know the stove. These two aspects show that the Chitetezo Mbaula is not as popular amongst the villagers as it is in Ligomba and Matanya and also in Ntcheu's villages.

**Figure 12: Stated reasons for not using the Chitetezo Mbaula – Thyolo**



Unlike in Mulanje the durability of the stove does not play a significant role amongst the stated reasons in Kabuthu and Chamasowa. As in Chiwembu and Kanama<sup>2</sup> this most likely results from the improved quality of the clay stoves that could be achieved from the beginning of the production as well as from the fact the stove production in Thyolo is still young, compared to Mulanje's villages.

Fireless cookers are even rarer in Kabuthu and Chamasowa than within the other villages, as only one household in each village stated to use one.

#### Observed Conditions of the Chitetezo Mbaula

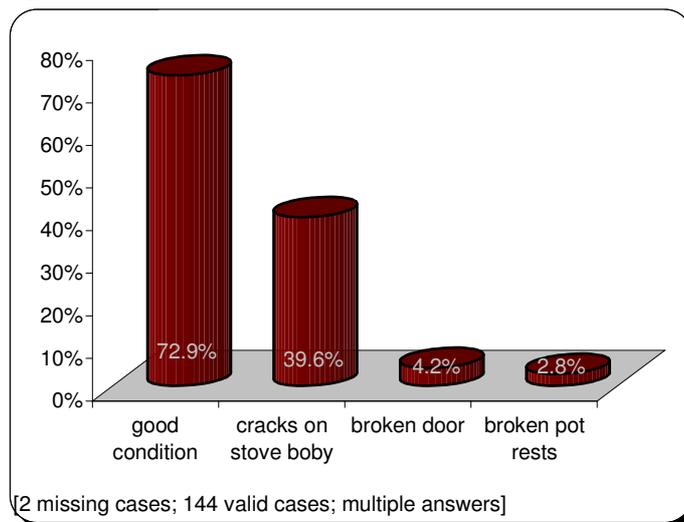
In the course of the survey, field observations have been recorded about the conditions of all stoves regarding cracks and damages. Results are presented in this chapter. Included are the households with Chitetezo Mbaula from all villages, plus the additional selected samples of stove users in Thyolo<sup>12</sup>. It has to be taken into account that 26.7% of the

<sup>12</sup> In Kabuthu and Chamasowa a small sample of households with Chitetezo Mbaula has been selected in addition to the random sample to cover at least 15 households in each village that own an improved firewood stove (Table 1). To provide representative results, these selected samples have not been included into the general analysis of stove adoption.

Chitetezo Mbaula households own two of these stoves and a few households even have three (3.4%).

Figure 13 highlights that in 72.9% of the households at least one of the Mbaulas was found in a good condition without noticeable cracks or damages. Around 40% of the households possess a stove showing cracks on the stove body. A small number of stoves have a broken door<sup>13</sup>, mostly in form of an open crack that splits the clay above the door vertically. This damage does not necessarily lead to loss of efficiency, but it determines the stove’s durability. Five Chitetezo Mbaulas were found with broken pot rests, which may lead to a serious loss in efficiency, as the pot may be too close to the stove’s upper edge; hence hot air cannot flow around the pot.

**Figure 13: Conditions of the Chitetezo Mbaulas**



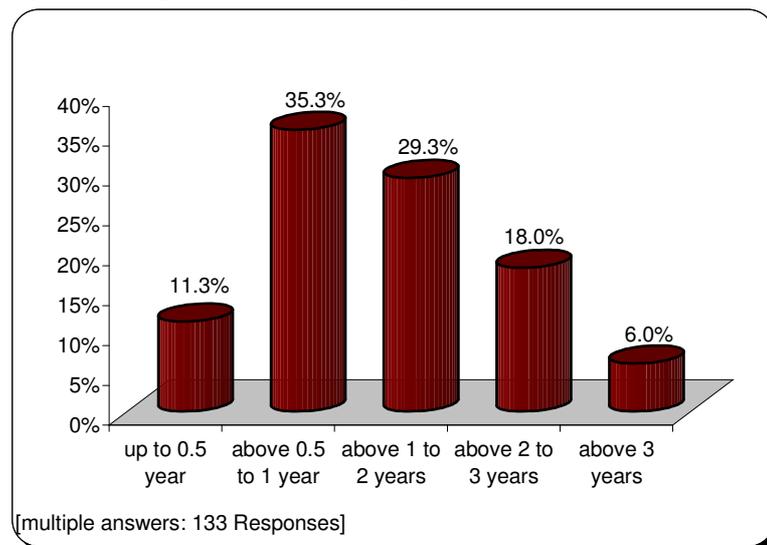
According to the kind of damage observed, three categories of stove condition are formed: good condition (no damages at all), medium condition (cracks and/or broken door) that indicate a loss in durability and bad condition (broken pot rests) that may undermine the efficiency. To relate the observed conditions to the stove’s age, the estimations of the stoves’ ages are presented in Figure 14. The stoves included here are those which are in daily use.

By examining their ages it has to be taken into account that three out of four producer groups started their production within the previous two years. Stoves in Chiwembu were produced for half a year, in Mapanga for 1.5 and in Kanama<sup>2</sup> for 2 years by the time when the survey was implemented. The most often estimated ages of the Chitetezo Mbaula in daily use are between six months and one year. The second biggest share of stoves is above one year up to two years old. The oldest stove found, in one of the households in Mulanje, had a production date from 1999 written on it and was still in medium good condition.

The average age of the portable stoves that are used every day is 1.7 years.

<sup>13</sup> “Door” is the term used for the opening for firewood in the stove’s front.

**Figure 14: Age of stoves in daily use**

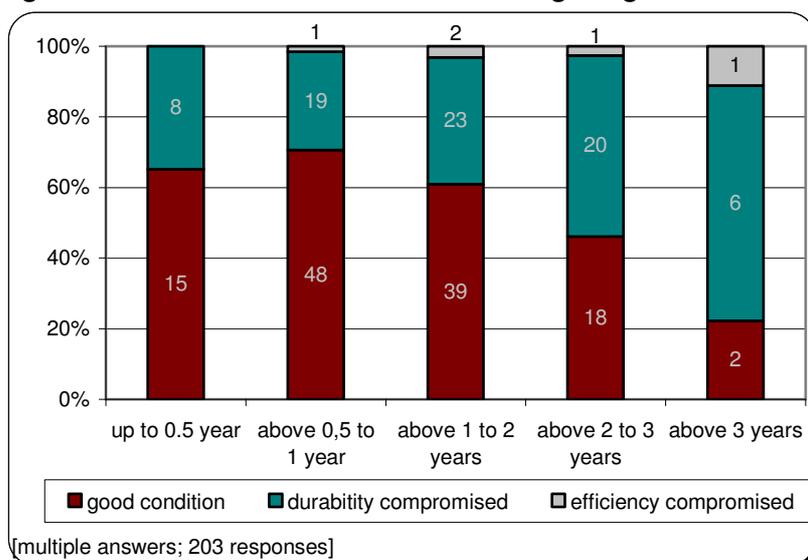


Continuing on to the observed conditions of the stoves, Figure 15 presents all observed conditions of the stoves in relation to their respective age. It shows that up to an age of two years, more than 60% of the respective stoves are in good condition. The age of two years also presents the officially estimated lifespan of the Chitetezo Mbaula. The results show that this seems to be a realistic figure, as only 3 stoves below that age have been found in bad conditions with expected reductions in efficiency.

In the categories above two years of age, the relation changes and the majority of observed stoves are compromised in terms of durability due to cracks and/or a broken door.

It is remarkable that only 5 out of 203 observed stoves have been found in bad condition. This indicates that stoves are produced in a relatively good quality and that users are likely to replace their Chitetezo Mbaula when broken.

**Figure 15: Condition of the stoves according to age**



### 4.1.2 Cooking information

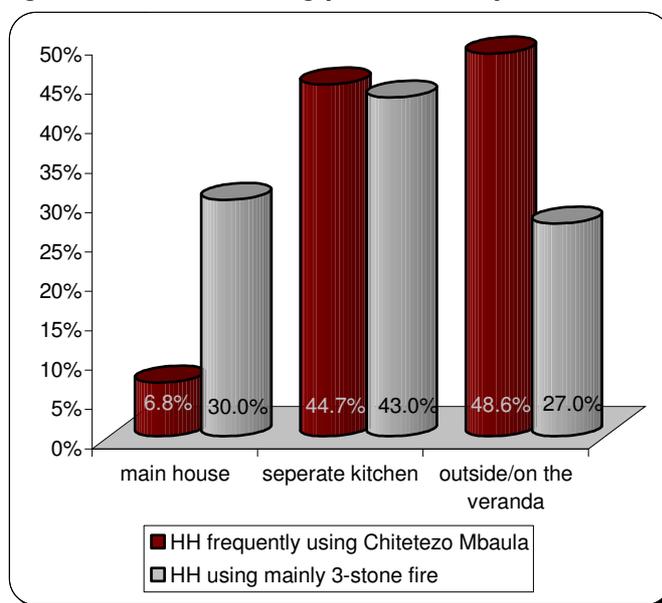
The following chapter will present the results of the survey concerning cooking habits and practices. Data will be split into two separate groups. One group consists of those households using the Chitetezo Mbaula highly frequented (daily or often)<sup>14</sup> while the other group consists of households mainly cooking on three stone fire (using three stone daily and Chitetezo Mbaula sometimes to never)<sup>15</sup>.

#### Ligomba & Matanya (Mulanje)

In Mulanje almost half of the households frequently using the portable stove stated to usually cook outside (48.6%), whereas a slightly smaller share cooks inside a separate kitchen (44.7%). It has been observed that households prefer cooking outside even if they have a separate kitchen hut, ever since they are using the Chitetezo Mbaula. These families are now using their kitchen to keep livestock, like chicken or pigs. Only a few households are using the improved stove to cook inside the main house.

Figure 16 shows that the average share of households cooking inside a separate kitchen with Chitetezo Mbaula (44.7%) is similar for those households that are mainly cooking on three stone fire (43%).<sup>16</sup> However significant differences can be observed between both groups concerning cooking inside the main house and cooking outside: Cooking in the main house is practiced considerably more often by three stone fire users than by Chitetezo Mbaula users, while a much smaller number is cooking outside with three stone than with the improved stove.

**Figure 16: Usual cooking place - Mulanje**



These differences reflect the flexibility households gain due to the portability of the improved stove. While the three stone fire is usually not moved between different places, the Chitetezo can be used more flexible. This can be explained as follows: All interviewed households in Mulanje with three stone fire specified to only have one of it. To move this fireplace into another place is long-winded for the person cooking, because the stones are heavy and all the ashes in-

<sup>14</sup> The “Chitetezo Mbaula group” covers the following number of households:  
 -Mulanje: 20HH Ligomba, 28HH Matanya (HH frequently using a fixed type of stove are not included)  
 -Ntcheu: 20HH Chiwembu, 23HH Kanama 2  
 -Thyolo: 14HH Kabuthu, 12HH Chamasowa  
 These households may also use the three stone fire frequently.

<sup>15</sup> The “three stone fire group” covers the following number of households:  
 -Mulanje: 25HH Ligomba, 10HH Matanya;  
 -Ntcheu: 44HH Chiwembu, 28HH Kanama 2;  
 -Thyolo: 44HH Kabuthu, 44HH Chamasowa

These households may also use the Chitetezo Mbaula from time to time.

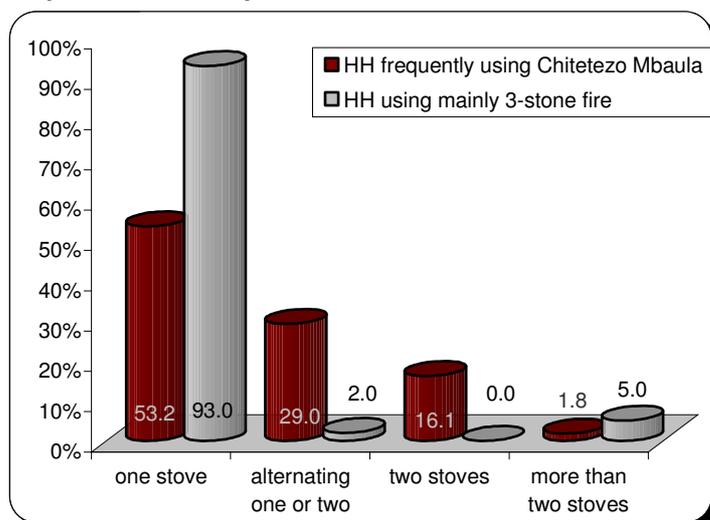
<sup>16</sup> Out of those households cooking inside (kitchen or main house) with improved stove, 9.8% mentioned to do that only during rainy season as well as one fifth (20.3%) of those households cooking on three stone fire.

between remaining from the fire have to be removed from the floor. This can only be done when the fire is extinguished. Hence people prefer cooking inside to avoid rain. However the portable clay stove can be moved during the cooking process, because its' handles allow to carry it around and due to the enclosed stove body embers can be moved without extinguishing the fire. Therefore more Chitetezo Mbaula users choose to cook outside or on the veranda and only moving inside only if the weather gets too bad.

The Chitetezo Mbaula enables households to shift their cooking place out of the main house into the open. Thus the use of improved firewood stoves can reduce indoor air pollution in the main house not only by its clean combustion, but by the removal of the pollution source from the house entirely. As a great deal of the family life takes place in the main house, this is an impact that is beneficial for the health of the whole family. Furthermore the house can be kept free of ashes and dirt caused by the cooking process.

Besides the place of cooking it was examined how many stoves people use simultaneously for cooking their usual meals. The common staple food in the rural areas of Malawi is Nsima, a dish made out of maize flour which is usually eaten with relish. In the morning villager typically eat porridge made out of maize flour.

**Figure 17: Number of stoves/fires used for cooking the daily meals - Mulanje**



The interviewees were asked to specify if they light one stove or open fire for cooking, which means they are cooking one dish after the other (e.g. first relish and afterwards Nsima). Otherwise people may use two stoves at once<sup>17</sup> or they combine using a stove and the open fire at the same time to cook dishes parallel.

Results are presented in Figure 17: Villagers which are mainly cooking on three stone fire usually only light that one, for cooking one dish after the other (93%). This stands to reason, because none of the surveyed households in Mulanje

possesses more than one open fireplace. Only very few of the interviewees mainly cooking the traditional way combine the open fire with other stoves (Chitetezo Mbaula, fixed stove type, charcoal stove).

A majority of 53.2% of the villagers frequently using the Chitetezo Mbaula also usually uses one stove for cooking. Another 29% stated to do both, using one or two cooking facilities at once depending on the time of the day. These households switch to cook parallel at times of the day, when cooking has to be done fast or in a big extend.

More than one sixth of the households using the improved stove frequently stated to generally use a second stove or an additional three stone fire to prepare their meals.

Unlike in those households mainly using three stone fire, it is quite common in households frequently using the portable stove to use more than one facility for cooking the usual meals. This means that unexpectedly people adopt new cooking habits together with the improved technology.

<sup>17</sup> About 20% of the households in Ligomba and 34% in Matanya own more than one Chitetezo Mbaula, whereas no one in these villages has more than one three-stone fire.

The differences in cooking behaviour between both groups may result from a longsome adoption process. Households in Malawi may not replace their three stone fire immediately by a new technology, but it rather takes a long time to change the traditional cooking habits. Hence the presented results may show a snap-shot of this transition process.

But on the other hand, an average of 27% of the households in each village owns more than one Chitetezo Mbaula. Hence it is possible that these households just accustomed themselves to cook on more than one stove. Reasons for lighting two stoves may be that people are rather willing to light an additional stove due to the savings of firewood they experience or that they want to increase the time saving they already experienced on one stove.

Since no data is available about the types of cooking facilities people combine, no final conclusion can be made about the reasons for the modifications/adjustments of cooking habits by Chitetezo Mbaula users.

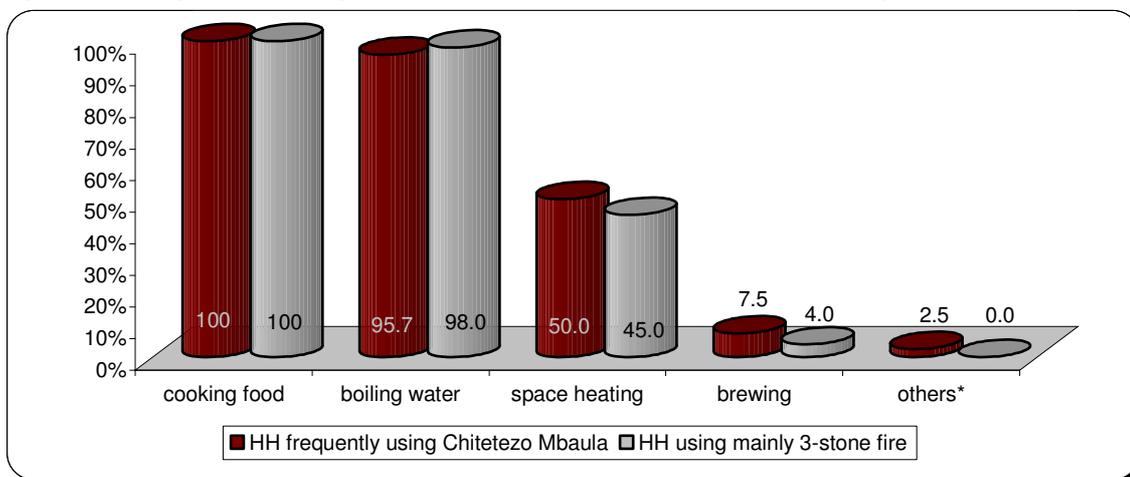
Changing habits in terms of using multiple cooking facilities need to be observed critically because they may influence the impacts of the improved stove in terms of firewood reduction. It is supposable that it takes more fuel to light two fires in the stoves even if the time spend on cooking halves, as it takes time and fuel to get a constant flame. Especially when the traditional open fire is used in addition to the Chitetezo Mbaula, the potential for reduced firewood consumption diminishes.

These are interesting aspects that should be examined and clarified in future surveys. They may also influence the projects calculation methods regarding the number of stoves and the firewood used per household.

A more important aspect determining the firewood consumption than the number of stoves used is the frequency of cooking. If firewood savings lead to an increase of cooking times per day, impacts on firewood consumption are compensated. But results show that this critical point can be excluded: It is most common amongst all interviewed households in Mulanje to cook thrice a day, regardless whether the improved stove or the traditional fire is used. At least 80% of both groups are cooking thrice a day, the remaining households stated to cook two meals per day only, while only one household in each group mentioned to usually cook more frequently (Annex 7).

The stove seems to have no impact on the frequency of cooking. Hence saved firewood is not reinvested into more cooking.

**Figure 18: Purpose of using Chitetezo Mbaula/three stone fire - Mulanje**



\*others: "roasting maize"

Figure 18 presents the purposes for using the improved firewood stove stated by the respective group of households as well as the purposes of using three stone fire stated by

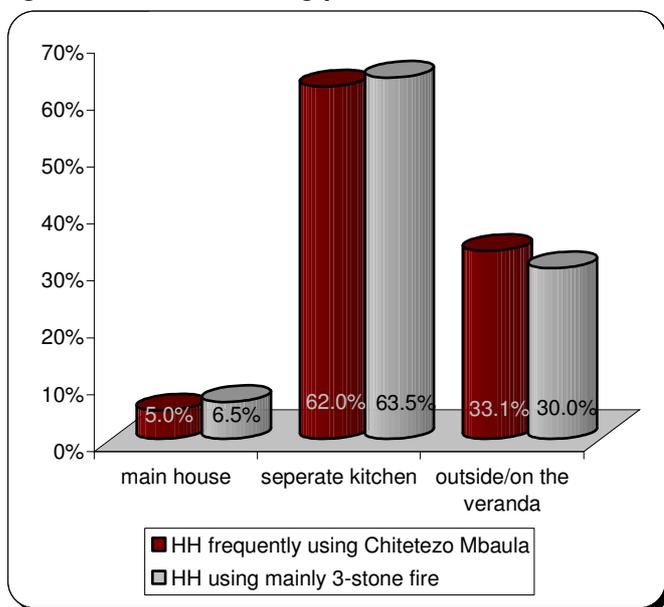
the second group. The distribution of answers is almost equal comparing both groups. All households are using their stove/three stone fire for cooking food. Almost all stated also the purpose of heating water (e.g. for bathing). The portable stove as well as the three stone fire is used for space heating by about half of the cases of both groups and some households also stated to make local brew.

These results indicate that the Chitetezo Mbaula has the potential to fully replace the three stone fire as all functions of the open fire can be delivered by the portable stove.

Chiwembu & Kanama2 (Ntcheu)

Ntcheu’s Chitetezo Mbaula users and users of the three stone fire are not showing significant differences in terms of the place they mainly use for cooking (Figure 19). A majority of over 60% in each group usually cooks inside a separate kitchen, around one third cooks outside, while a small number of households are cooking inside the main house.<sup>18</sup>

**Figure 19: Usual cooking place - Ntcheu**



Compared to Mulanje the number of households having and using a separate kitchen is noticeably high in Ntcheu. In both districts a kitchen is the most common place for cooking with three stone fire. But cooking inside the main house is on the second rank of cook places by the three stone fire group in Mulanje villages, while it has rarely been stated in Ntcheu.

Amongst the households of the Chitetezo Mbaula group there is a significant difference between both districts concerning the number of families cooking outside. While outside cooking is the first choice in Mulanje by nearly half of the respective households, it is only done by one third in Ntcheu.

It can be concluded that the use of the improved stove has no impact on the cook place households chose in the surveyed villages. This may be due to the fact that in general only a few households rely on cooking in the main house so that the need of switching to another place is not as prominent as in the Mulanje villages. Furthermore the climate conditions in Ntcheu are more unattractive for cooking outside, as the region is mountainous and gets much colder than Mulanje. Hence, the choice of cooking place is not influenced by using the improved stove in the Ntcheu villages and therefore has less impact on indoor air pollution in that specific context.

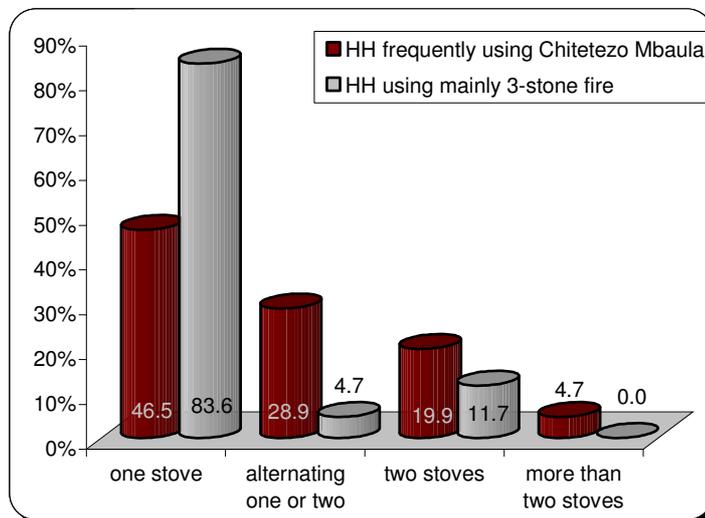
The distribution of the number of stoves used for cooking the usual meals in Chiwembu and Kabuthu is similar to the distribution in the Mulanje villages (Figure 20). The households mainly using the three stone fire commonly light one fire only (83.6%). As in Mulanje this results from the fact that households only possess one three stone fireplace.<sup>19</sup> The frequent portable stove users also mainly use only one facility, but in a significantly smaller extend of 46.5%. Another 28.9% of these households mentioned to

<sup>18</sup> The share of the households frequently using the portable stove inside (main house or separate kitchen), but only during rainy season is 11.8%. For the group of cases mainly using three stone fire this is 5.7%.

<sup>19</sup> Only one household in each village has two fireplaces.

use one as well as two cooking facility at the same time, depending on the effort. About one fifth usually prepares meals by lighting two stoves or a combination of stove and open fire.<sup>20</sup>

**Figure 20: Number of stoves used for cooking the daily meals - Ntcheu**



The share of household mainly using three stone fire that stated to also or exclusively cook on additional improved stove (Chitetezo Mbaula or charcoal), is with 16.4% higher than in the Mulanje villages. Similar to Ligomba and Matanya, these unexpected modifications of previous cooking habits may diminish the stoves impacts on firewood consumption.

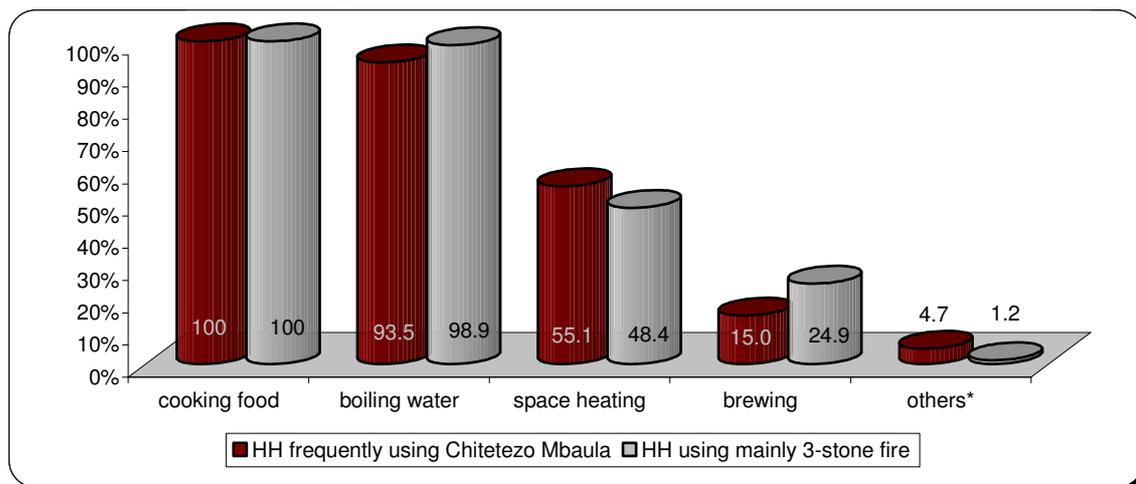
Like in Mulanje the regular use of the improved stove does not influence the frequency of cooking. Both user groups stated that usually three meals are prepared per day (around 83%). An average of 16% of each village stated to cook twice a day, while it is not common to cook more often than thrice (Annex 8). These cooking habits are almost equal to those in Mulanje. It can be concluded that firewood savings resulting from the use of the improved stove are not reinvested into an increase of cooking times.

The stated purposes for using the Chitetezo Mbaula by its frequent users, as well as those for using the three stone fire given by the other group, are leading to similar results as in Mulanje. Cooking food and boiling water are mentioned by almost all households in both groups, followed by space heating, which is slightly more common in Ntcheu than in Mulanje. Furthermore brewing is done more often, by 15% of households using the improved stove compared to 7.5% in Mulanje. On three stone fire, brewing is done by one quarter of the respective households (Mulanje: 4%).

Figure 21 illustrates the different purposes of use in Chiwembu and Kanama2. The continuous similarities between Chitetezo Mbaula and three stone fire usage emphasize again that the improved technology can serve all these purposes and therewith fulfils an important precondition to replace the traditional open fire.

<sup>20</sup> About 3.1% of the households in Chiwembu and 17.7% of those in Kanama2 own more than one Chitetezo Mbaula.

**Figure 21: Purpose of using Chitetezo Mbaula/three stone fire - Ntcheu**



\*others: "roasting maize"

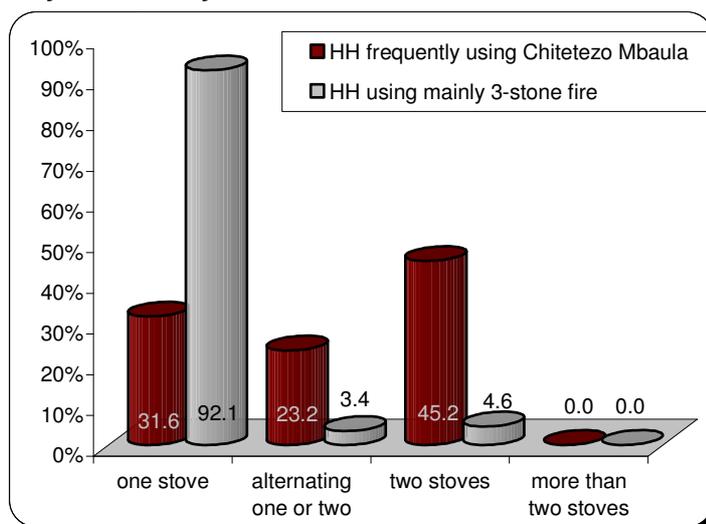
**Kabuthu & Chamasowa (Thyolo)**

The examination of cooking habits in the two surveyed Thyolo villages, Kabuthu and Chamasowa, leads to the following conclusions:

The frequent use of the Chitetezo Mbaula has no considerable impact on the place of cooking people chose (Annex 10). The Majority of both groups, households frequently using Chitetezo Mbaula and households mainly using three stone fire, has and uses a separate kitchen for cooking. Hence like in Ntcheu the improved stove has no additional impact on indoor air pollution in terms of people avoiding to cook inside, but still smoke is reduced significantly by the clean combustion of the stove. That will be shown later in this chapter.

The unexpected impact of the Chitetezo Mbaula usage on cooking habits concerning the number of stoves used is even more distinct in the Thyolo villages than in the other research areas. Figure 22 presents the distribution of answers given to the respective question. The group of households frequently using Chitetezo Mbaula attracts immediate attention due to the fact that the biggest share of these households (45.2%) usually uses two cooking facilities at the same time.<sup>21</sup> Only 30% of this group kept the traditional habit and uses one stove.

**Figure 22: Number of stoves/fires used for cooking the daily meals - Thyolo**



<sup>21</sup> Only 6% of the households in each village own more than one Chitetezo Mbaula. Therefore using two cooking facilities means most likely a combination of improved stove and three stone fire.

Those households mainly cooking in the traditional manner almost completely stated to use only one open fire to prepare their daily meals.<sup>22</sup> Hence these households are cooking one dish after the other just like it is the case for the surveyed three stone groups in Mulanje and Ntcheu.

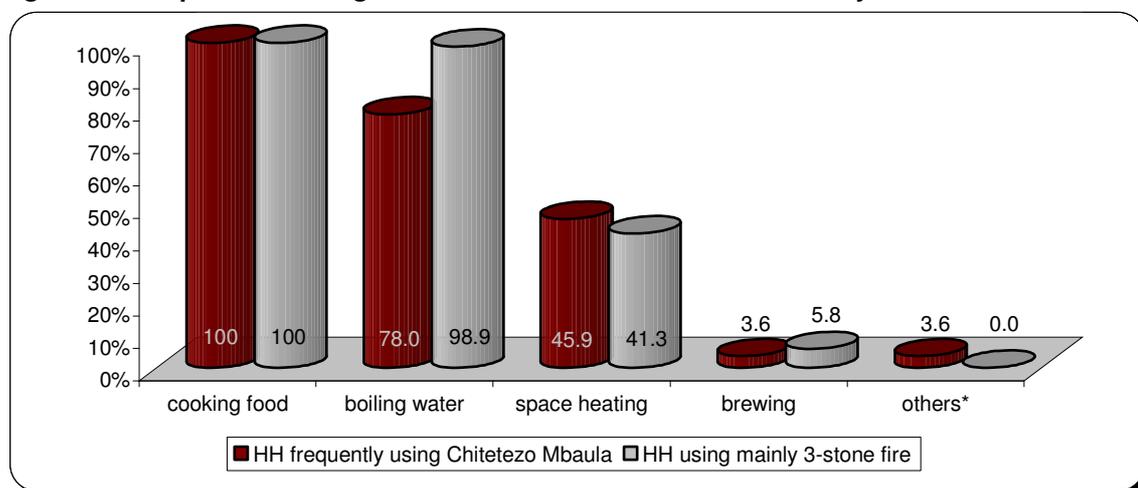
Due to the fact that only an average of 6% of the surveyed villagers owns a second Chitetezo Mbaula and an average of only 9.9% owns a charcoal stove, whereas almost all households have an open fireplace, it is most likely that the second facility used by Chitetezo Mbaula users is the traditional three stone fire. Certainly, this diminishes the impacts that the adoption of the improved firewood stove can achieve.

In Kabuthu and Chamasowa, alike the other research areas, the frequent use of the Chitetezo Mbaula has no impact on the number of meals cooked per day. Similar to the other surveyed villages it is most common in Thyolo's villages two cook thrice a day (Annex 9).

Results in Kabuthu and Chamasowa regarding the purposes of using the improved stove and the three stone fire are mostly similar comparing both facilities (Figure 23). While no major differences occur concerning the purposes of cooking food, space heating and brewing, this is the case for boiling water. Water is heated on the Chitetezo Mbaula by 20% less households of the respective group than it is done on the fireplace by the second group. This may be due to the perception amongst some villagers, that big pots as well as metal buckets (usually used for water heating) are too big and heavy to be used in the portable clay stove.

But still, examining the functions that the improved stove delivers compared to the traditional fireplace leads to the conclusion that the Chitetezo Mbaula could replace the three stone fire if fully adopted by the villagers.

**Figure 23: Purposes of using Chitetezo Mbaula/three stone fire - Thyolo**



<sup>22</sup> Like in the other research areas this is consequential, as households usually only possess one fireplace. Only one household per village was found with two three stone fireplaces. Other types of stove are not wide spread in Kabuthu and Chamasowa.

Good cooking practises

Within its section about cooking habits the household questionnaire also included a component of observation. If the interviewee was found in the process of cooking, practices in terms of the use of firewood and lid have been recorded as well as the presence of smoke in the kitchen (provided that cooking is done inside). Due to the fact that the number of valid cases (where cooking actually could be observed), turned out to be small in some villages, the households of all district are analysed together in this section.

**Figure 24: Observed cooking practices**

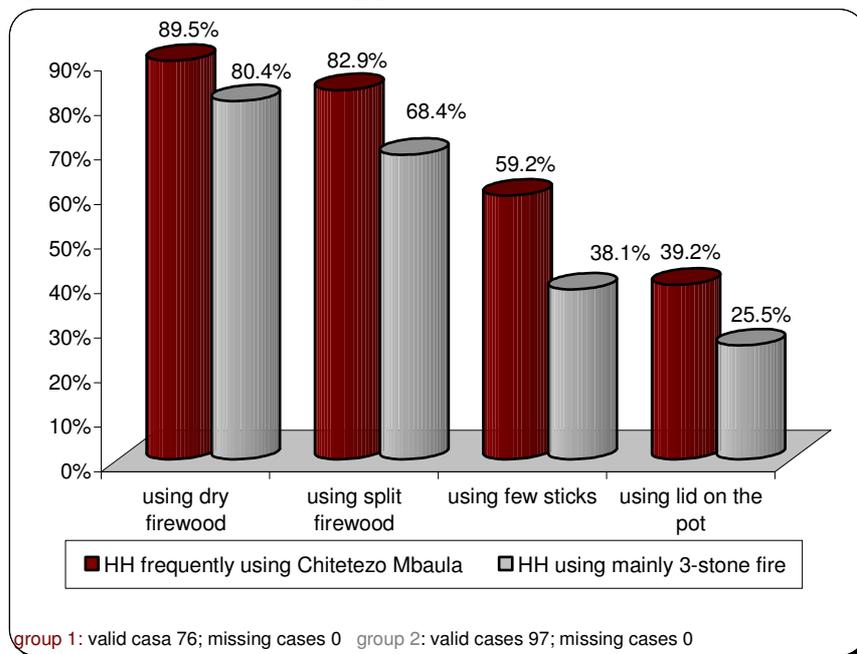


Figure 24 shows that the use of dried firewood for cooking is widespread amongst stove users as well as three stone users. But still this practice has been observed more often in households frequently using Chitetezo Mbaula.

Firewood is split by almost 83% of those households frequently using the improved stove. The respective share of households mainly cooking on three stone fire is 14.5% less.

The third cooking observation concerned the amount of firewood used in terms of the number of sticks. The average amount defined by ProBEC is the use of around three sticks which have a thickness comparable to two fingers. This is also the reference value used by the project to introduce good cooking practices in the course the producer trainings. A few sticks of firewood are even enough to cook on three stone fire, if other good cooking practices like the drying and splitting of firewood as well as the use of a lid on the pot are followed.

38.1% of the group mainly cooking on three stone fire was observed to use only few sticks for cooking. This practice was observed significantly more often in the households frequently cooking on Chitetezo Mbaula (56.2%).

The use of a lid on the pot while cooking is not quite common amongst the observed households, but there's also a visible difference between the two observed groups, in terms of a bigger share in the Chitetezo Mbaula group.

According to the project specific indicators, good cooking practices shall be adopted by at least 50% of the households using the improved stove. The results show that this goal is achieved in terms of the usage of dried and split firewood as well as in terms of the use of a few sticks.

The adoption of using a lid does not yet reach the aimed 50% of households using the improved technology. At this point it has to be taken into account that the use of a lid is not feasible for Nsima, one of the most common dishes within the research area as it has to be observed while cooking and needs to be stirred frequently. Furthermore a challenge in this context is that pots in Malawi are usually sold without lids.

Three out of four examined good cooking practices achieve the aimed user rate of 50%. This is a satisfactory result. However, it is difficult to determine in which extend these achievements do result from project activities, as no baseline data about good cooking practices is available.

Smoke reduction

Cooking with Chitetezo Mbaula can be almost smoke-free, provided that the firewood used is dry and split as well as limited in its number of pieces. Hence the observation of smoke emission during the cooking process represents a useful indicator to prove the adoption of good cooking practices.

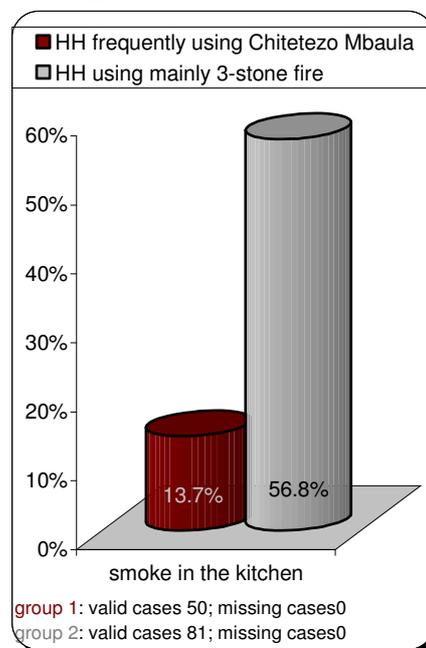
Smoke-free cooking furthermore represents the main precondition in terms of preventing indoor air pollution. It leads to a reduction of health hazards caused by smoke, to a cleaner kitchen environment compared to the three stone fire and hinders the pollution of food by smoke particles.

Observations concerning the presence of smoke in the kitchen lead to the following results: Smoke was observed in 13.7% of the Chitetezo Mbaula group compared to 56.8% of the households mainly using three stone fire (Figure 25).

Unfortunately the collected data cannot clarify if the households of the first group were actually found cooking on the Chitetezo Mbaula and not on another facility, even if the chances seem to be good. The same problem occurs to the second group of households mainly using three stone fire in terms of being observed cooking on the open fire or on another cooking facility. Hence the actual smoke reduction that is coming along with the improved stove usage may not be fully captured.

Nevertheless the impact of the portable stove usage in terms of smoke reduction is obviously. In about 86% of the observed households that frequently use Chitetezo Mbaula no smoke was noticed in the observed cooking process. This proves that stove users benefit from a significant reduction of indoor air pollution. Moreover this indicates the impacts of the stove in terms of reducing health hazards caused by lingering in smoke and its inhalation. In the majority of cases where households mainly using three stone fire were found cooking, smoke was observed in the kitchen. But still in a considerable share of the cases no smoke could be observed. This may be due to the common use of good cooking practices even amongst these households, especially in terms of the usage of dried and split firewood. It can be assumed that the adoption of good cooking practices reduces the smoke emission and therewith the problem of indoor air pollution.

**Figure 25: Cases of observed smoke in the kitchen while cooking**



### 4.1.3 Firewood Information

#### Ligomba & Matanya (Mulanje)

Firewood is the main source of fuel used in Mulanje. Almost all interviewed households named it as the most important fuel for cooking. The few remaining households stated agricultural residues (pigeon pea stalks) or bamboo as their major fuel. Neither charcoal nor any non-biomass fuel is used as a major fuel for cooking.

Besides firewood, the majority of households ranked different types of agricultural residues as second and third important fuels. These are mainly maize cobs, pigeon pea stalks, and stalks from maize, cassava or sorghum. See Annex 11 for detailed information about major fuels used.

**Figure 26: Supply of fuel wood - Mulanje**

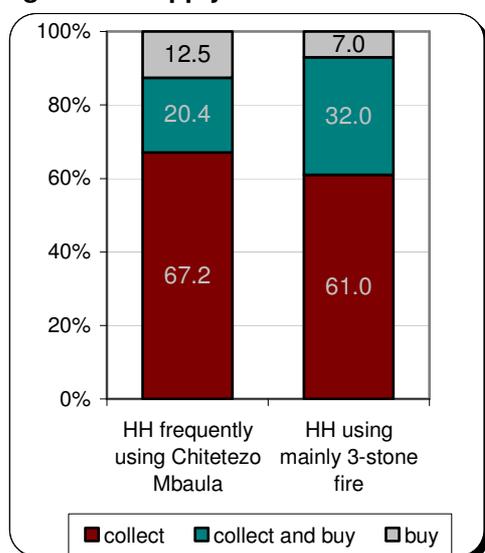


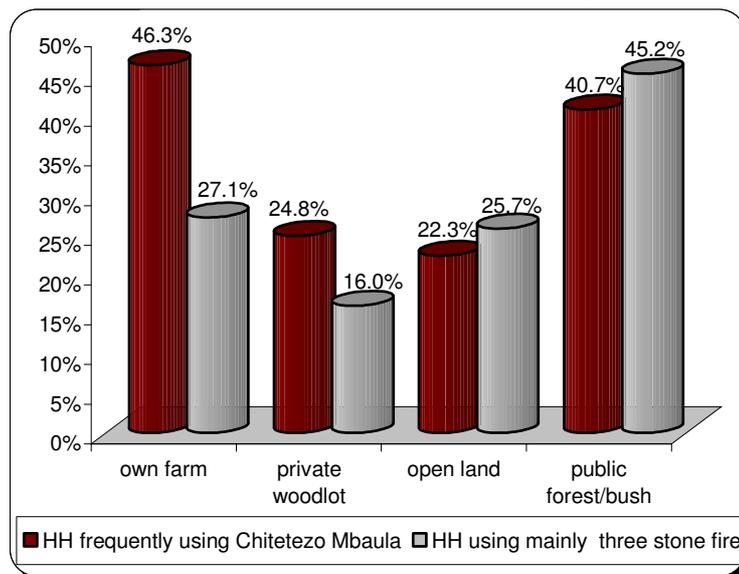
Figure 26 shows how households in Mulanje procure their firewood. The majority of the villagers collect firewood, whereas combination of collecting and buying is the second frequent response. Furthermore a few households stated to exclusively buy firewood.

Firewood collection takes place mainly at the own farm and in public forests. The distributions of responses given by frequent Chitetezo Mbaula users and those mainly using three stone fire concerning their sources of firewood collection are presented in Figure 27.

The most considerable difference between the two groups is that almost 20% more households of the first group gather their firewood on the own land. This indicates that frequent Chitetezo Mbaula users do more

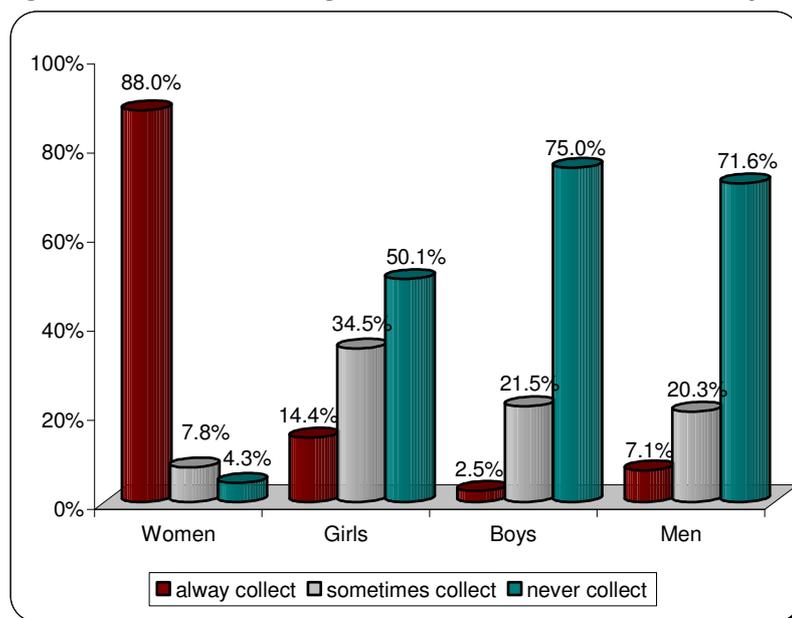
likely plant their own trees to obtain firewood than those households that mainly cook on three stone fire. This may result from former IFSP activities that promoted individual tree planting for firewood. It can be assumed that more Chitetezo Mbaula users have been engaged in former project activities than those sticking to traditional habits. The individual tree cultivation of improved stoves users certainly comes along with less forest degradation, as more firewood is taken from the own planted sources. To prove this assumption it would be interesting to also examine the amounts of firewood villagers of each group take from public forests.

**Figure 27: Source of collected firewood - Mulanje**



The collection of firewood in rural areas of Malawi is traditionally women’s responsibility. This is clearly evidenced by the answers regarding the persons in charge for firewood collection: In average 98.6% of the households that collect firewood in Mulanje female household members are involved in those activities. Figure 28 shows the workload of gathering according to the categories of gender and age. It is obvious that contrary to women, the majority of men (71.6%) is not involved in the collection at all. Boys are as rarely (about 24%) involved as men, while girls gather firewood in half of the respective households.

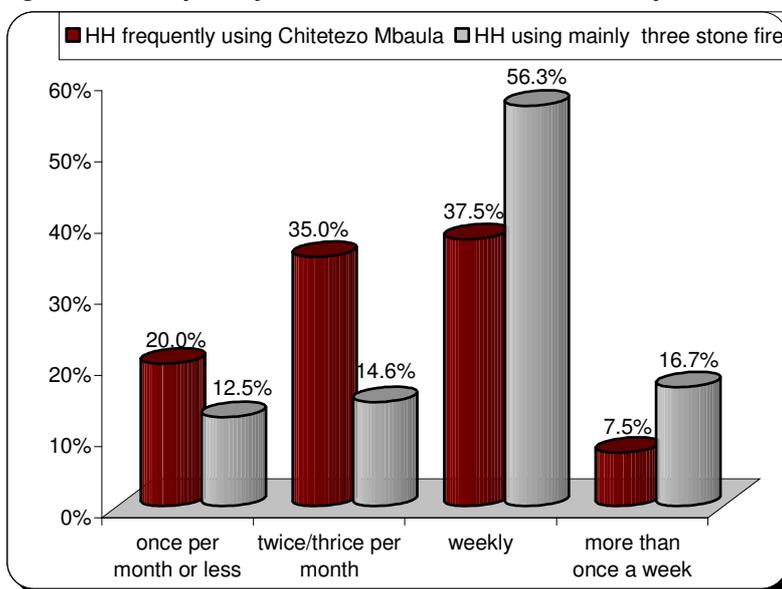
**Figure 28: Person in charge for firewood collection - Mulanje**



[percentages in each category may not add up to 100, because not in all HH all categories apply]

Families in Mulanje have different habits of firewood collection. Some collect small amounts (branches and twigs) on a high frequency, up to daily. These households do not stock their firewood but collect when the need arises. Others cut trees and stock the firewood as reserve, until the next felling is necessary, after two or three months. Depending on the kind of firewood collected, either branches and twigs or trees, and on the distance of the firewood source, firewood collection requires expenditure of time. Hence both indicators, frequency of firewood collection and time spend on each gathering, are examined in the following. It has to be taken into account that all results given here base on estimations given by the interviewees. Especially time spans are often hard to estimate for the villagers, so these results should be considered with a bit of reservation. Furthermore it should be considered that the time spend on firewood collection may differ throughout the year, because in the months of harvesting, agricultural residues are commonly used for cooking to compensate firewood.

**Figure 29: Frequency of firewood collection - Mulanje**



Comparison of the frequency of firewood collection in the Mulanje sample<sup>23</sup>, between households frequently using Chitetezo Mbaula and those that mainly cook on three stone fire, yields a considerable tendency of the first group to collect firewood less often than the second group (Figure 29). 73% of the three stone fire category responded to collect once a week or more often, while only 45% of the households cooking on Chitetezo Mbaula collect that frequently.

The average collection frequency in Ligomba and Matanya is four to five times per month for households mainly cooking the traditional way and three times for households frequently using the improved stove (Annex 14). More precisely, the frequency of firewood collection is reduced by roughly 36% due to the frequent use of Chitetezo Mbaula. It has to be taken into consideration that 23% of the collecting households only collect partly besides buying firewood. It can thus be assumed that this group primarily benefits by buying less firewood.

<sup>23</sup> Examined are all households that stated to collect firewood exclusively or partially.

Another important aspect of the impacts of stove usage on firewood collection is the actual time spent on that activity. Estimations on duration vary between 20 minutes and 10 hours per collection. It mainly depends on the source of firewood people access and the frequency of gathering. Households that rely on public forests have to walk far distances and furthermore have to pay a fee (observed in Matanya) to enter the forest and collect. These households usually

spend a long time on firewood collection, but on a low frequency. However, households collecting firewood on their own land around their houses often collect small amounts on a high frequency. Some of these households even collect daily.

Comparison of the estimated collection time between improved stove users and three stone fire users shows differences between both groups (Figure 30). The distribution of households mainly cooking on three stone fire is almost equal in each of the four categories of time spent, around 25%. However, less frequent improved stove users estimated to collect more than six hours (14.3%). Its majority stated to collect more than one up to six hours (more than 30% per category).

Averaging the estimated collection times shows that both groups spend three to four hours on the activity (Annex 15). Thereby, households frequently cooking on Chitetezo Mbaula spent 11% less time on firewood collection than those mainly cooking in three stone fire. This is equivalent to around 25 minutes per gathering.

Considering both the average frequency and the average time spent on firewood collection, it can be concluded that the time spend on firewood collection is about 43% less for those households frequently using the improved stove. This means a saving of roughly eight hours per month.

In the beginning of this chapter it has been shown that in the observed Mulanje villages 32.9% of the improved stove users and 39% of the three stone fire users are partly or completely buying their firewood. The amount of money households spent on firewood varies significantly. This is due to the fact that some households only buy small amounts as a supplement to the collected firewood whereas others completely rely on purchase. Hence the amounts of money spent on firewood per month range from 20MK (Malawi Kwacha) to 1500MK<sup>24</sup>.

Figure 30: Time spent per firewood collection - Mulanje

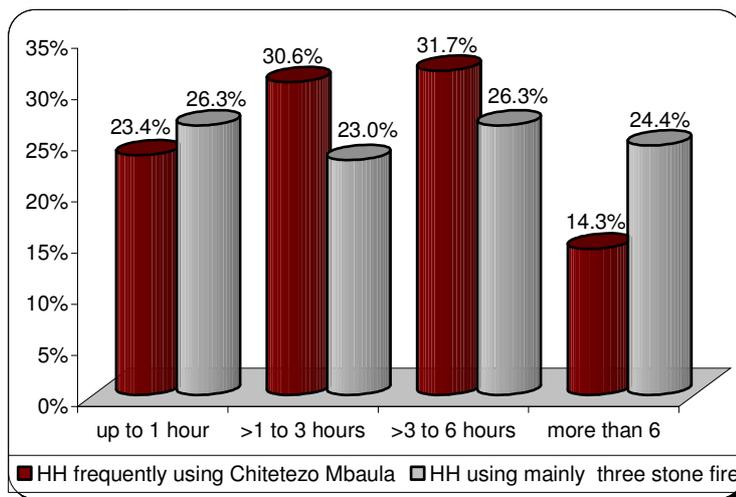
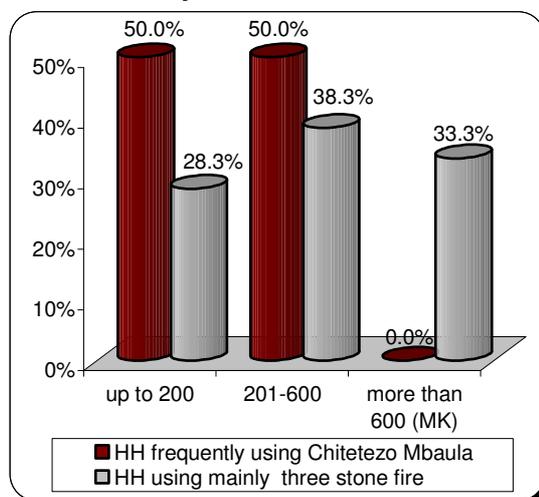


Figure 31: Money spend on firewood per month - Mulanje



Valid cases (group 1/group 2): Ligomba 6/7; Matanya 10/5

<sup>24</sup> 225MK were equivalent to 1€ by the time of the survey.

The estimated amount of money spent on firewood per month is represented in Figure 31. Differences between households frequently using Chitetezo Mbaula and those mainly using three stone fire are obvious. Improved stove users do not spend more than 600MK per month, with their expenses ranging between 20MK and 600MK. Cases are distributed equally in the first two categories of expenses.

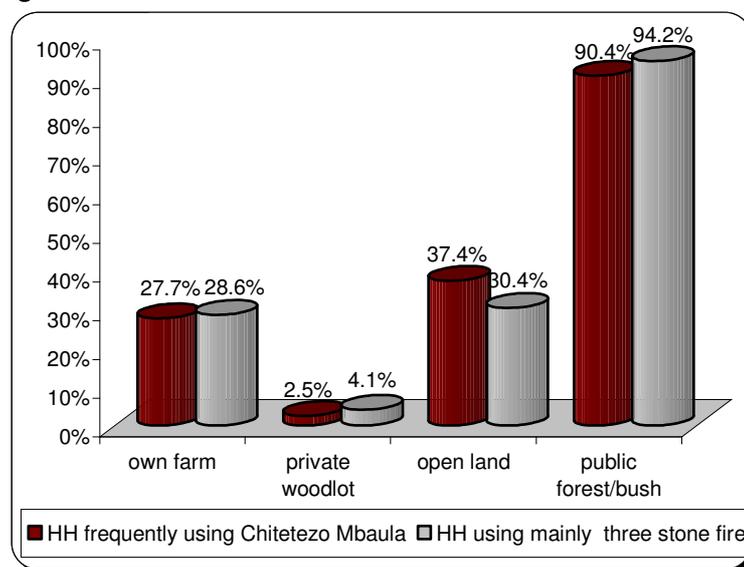
However the costs of those households mainly cooking the traditional way range from 200MK up to 1500MK per month. One third of the cases stated expenses within the third category of more than 600 Kwacha. Hence these households spend considerably more money on firewood than improved stove users.

Chiwembu & Kanama2 (Ntcheu)

Without exception, all surveyed households in Chiwembu and Kanama2 rank firewood as the most important fuel used for cooking. This is similar to the responses in Mulanje. And like in Mulanje agricultural residues are the major second and third important fuels. These are mainly maize cobs as well as maize, sorghum, cassava or pigeon pea stalks. But due to the fact that interviewed families in Ntcheu mainly keep livestock (cattle) than cultivate land, the availability of agricultural residues for cooking seems to be limited. Around half of the households stated to not use more than two types of fuel for cooking. See Annex 12 for detailed information about the cooking fuels used.

In Ntcheu, firewood scarcity is not as severe as it is in Mulanje. All surveyed households stated to procure their firewood through collection. None of the interviewees mentioned that their family relies on buying or even partly buying fuel wood.

**Figure 32: Source of collected firewood - Ntcheu**

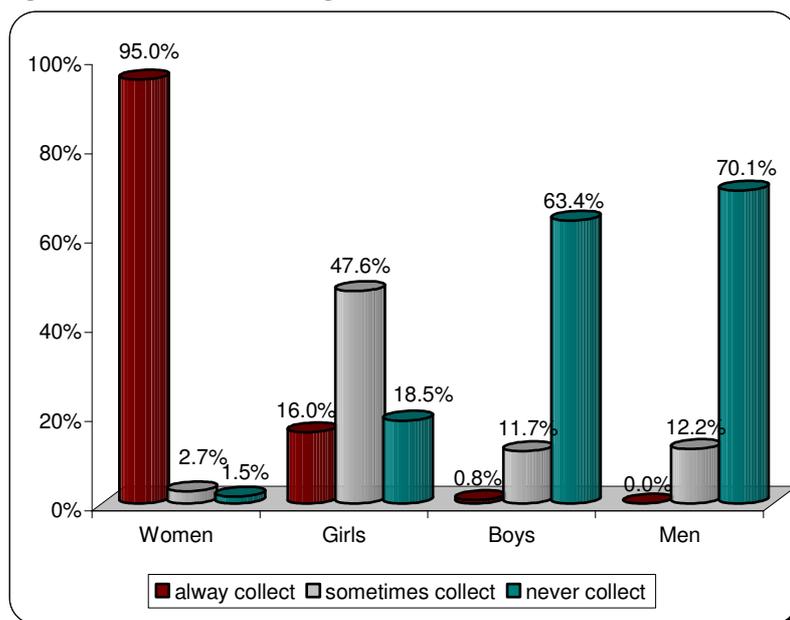


The collection of wood is done in public forests by almost all of the interviewed households. This shows that public firewood is still sufficiently available within the examined area. Compared to Ligomba and Matanya, where less than half of the households collect in public forests, the respective numbers in Chiwembu and Kanama2 are very high and therewith the pressure on forests caused by firewood consumption. Besides the public forest, open land and own tree plantings play a role amongst the collection sources in Ntcheu, but villagers usually do not rely on other people's woodlots. The source of firewood is rather similar between households frequently using improved stove and those mainly using three stone fire ( Figure 32).

In the previous section about Mulanje it was already shown that firewood collection is a gender related issue in Malawi. This also applies to Ntcheu (Figure 33), where the involvement of men is even lower than in Mulanje. In almost all households firewood is frequently collected by women (95%) and girls (16%) while the majority of men and boys are not involved at all or do only collect from time to time.

In comparison to the Mulanje villages, girls are in charge for firewood collection more often. Only averaged 18.5% of the Ntcheu households stated that girls are not involved compared to half of the cases per Mulanje village. Overall, female household members in Ntcheu are involved in the firewood activities in 99.2% of the cases.

**Figure 33: Person in charge for firewood collection - Ntcheu**

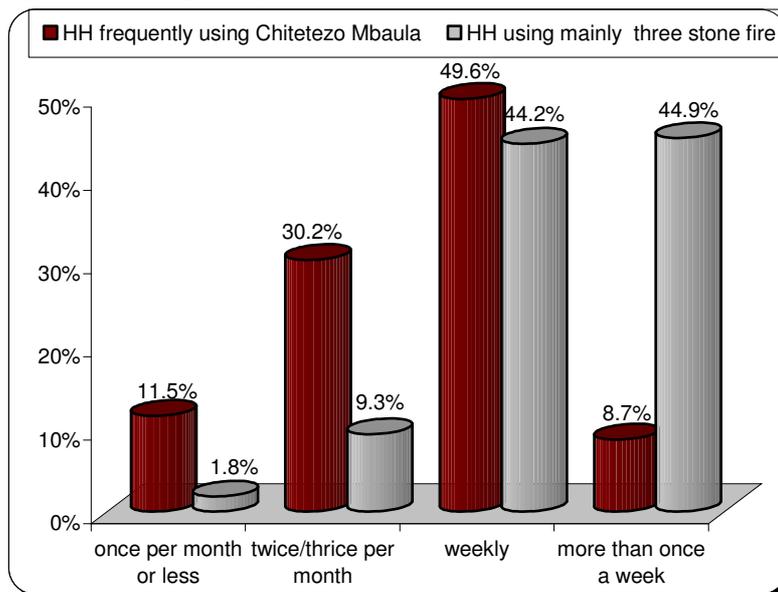


[percentages in each category may not add up to 100, because not in all HH all categories apply]

Besides the responsibilities concerning firewood collection, its effort in terms of frequency and duration has been examined with the following results.

As in Mulanje, collection times differ significantly between improved stove users and three stone fire users (Figure 34). In Chiwembu and Kanama2 these differences are even more obvious. The majority of almost 45% of the households mainly cooking the traditional way stated to collect fuel wood more than once a week up to daily whereas only a few households frequently using Chitetezo Mbaula (8.7%) do collect that often. The majority of improved stove user (49.6%) stated to collect once a week.

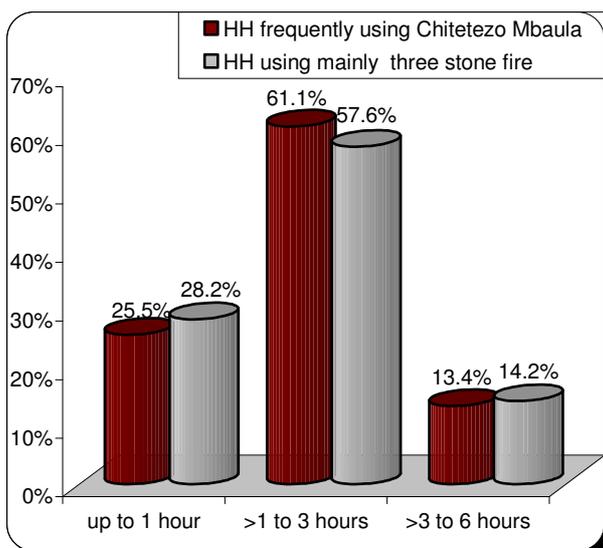
**Figure 34: Frequency of firewood collection - Ntcheu**



Those households in Ntcheu mainly cooking on three stone fire stated on average to collect between six and seven times per month (6.6). Improved stove users however only collect four times (Annex 14). Hence households frequently using Chitetezo Mbaula collect firewood 40% less often than households cooking on the traditional three stones. The difference caused by the improved stove is thus higher in the Ntcheu villages than in Mulanje, where the collection times are reduced by 36%.

Overall, the frequency of firewood collection in the surveyed villages in Ntcheu is higher than in those of Mulanje. On the other hand the time spent per gathering is generally less (Figure 35).

**Figure 35: Time spend per firewood collection - Ntcheu**



The majority of households estimated a duration between one and three hours and the second-most mentioned duration was even less. Furthermore, in contrast to Mulanje, none of the surveyed households in Ntcheu spends more than six hours on collection.

Estimated collection times in Ntcheu are almost equal according to the two examined groups, frequent Chitetezo Mbaula users and mainly three stone fire users. Both groups need an average of 2 hours. Comparison results in a slight difference in terms of 3% (4 min) that Chitetezo Mbaula users collect less (Annex 15).

Combining these results about frequency and duration of firewood collection in the surveyed Ntcheu villages leads to a total of collection time per month. By this calculation it can be concluded that due to the use of the Chitetezo Mbaula a household in Chiwembu or Kanama2 reduces the time spend per firewood collection by 42%. This is roughly six hours per month.

Money savings in terms of reduces firewood purchase cannot be observed in the surveyed villages in Ntcheu, because all households exclusively collect their firewood.

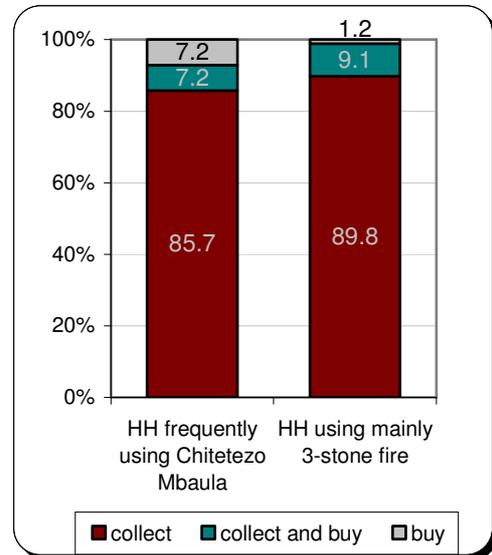
Kabuthu & Chamasowa (Thyolo)

The survey on the main fuels used for cooking in Thyolo shows similar results to Mulanje and Ntcheu. Firewood is the most important fuel for almost all households. Only a few households didn't rank firewood as their main fuel, but instead twigs and agricultural residues.

The fuels ranked as second and third important are types of agricultural residues (mainly maize cobs and pigeon pea stalks). See more details listed in Annex 13.

It is most common in Thyolo to collect firewood. Only a small share of households relies on buying or partly buying of firewood. There is no major difference visible between Chitetezo Mbaula users and three stone fire users (Figure 36).

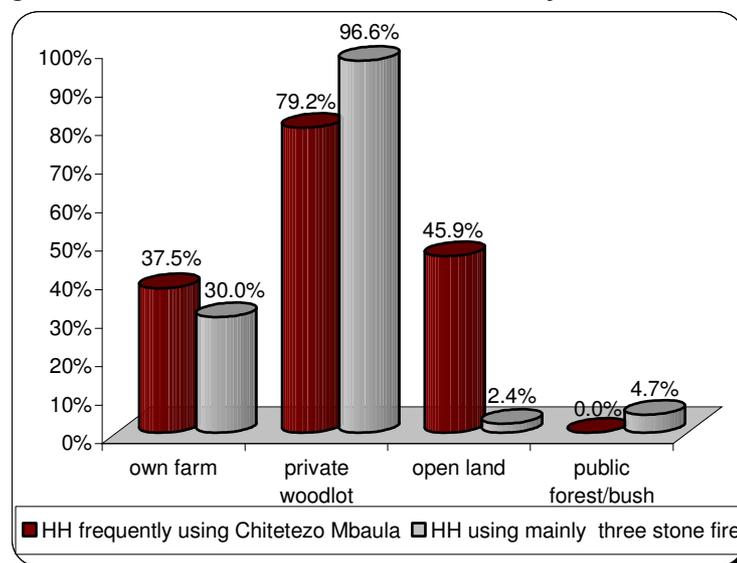
**Figure 36: Supply of fuel wood - Thyolo**



The collection of firewood in the visited villages mainly takes place in private woodlots (Figure 37). Unlike in the other research areas, villagers in Thyolo do not have access to public forests, as none of these are left within the area. Therefore the majority of interviewees stated to gather fuel on a large private farm that can be reached from both villages. Furthermore, around one third of the households can benefit from own tree plantings as a firewood source.

Comparing the households that frequently cook on improved stove with those mainly using the traditional three stone fire exposes a considerable difference regarding the gathering of firewood on open land. Almost 46% of the Chitetezo Mbaula users per village stated to collect their fuel on open land, whereas it has been mentioned by only one household mainly using three stone fire only. It is difficult to find a satisfactory explanation for this difference. It may result from the fact that the small pieces of fuel that can be found on open land, like sticks and stalks, can be efficiently used to cook on Chitetezo Mbaula, but difficult to be used sufficiently for cooking on the traditional open fire.

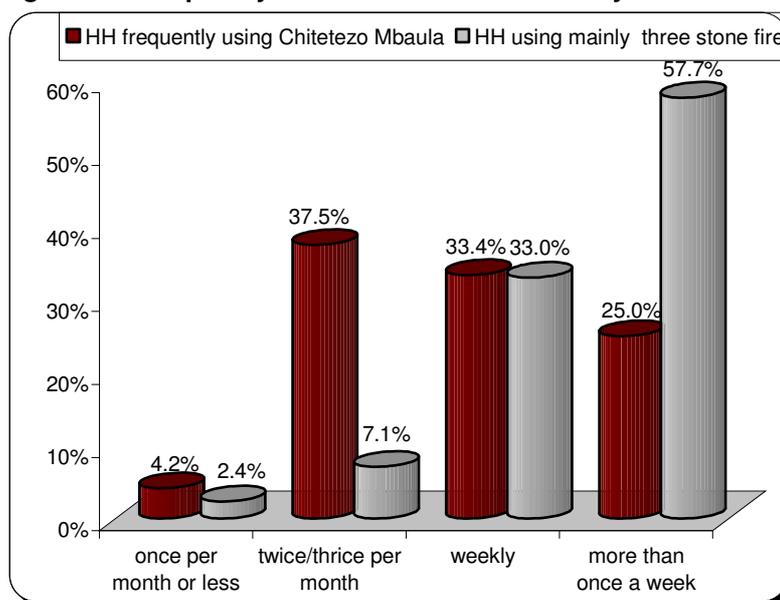
**Figure 37: Source of collected firewood - Thyolo**



Results concerning the distribution of workload in firewood collection in Thyolo are similar to the other surveyed districts (Annex 16). All households stated that female members are involved in firewood collection. Fuel wood is frequently collected by women in 95% of households and by girls in 30%. Only a small share of men and boys are sometimes also involved in gathering (below 10%).

The frequency of firewood collection in Kabuthu and Chamasowa is the highest found within the research area (Figure 38). A majority of almost 58% of the households mainly using three stone fire stated to gather several times per week. In contrast to that, most of the households that frequently use the fuel saving stove stated to only collect three to two times per month (37.5%). A third of both groups gathers fuel once a week.

**Figure 38: Frequency of firewood collection - Thyolo**



The estimations given by the interviewees lead to an average collection frequency of almost eight times per month (7.9) for households mainly cooking the traditional way and slightly more than four times (4.3) for the Chitetezo Mbaula group (Annex 14). It can be concluded that in Kabuthu and Chamasowa the frequency of firewood collection in households using Chitetezo Mbaula is reduced by an average of 46%. This is the highest impact reached in terms of collection frequency within the research area.

Gathering firewood in Thyolo's villages is not only most frequently done, it is also most time consuming. See

Annex 17 for the respective diagram of durations. On average, women estimated that they need between five and six hours per collection (Annex 15). Comparison between the two user groups leads to a small difference of 5.8% (19 min) that is spend less by households frequently cooking with Chitetezo Mbaula.

Considering the impacts of the Chitetezo Mbaula on frequency and duration of firewood collection in Kabuthu and Chamasowa, it can be concluded that the effort of time spent on gathering each month is reduced by 50%.

Cost saving impacts of the fuel saving stove only concern a small number of people within the surveyed Thyolo villages, because wood is rarely purchased in that area. But similar to the respective households in Mulanje, the small number of statements given on expenses obviously differs between both examined groups. The households frequently cooking with Chitetezo Mbaula spend less money on firewood than those sticking to the traditional three stone fire (Annex 18).

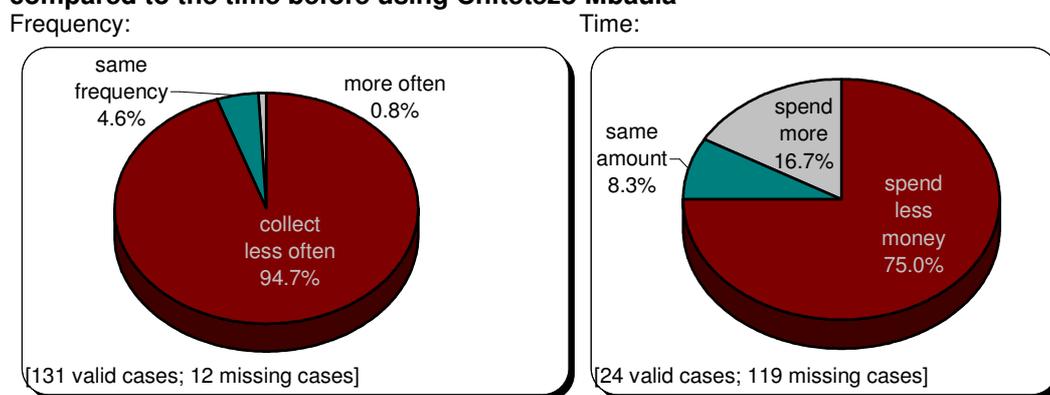
#### 4.1.4 Specific information on households using Chitetezo Mbaula

The following chapter focuses only on those households that are using the Chitetezo Mbaula<sup>25</sup>. These households were consulted with an additional section of the questionnaire that was developed specifically for improved stove users.

##### Changes in firewood collection and purchase

One part of this section deals with the situation of the households' firewood collection and expenses in the period before the Chitetezo Mbaula was acquired. For that purpose interviewees were asked to estimate how often they went for firewood collection and how much money they spend before using the improved stove. The comparison between these retrospective perceptions with those statements concerning the current situation leads to the following results:

**Figure 39: Frequency of collection and amount of money spend on fuel wood compared to the time before using Chitetezo Mbaula**



A majority of 95% of the improved stove users stated a lower frequency of firewood collection when asked for their collection habits after using the Chitetezo Mbaula. 5% of the stove users stated the same collection frequency and only one household estimated to collect more often since using the improved clay stove.

It has to be taken into account that retrospective statements might be influenced by personal perceptions. Furthermore differences in collection habits and firewood purchase can be caused by changes in household size, etc. that might have occurred in the respective period of time. Nevertheless, this result indicates that the difference in firewood collection between households mainly using three stone fire and those frequently using Chitetezo Mbaula is due to the use of the improved stove.

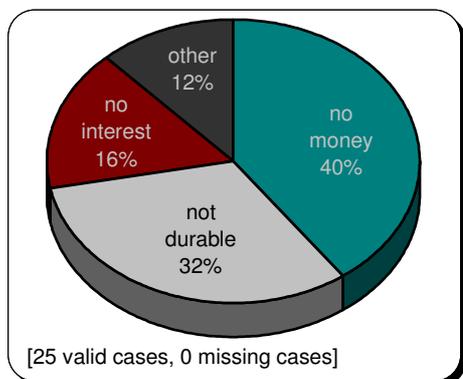
The same can be observed for the amount of money spent on firewood. Three fourth of the stove users spend less money after using the improved stove. This result supplements comparisons between mainly three stone fire users and frequent improved stove users made in Chapter 4.1.3. Again it can be reasoned that the use of the improved stove reduces firewood consumption and therewith the frequency of collection as well as the amount of money spend in the purchase of firewood.

<sup>25</sup> The sample used for that purpose includes data of all households that possess a Chitetezo Mbaula, excluding those that stated to never use it

### Replacement of the stove

It is one of the most important indicators for sustainability of the project implementation that households replace their worn out or broken stoves and do not revert to cooking only on the three stone fire.

**Figure 40: Given reasons from ex-users for not replacing the improved stove**



Others: not applicable: don't know where to find:

8% of all interviewed households (random sample) stated that they have been using an improved stove in the past, but do not possess one any longer. The main reason given for not replacing the stove is a lack of money, stated by 40% of the ex-users. Almost one third experienced problems with damages of the former stove and is discouraged by the short lifespan of the Chitetezo Mbaula. Another 16% lost interest in the stove.

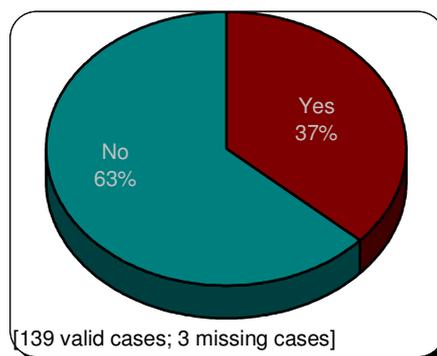
Compared to the study of 2004 the arguments of ex-users have changed. At that time the cardinal reason given from ex-users for not replacing the stove was the durability. People explained to be discouraged by a lack of quality that lead to fast damages and therewith to a

short lifespan of the stove.<sup>26</sup> These arguments still remain in the perception of people but now a lack of money is predominantly held responsible for not replacing. This shift in argumentation reflects the establishment of the new stove implementation approach, which improved the quality of stoves. In 2004, ex-users in Mulanje were still discouraged by a lack of quality of stoves resulting from a lack of professional firing in the first program phase. Furthermore all these households built their stove by themselves, so that money was not an obstacle. Today the group of ex-users turns out to be quite small. The stated argument of lacking money shows that the stove is a market product today. The question remains if stoves are actually too expensive to be accessed by the respective households or if it is a question of setting priorities in everyday live.

Amongst the stove users 37% of the interviewees mentioned that their households replaced the improved stove in the past.

The high number of households that have not yet replaced their improved stove might result from the fact that the stoves in general are quite young within the research area. 76% of the observed stoves do not exceed the expected lifespan of the stove of two years. Field observations showed that only a few stoves found in the households are in bad condition (see chapter 4.1.1).

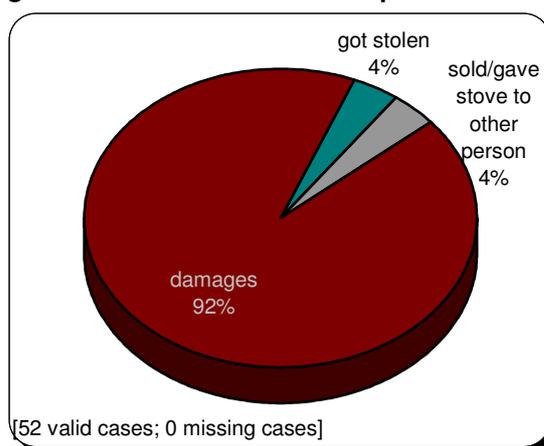
**Figure 41: Did users ever replace the Chitetezo Mbaula?**



The main reason for replacement given by the respective households is that the previous stove got damaged or broke down. Some households stated that their old stove got stolen or was given away to another person (Figure 42).

<sup>26</sup> Cf. Brinkmann 2005, p.17

**Figure 42: Given reasons for replacement**



Perceived advantages and disadvantages of the stove

Almost all users of the Chitetezo Mbaula considered fuel saving as one of the advantages of the stove usage. After that, reduced smoke and fast cooking<sup>27</sup> are the most mentioned advantages that are each appreciated by more than 50% of the stove users. Another frequently named advantage is a clean cooking environment (34.8%), which means that no ashes are polluting the kitchen and there is less soot on the pots after cooking so that they can be cleaned easily. Table 2 gives a detailed list of the advantages that stove users appreciate.

<b>Advantages of Chitetezo Mbaula</b>	<b>Count</b>	<b>Percent of responses</b>	<b>Percent of cases</b>
fuel saving	140	28.5%	99.3%
reduced smoke	79	16.1%	56.0%
fast cooking	77	15.7%	54.6%
clean kitchen & pots	49	10.0%	34.8%
more comfort	28	5.7%	19.9%
less burns/accidents	26	5.3%	18.4%
less respiratory diseases	22	4.5%	15.6%
better taste of food	20	4.1%	14.2%
portability	19	3.9%	13.5%
money saving	12	2.4%	8.5%
less eye diseases	6	1.2%	4.3%
fire burns more efficient	5	1.0%	3.5%
heat retention	3	0.6%	2.1%
fire needs less attention	2	0.4%	1.4%
conserves the forests	2	0.4%	1.4%
less rapes	1	0.2%	0.7%
<b>total</b>	<b>491</b>	<b>100.0%</b>	<b>348.2%</b>

[141 valid cases; 2 missing cases]

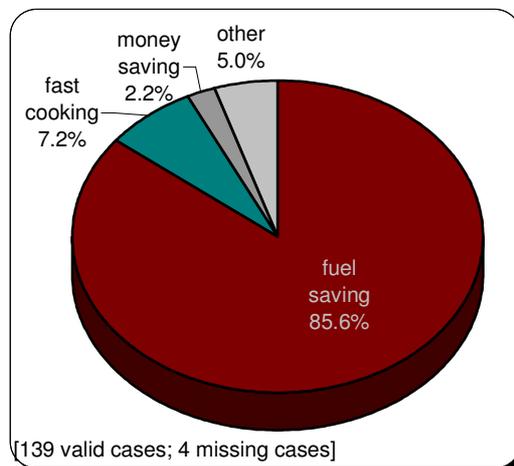
**Table 2: Advantages of Chitetezo Mbaula**

<sup>27</sup> As explained in chapter 4.1.2, between 46.6% and 68.5% of the surveyed villagers frequently using Chitetezo Mbaula adopt the habit to sometimes or always cook on two facilities at the same time. It can be concluded that this is the main reason for less time spend on cooking ("cooking fast").

The surveyed advantages in Malawi in 2004<sup>28</sup> correspond with those from today, but the distribution of answers differs. In 2004 also fuel saving has also been stated in the first place. After that fast cooking was mentioned followed by heat retention. Smoke reduction, which is on the second rank today, only played an inferior role in the perception of users three and a half years ago.

To rank the multiple answers the interviewees give when asked for the stoves' advantages, they have also been asked to name the advantage which is most important for them. The results show, that the majority of the respective households (85.6%) experience fuel saving as the most important advantage of the Chitetezo Mbaula (Figure 43). Considering that fuel saving has been mentioned as an advantage in general by almost all households and therewith by far more often than all other advantages, this result could be anticipated. It is noticeable that "reduced smoke" which is the second most stated advantage of the Chitetezo Mbaula has only been mentioned as major advantage by one household. Smoke reduction is considered by the majority of households but it doesn't seem to be as valued as fuel saving and "fast cooking", which is ranked as the most important advantage by 7.2% of the interviewed users.

**Figure 43: Most important advantage of Chitetezo Mbaula**



Other: reduced smoke; portability; fire needs less attention; clean kitchen; more comfort; less rapes due to less firewood collection; better taste of food

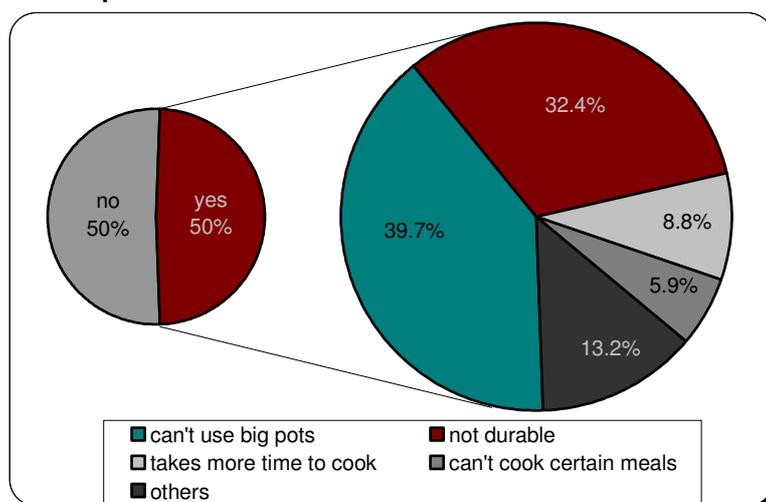
Besides the advantages of the improved stove, people have also been asked about the disadvantages they experience. Half of the stove users stated that the stove does not have any disadvantages for them. The remaining 50% of users have been asked to name the problems they perceive with the improved stove: About 52.1% of these households mentioned a difficulty to use big pots. Almost half (49.3%) also perceive that the stove damages easily and is therefore not durable<sup>29</sup>. These two are the most frequently mentioned problems users have. Others are for example the perception that it takes long time to cook with the portable stove (14.1%), that it is not possible to cook certain meals (14.1%) or that wet wood cannot be used for cooking (12.7). See Annex 19 for the detailed list of disadvantages.

Ranked as the most important disadvantage of the Chitetezo Mbaula is a difficulty to use big pots by almost 40% of the respective households, followed by problems with durability, which are named by 32%. Furthermore a long time for cooking and problems to cook certain meals are named as major disadvantages of the stove (Figure 44).

<sup>28</sup> Cf. Brinkmann 2005, p.17

<sup>29</sup> It was stated in all villages that the improved stoves are not durable. It is not a specific disadvantage for Mulanje, which might have been expected as users may have experienced problems in terms of quality in the first project phase.

**Figure 44: Do HH experience any disadvantages? Which is the most important one?**



Others: can't use wet wood (3), too hot to handle (3), not possible to sit around the fire (1), not possible to roast (1), too heavy (1)

#### Use of saved time and money

Without exception all interviewees using Chitetezo Mbaula indicated to save time by using the improved stove either in terms of fuel savings and therefore less firewood collection or in terms of fast cooking due to the efficient combustion and high heat.

Questioned about what the households do with the additional time they gain, lead to the following three major activities: doing household chores (45.5%), doing farming activities (34.3%) and resting (27.3%). Farming is a productive activity and contributes to the families' subsistence and therewith food security. It also has potential to improve the households' income through sales of agricultural products. Furthermore the fact that more than a fourth of the interviewees mentioned that time is used for resting indicates that using the Chitetezo Mbaula is a relief in the daily life of rural women. See Annex 20 for the complete list of activities people stated to do in additional time. The answers given here are similar to the results of 2004<sup>30</sup> where household and farming activities were the most named uses of saved time, whereas resting was only mentioned sparsely in that period.

The majority of households exclusively collects firewood and does not spend money for it. Therefore only a small share of households (19 out of 143) using Chitetezo Mbaula perceives to save money due to the reduced firewood consumption. These households were exclusively found in the Mulanje villages where the purchase of fuel is quite common. These households state a major use of the money saved as buying complementary luxury goods like sugar, salt or soap. This has been named by almost half of the respective households. Buying food was stated by about one fourth. Annex 21 presents a detailed list of the use of money saved.

In the study of 2004, the majority of the surveyed stove users in Mulanje specified to invest the saved money in households utensils. Buying food turned out to be the second most mentioned answer, as it is today.<sup>31</sup>

#### Procurement of the improved stove

Only 36.1% of the improved stove users received their stove through a commercial transfer in terms of cash exchange (28.5%) or payment in kind (7.6%). The majority of

<sup>30</sup> Cf. Brinkmann 2005, p.20

<sup>31</sup> Cf. Brinkmann 2005, p.19

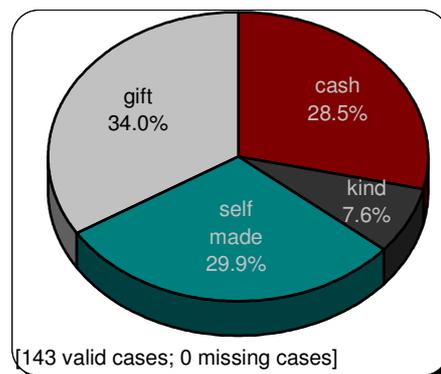
households procure the Chitetezo Mbaula in a non-commercial way. They either receive it as a gift (34%) or they build a stove by themselves (29.9%). The fact that more than one third of the stove users receive the stove as a gift raises the question of where this gift comes from. One answer may be that the stove is given away for free by the producer oneself due to socio-cultural obligations to the family and other community members. However another answer may be that someone else bought the stove from the producer and presented it to the respective household, which means that in that case the original procurement of the stove is commercial.

The way of procurement is a critical indicator when trying to answer the question of whether the ProBEC clay stove intervention in Malawi is implementing a commercial approach or not. Figure 45 can not give a satisfying answer to this question.

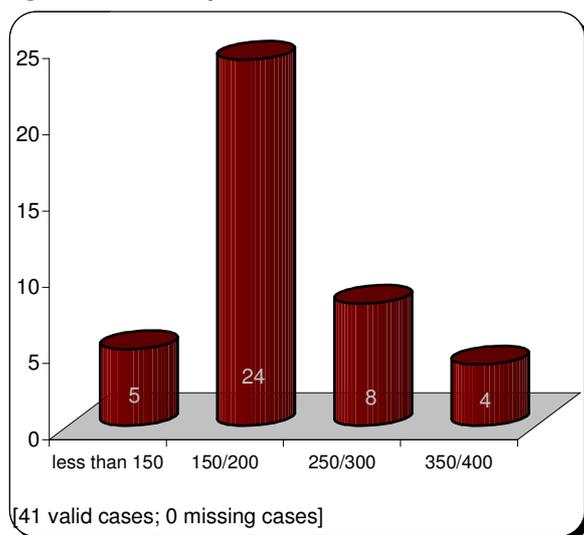
Another interesting result is that almost 30% of the stove users build the stoves on their own. Considering the fact that the households were chosen as a random sample, it is unlikely that the share of surveyed stove producers amongst the households is that high<sup>32</sup>. Hence it can be assumed that some households build stoves even if they are not professionally skilled. This circumstance is a potential hazard for the quality of stoves. But a detailed data examination concerning the self-made stoves show that 74.4% have been categorized by the researchers to be in a good condition. It has also to be taken into account that self-made stoves do appear in all villages. It is not a specific phenomenon in Mulanje<sup>33</sup>, where the training in stove construction was accessible for everyone.

The appearance of imitations or replicas shows that the Chitetezo Mbaulas are desirable and have a good reputation within the village.

**Figure 45: Procurement of the stove**



**Figure 46: Price paid for Chitetezo Mbaula**



Examining the share of households acquiring the improved stove with cash payment, the following price ranges arise: The majority of 24 from the respective 41 households paid 150 or 200 Malawi Kwacha for the stove. Only a few households paid less than that starting from 50MK. One fifth paid 250 or 300MK and some households paid up to 400MK to acquire the stove. Comparing the villages of the three Districts shows that prices paid for stove purchase are relatively low in the Mulanje villages (50-200MK), moderate in the surveyed villages of Ntcheu (100-250MK) and comparably high in Thyolo, where the producers group targets an outside market (120-400MK). See Annex 22 for the price ranges according to each village.

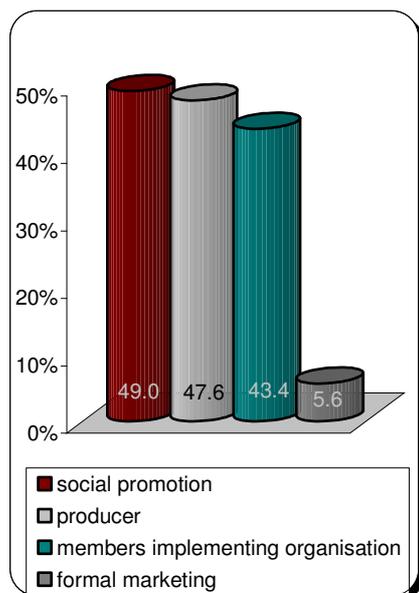
<sup>32</sup> This is also unlikely for the selected sample of stove users in Thyolo which is added to the improved stove users of the random sample in this Chapter.

<sup>33</sup> Average share of users with self made stove: Mulanje per village 33.4%, Ntcheu per village 38.2%, Thyolo per village 12.6%

Stove promotion

The question about how people get in touch with the improved technology leads to assessments about the stove marketing. Almost half of its users got to know about the stove, amongst others, through social promotion (49%). This includes public meetings, field days and information through neighbours, family, friends, or the local leader (see also Annex 22). This result indicates the involvement of the community in the stove

**Figure 47: How households got to now about the improved stove**



[multiple answers:  
141 valid cases; 2 missing cases]

dissemination processes. Improved stoves are not only producers' business but seem to concern the whole village. This involvement of the community also indicates the acceptance of the Chitetezo Mbaula by villagers and local leaders.

The second important source of reference about the improved stove is the producers, mentioned also by almost half (47.6%) of the stove users as one of the first information sources. Hence, it can be assumed that producers implement marketing strategies to promote their stoves successfully.

The promotion by members of ProBEC, the respective partner organisations (Concern Universal or Africare) or the community-based organisation (Mapanga) was one of the ways to get in touch with the stove for 43.4% of the stove users. Only a small share mentioned radio promotion and print media (brochures leaflet, newspaper) as one of the first information sources. This is consistent with the fact that no extensive promotion by radio or print media has been done in the villages by the implementing organisations in the past years.

## 4.2 Stove producer information

Supplementary to the household survey, stove producers have been interviewed in the respective villages to get an insight about their group structure and progress. Four producers in each group have been selected for that purpose. One interview was always conducted with the respective group leader (chairlady), while the other interviewees have been chosen randomly. A total of 20 producer interviews has been conducted addressing 17 female and 3 male producers. This chapter will give a short summary of the information gathered in the course of these conversations.

### 4.2.1 Producer groups

#### Ligomba Women Group (Mulanje)

Ligomba village is involved in stove activities since 1999, by the time when IFSP started stove implementation as a self help intervention. Inspired by the commercial stove production in the neighbouring pilot village Likalawe, one committee member joined the ProBEC training in commercial stove production and promotion. Subsequently Ligomba's stove committee built a kiln for professional firing and moved into commercial stove production in 2003/2004. At that time ten women were involved in the stove activities. Today their number decreased to seven. The group established a continuous production. They are supported by the village leaders and accepted amongst their community. New members are welcome to join the group without paying fees.

The producers describe the availability of clay in Ligomba as more than enough. It takes about one to two hours to dig and transport one head-load of clay. However, due to the scarcity of firewood, many producers have to purchase the share of firewood they contribute to the kiln firing. In addition to the improved wood stoves, it is common in the group to mould flowerpots from the clay and fire them in the kiln, together with the stoves. These flowerpots are used for own purposes or exchanged with villagers for other goods.

Project monitoring sheets about the outcomes of kiln activities documented two firings for the first three month of 2008, in January and February. In these firings 135 stoves of good quality have been produced. In the preceding year Ligomba women's group fired the kiln 10 times and produced 651 good quality stoves out of a total of 719.

Translating this data into monthly production comes to the following averages considering the year 2007 and the first three month of 2008:

<u>Ligomba Women's Group</u>	
Monthly production of good quality stoves	52
Monthly production per group member	7-8

#### Matanya Group (Mulanje)

The Chitetezo Mbaula has been introduced to Matanya village in the year 2000. The step over to a commercial production took longer than in Ligomba. Until the assessment in 2004 stove construction had not been established successfully by the 10 members of the stove committee. This was mainly due to problems of stove quality. Only after the assessment visits, with joint analysis of problems, the Matanya stove producers were motivated to further activities.<sup>34</sup> They transferred into commercial production in small steps, first firing stoves in the kiln of the neighbouring village (Kambenje). In 2006 the

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<sup>34</sup> Cf. Brinkmann 2006, p.xxiii

Matanya group finally built and fired its own kiln. A continuous production is established today, but on a very small scale. Group members complain that they cannot access markets outside their village.

As in Ligomba, the producers group is an integrated part of the community and is supported by the village chief. Matanya Group consists in seven people today, six women and one man. The membership in the producers group is free and interested villagers are welcome.

The producers assess the availability of clay as more than adequate. Clay gathering takes them about two to three hours. Expenditures for firewood purchase arise for many group members due to the lack of availability. Besides the portable stoves Matanya's producers also mould flowerpots to be fired in the kiln. These pots are made for own use or exchanged for goods with other villagers.

In the first quarter of 2008 the kiln was fired once (March) and 71 out of 72 portable stoves were burned successfully. Only three firings have been documented in 2007 with a total load of 219 Chitetezo Mbaulas out of which 215 came out in good conditions. This leads to the following production rate:

<u>Matanya Group</u>	
Monthly production of good quality stoves	19
Monthly production per group member	2-3

#### Nkonya Wa Abambo (Chiwembu, Ntcheu)

The Chiwembu group was originally founded in 2004 under the assistance of Concern Universal and the Ministry of Health. Activities of the group include food processing and utilisation, kitchen gardening and crop diversification. The request to get into the production of fuel-saving stoves came from the group itself.

Concern Universal arranged the production training for Chitetezo Mbaulas, implemented through GTZ/ProBEC, in October 2007. This was also when the group members fired their kiln for the first time. Nkonya Wa Abambo consists of 14 members out of which 2 are men. At least two of the participating women are disabled to walk. The stove business presents a special chance for them to contribute to their family's income as well as to overcome social isolation.

Chiwembu group is the "youngest" producers group visited within the survey. Members of the group are still in the process to establish their business. By now, two firings have been done in October 2007 and March 2008. In the first session, which was part of the training, 77 stoves were successfully burned. In the second firing the number rose to 125.

The clay source of stove production is located within the village itself, hence its collection is not time-consuming. The availability of clay is determined as adequate. The producers do not have expenditures for firewood, as enough wood can be gathered in the area.

The interviews showed that up to now the producers in Chiwembu did sparsely develop marketing and promotion skills and they are uncertain about how to proceed. This is due to the fact that the Chiwembu group still needs to gain experiences in their business. These learning processes may have been slowing down by a stove purchase of Concern Universal (100 out of 125 produced in the latest firing) that relieved producers from the need of active promotion and marketing. The group is furthermore challenged by a barrier they have to face within their community in terms of acceptance of their work and the improved stove itself. The villagers react reserved and some even begrudge the producers group their learned skills. This seems to be a problem every group has to face in the beginning. It will still take some time and also the demonstration of good attitudes towards the stove activities by the respective village leaders to overcome this barrier.

Nkonya Wa Abambo present itself as a closed institution. A membership has to be paid to join the group and learn the stove construction skills. Group members are intent to not share the market with too many producers, as they are scared to overstock it and loose profit.

<u>Nkonya Wa Abambo</u>	
Monthly production of good quality stoves	34
Monthly production per group member	2-3

Tiyese (Kanama2, Ntcheu)

Initiated by Africare, Tiyese was founded in 2005 as a women's group for microfinance. The group got into the stove business in the middle of 2006 after the members had been trained by GTZ/ProBEC and a kiln was constructed. Under supervision of Africare the women from Kanama2 established a continuous production and marketing strategy. Their business seems to be stable and is accepted within their community. The local leader is proud of the group's work and supports it by promoting the stove amongst the neighbouring village chiefs.

The producers in Kanama2 describe the availability of clay as more than enough, but with the source far away. Collection takes around four hours. As in Chiwembu none of the interviewees has additional expenses for firewood. The nine group members protect their knowledge and skills. Similar to Chiwembu a fee has to be paid to enter the group and get trained in stove construction.

In 2007 the kiln in Kanama2 was fired four times and a total of 264 good quality stoves have been produced. By the time of the assessment visit no firing had been done in 2008 so far, but stoves have already been moulded and were in the process of drying.

<u>Tiyese</u>	
Monthly production of good quality stoves	18
Monthly production per group member	2

Mapanga (Thyolo)

The producers group in Mapanga has been initiated by the Mapanga Community Based Organisation. This CBO was founded in 2001 and has several objectives. Around 25 villages are members of the organisation and the number is still increasing.

GTZ/ProBEC trained 60 members of the CBO in the end of 2006. The kiln was constructed in one of the community's villages, Chamasowa.

Stove production was implemented as part of the income generating activities of Mapanga. The producers group, which now consist of 10 women and 5 men, established a well-organised and high-frequency production. Furthermore a production centre was built composed of two buildings for stove construction and for displaying them after firing.

Unlike the other producers groups, Mapanga targets an outside market. Stoves are not promoted within the own villages. Clients are mostly partner organisations, hospitals, schools and others. The CBO pushes the stove promotion and connects interested clients with the production centre. Therefore the numbers of sales are high; also the prices are the highest within the research area.

The availability of clay is adequate for the group's needs. It takes two to three hours to dig and carry one load of clay. Due to a lack of firewood, it is common that producers have to purchase wood for the kiln firing.

In 2007, Mapanga's stove producers fired the kiln 24 times and produced a total of 1984 good quality stoves. Two further firings have been done in February and March 2008, in which 170 stoves have been burned successfully.

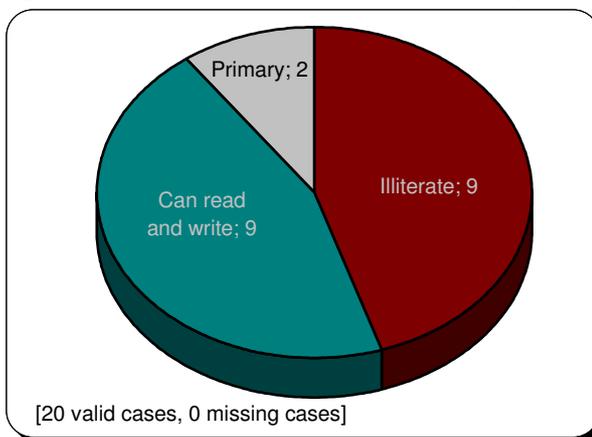
<u>Mapanga Group</u>	
Monthly production of good quality stoves	144
Monthly production per group member	9 -10

### 4.2.2 General information on stove producers

Within the research area, around 52 persons are active members of the five stove production groups. These stove producers are mostly women. Two of the visited groups, Ligomba and Kanama<sup>2</sup>, are pure women’s groups. Altogether men represent 15% of the producers. By chance this is also the share of men interviewed in the course of the producers’ survey.

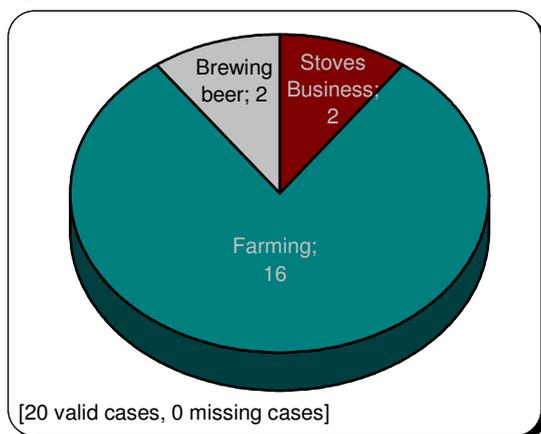
**Figure 48: Producers – educational background**

To illustrate the producers’ economic background, they have at first been asked about their educational career. Figure 48 shows that almost half of the interviewees are illiterate, while the other half went to primary school for at least three years and it can therefore be assumed that they can read and write. Only two of the interviewed producers completed the seven years of primary school.<sup>35</sup>

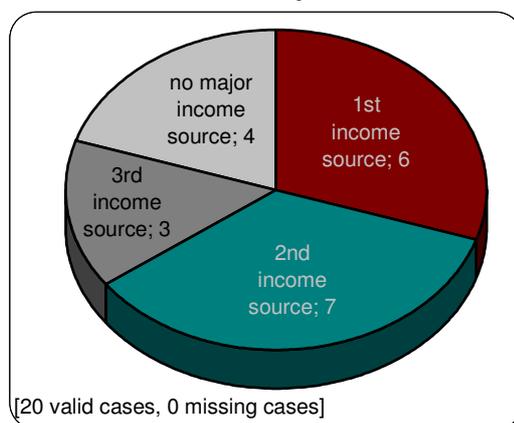


The monthly production rate examined above shows that stove business in the surveyed area cannot be categorized as a full-time job. The highest production rate was found in Mapanga, where the producers meet for stove construction in four afternoons per week. This is reflected in the self-assessment of the producers. Asked for their main occupation, only two interviewees named their stove business. As expected, a majority of 80% defines themselves as farmers (Figure 49).<sup>36</sup>

**Figure 49: Producers - main occupation**



**Figure 50: Stove business ranked as cash income source in producer HH**



Nevertheless, the stove business plays a role in terms of cash income. Producers were asked to name and rank their households’ cash income sources, including the income activities of all household members. After all, in 30%<sup>37</sup> of the cases stove business was named as the main cash income source of the household. As the second biggest income source it has been stated by more than a third of the interviewees. However, the stove

<sup>35</sup> The male producers are distributed as one for each category.

<sup>36</sup> Male statements: “Stove business” (2), “Farming” (1)

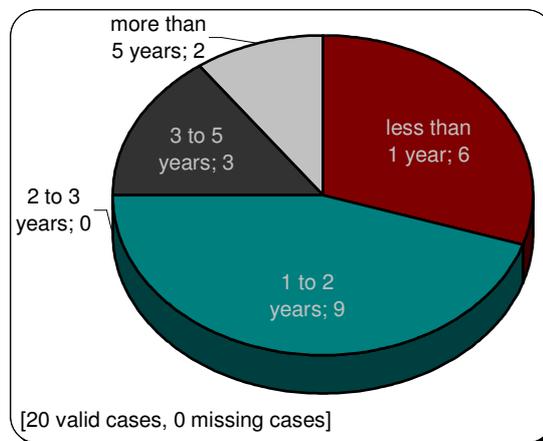
<sup>37</sup> Male statements: “1<sup>st</sup> cash income” (2), “no major income” (1)

business does not represent one of the three major cash income sources in 20% of the producer households (Figure 50).

Most interviewed stove producers are not yet long established in their business, since the groups, besides those in Mulanje, have not yet produced stoves for more than two years. Almost half of the interviewees stated to be member of a stove group for one to two years and another 30% stated less than one year.

The remaining fourth of producers is more experienced and specified to be active in stove production for three and more years. Evidently, these producers are member of the two Mulanje groups (Figure 51).

**Figure 51: Producers – years of activity in stove production**



All producers are using portable clay stoves in their own kitchen. Fireless cookers, which should also have been introduced during the stove construction training, are used by merely 30% of the cases.

#### 4.2.3 Information on stove production

The majority of interviewed stove producers came to their business through ProBEC or the respective partner organisation. 15 out of 20 joined a training conducted by ProBEC. Another four producers were trained by a village-based trainer and one interviewee just learned her skills through taking part at production activities. The training producers received was a technical training in stove construction and kiln firing; three quarter explained to also have been trained in kiln construction.

On the other hand 9 out of 20 interviewees stated to already have trained others in stove construction. These were the village-based trainers as well as some usual group members. Village-based trainers conducted trainings for members of their own group and also for groups in other areas. In the other cases producers trained relatives or other group members.

In all visited stove groups, work is done jointly. Group members meet at their production site, which is usually at the chairlady's yard, to prepare the clay and mould their stoves together. All tools, moulds and measurements needed for construction are treated as group property. Hence every producer has access to the necessary utilities.

The visited groups usually have none or low expenses for their production activities. Clay is the only raw material needed and can be collected for free. Furthermore each producer has to contribute her/his share of firewood for the kiln firing. Depending on the availability of wood, this is collected or has to be purchased. In Matanya and Mapanga, group members pay up to 100MK per person for the fuel. In Ligomba the costs for firewood can rise up to 150MK per firing and producer, whereas in the Ntcheu groups, enough fuel is available and producers do not need to purchase at all.

Even if clay collection is free, it takes time and is a burden, as the full sacks or buckets have to be carried on the head, since transport is unavailable or expensive. Depending on the distance of the clay source and of the number of trips that are made, clay gathering

takes up to six hours. For instance, the clay source in Chiwembu is located centrally within the village and producers estimate less than one hour for digging and carrying. Hence, when Chiwembu's group meets for clay collection, they dig around 80 buckets in one morning, which is enough for around 40 stoves. On the other hand Kanama2 is exemplary for long distances producers have to cover to reach their source of clay. Interviewees estimate that it takes four hours for walking and digging one load. Clay is transported in sacks, so that enough clay to produce three to six clay stoves (number depends on humidity and thus volume of clay) can be gathered in one trip.

80% of the interviewees stated that someone is assisting in that process of clay gathering. Mostly it is the children, mainly the daughters, helping to dig clay and carry it to the production site. Producers explained that it is also common that women from the village assist and get a stove in return. A common deal is to pay one good quality stove in return for gathering the amount of clay serving for the production of least two stoves. One producer furthermore stated to hire labour for 50MK per trip (digging and carrying). In the Mulanje groups, where firewood is scarcest, some producers also give stoves away in exchange of firewood. Clay collection is the only production step where any labour is hired. While digging and carrying clay is often done by others in return for one stove, cash payment has rarely been stated. A less common aspect of expenses is transport. Not many of the interviewed producers (4 out of 20) have access to market places, as these are usually far away. In Kanama2 one strategy to cope with that long distance is hiring labour for carrying. In that case the rates paid are 50-75MK for carrying one stove to the market or one of the second quality stoves from firing with cracks respectively.

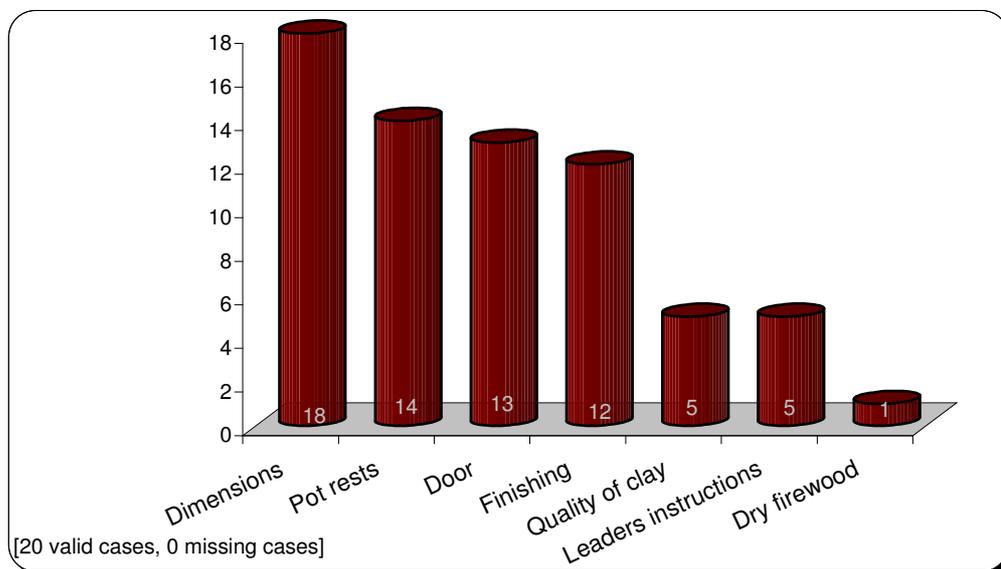
In all cases of hired labour, it is done by other women of the village; men (besides male producers) do usually not assist.

None of the interviewees calculates for her own labour costs, considering the time and effort spent on gathering clay and firewood, on moulding and firing the stoves as well as on promoting the stoves, for example at the market.

Quality criteria

Another important topic that has been discussed in the course of the producer interviews is quality control in stove production. The conversations indicated that quality criteria are taken seriously. Most important for the producers are the right dimensions, the correct installation of pot rests and doors as well as a good finishing. The quality of clay and its correct preparation seems to be mainly the concern of group leaders. The village-based trainer in Kanama2 also cares about the quality of firewood, as the use of wet wood for firing blackens the stoves (Figure 52).

**Figure 52: Criteria for quality followed in stove production**



Before firing, a quality control is done in all groups. This is important for the whole group, because badly prepared stoves may burst during the firing and destroy other stoves in the kiln. Quality control is the responsibility of the group leaders, but also the members are involved and control each others' stoves.

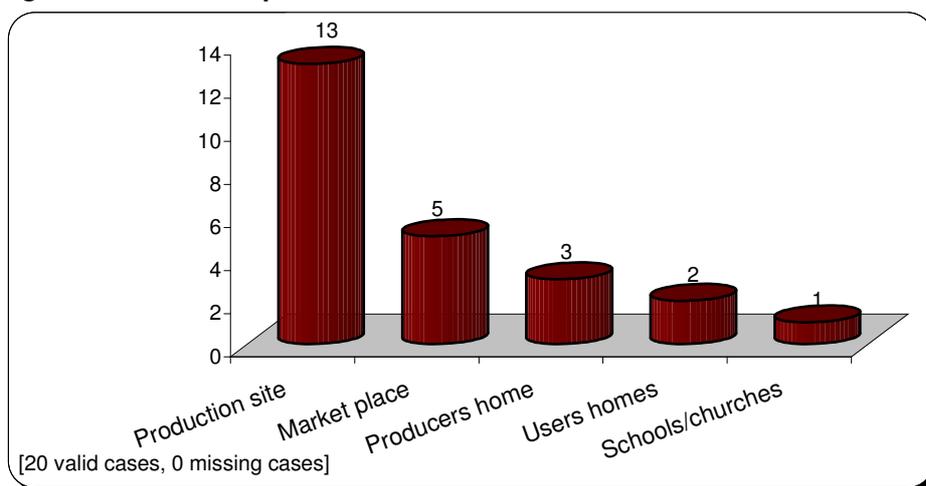
All visited groups are using the original stove design that has been taught in the construction training. The only modifications made are the individual ornaments that producers impress into the clay for decoration. Furthermore it is common (except in Chiwembu) that producers score the construction date onto their stove and half of the interviewees also write their initials.

After the stoves have been burned, the group meets to make a final quality control. In that process all stoves are graded. Within the first grade are those stoves without a spot that can be sold for the best price, which is 150MK in the Mulanje groups, 250MK in the Ntcheu groups and 400MK in Thyolo. Stoves of the second grade are those with cracks. Of course, these stoves are sold for less money. Bad quality stoves are handled differently according to the producers' groups. In Mulanje groups, these stoves are given away in exchange for assistance in clay gathering or firewood, while in Mapanga those stoves are exclusively used for own purposes but are not given away. In Ntcheu villages both ways have been reported.

Stove sales and promotion

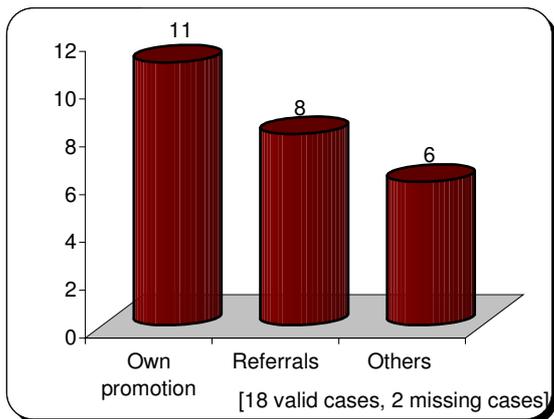
After successful production, stoves are mainly sold directly at the production site. In Mapanga, stoves are sold almost exclusively at the production site, as most of their clients are coming on their own through referrals of the CBO. In Chiwembu stoves are also only sold at the production site yet. A quarter of the interviewees do also sell stove at local markets; others sell at their own or the clients' homes. One producer also takes stoves to schools and church, to sell them there (Figure 53).

**Figure 53: Where do producers sell their stoves?**



To get an idea about the producers' promotion skills, the interviewees have been asked to describe how they get their costumers (Figure 54). One of the basic strategies consists in just using every opportunity of talking about the stove and its benefits, e.g. with friends and neighbours, at church or at the market place. For that purpose, some interviewees have a small model of the stove, to show around. One producer in Kanama2 for example promotes her stoves at awareness meetings and events of the ministry of forestry. Producers do also show their stoves to visitors in their own home, especially the village-

**Figure 54: How producers get their customers**



Others: Cooking demonstration day organised by CU, group donations of stoves to hospitals/schools (4), chief invites neighbouring chiefs for cooking demonstrations

based trainers that have a setup in their kitchens especially for demonstration, or if they live close to the road, they display their products at the roadside. Furthermore the kiln firing itself is often named as a useful advertisement as it sparks interest in the stoves by villagers and visitors.

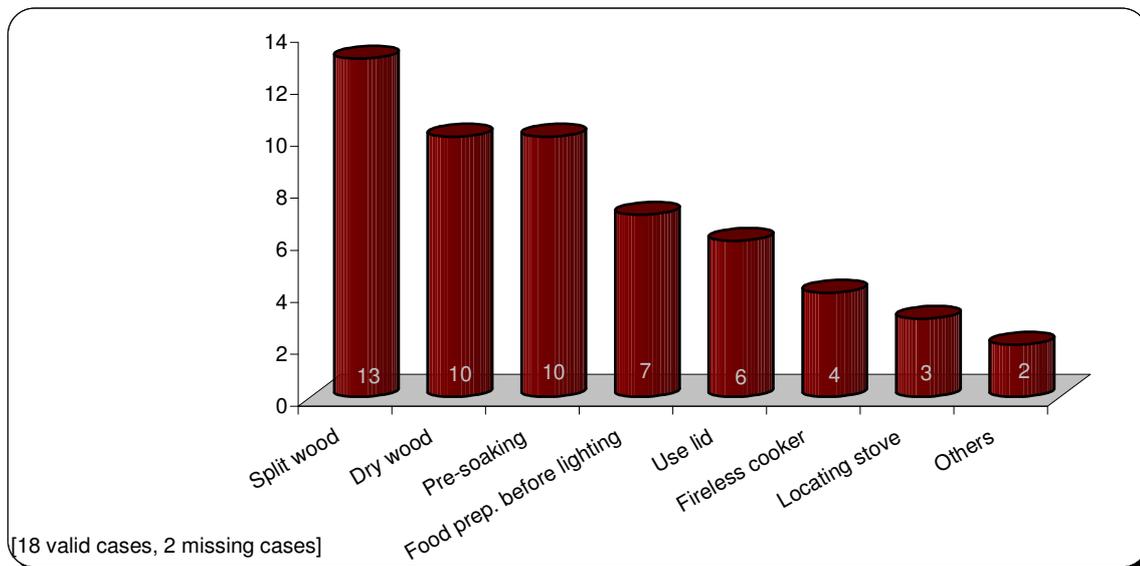
More extensive strategies of promotion are cooking demonstrations. Those have been stated in every group, but it remains unclear in which frequency they are practiced. In Kanama2 and in Chiwembu, cooking demonstrations are arranged after firing. When the kiln is unloaded, all stoves are displayed at the production site and villagers are

invited for a cooking demonstration. In Kanama2 the local leaders support the promotion as well and invite the neighbouring chiefs to join those events. Another opportunity that the producers choose for demonstrations is for example to assist with cooking at functions in schools and churches or at funerals.

Along with the increased use of Chitetezo Mbaulas, people also become customers through referrals. Mapanga Group pushes this mechanism additionally by donating stoves to hospitals and schools, to arouse the interest of people in these places. In this case, donations are organised through the Mapanga CBO that also supports the group in bringing partners and visitors of the organisation to the stove production site.

Producers in Chiwembu rarely developed promotion and marketing strategies up to now. Two out of four interviewed producers in this group did not yet do any promotion. This is due to the short time since Chiwembu's group started production, but also producers did not yet need to promote their stoves as almost all stoves from the second firing have been sold by the partner organisation.

**Figure 55: Advices given to the customer by stove sale**



Others: recommend receipt to prepare several foods together in one pot; promote shelves for Firewood storage

The surveyed producers groups are not equipped with users manuals. Hence all clients need to be advised orally on the correct use of the fuel saving stove, as good cooking practices are the key issue of efficient cooking. The advice producers state to give to their customers is not satisfactory. The most often stated advice (13 out of 20 producers) is to split the firewood for cooking. Other instructions are only given by half of the interviewees or less. These include the drying of firewood, the pre-soaking of beans and the use of a lid. Some producers furthermore promote the use of a fireless cooker or give advice about how to place the stove (e.g. facing the wind, or protecting it from rain). The use of a small amount of wood of a few sticks seems to be taken for granted, as it has not been mentioned as an advice by any interviewee.

The observations of the cooking practices of frequent stove users show that the use of dried and split wood is widespread practiced, but there is still a potential concerning the use of a reduced amount of sticks, which is not practiced by 40% as well as the use of a lid, which is not adopted by 60% (chapter 4.1.2, Figure 24).

The interviewed producers cannot tell if people replace worn out stoves or not. Only a few remembered that customers came a second time, but they could not tell if these customers bought an additional stove, a stove for other family members or a stove to replace their old one. But on the other hand none of the producers heard that clients reverted to exclusively using the three stone fire.

The producer group in Mapanga guarantees for the stoves' quality. Clients are offered a replacement stove, if one gets broken, but up to now no one took them up on their offer. The household survey turned out to be more informative on that issue, as it figured out that 37% of the Chitetezo Mbaula users already replaced their stove (chapter 4.1.4), while 8% returned to using the three stone fire (chapter 4.1.1).

#### Producer earnings

"The sales of Chitetezo Mbaulas are increasing". This is what all stove producers experienced since they started their business, except Chiwembu's producers, because they just started production. Even in Matanya, where producers complain about a lack of access to the market, the demand seems to be rising due to increasing awareness in the surrounding villages.

In general it is more profitable for stove producers to sell their stoves outside their village. Within their home villages social commitments/obligations lead to a relatively high rate of stoves that producers give away for free, mostly to family members, but also to other members of the community. This is also reflected in the results of the household survey regarding the way villagers get their stoves (4.1.4). Within the neighbouring villages and it is easier to sell stoves, mostly for payment in kind. However, the most profitable sales in terms of cash transfer seem to be possible on a local market place, but this also demands more effort in means of transportation and time. For the Mapanga group it is not necessary to access a market place, as they already have a rising demand of sales at their production centre.

Stove producers do not keep records about their own production and sales, but group records are kept about the total outcomes of the kiln firing. In Chiwembu and Mapanga the stove sales are drawn up in a joint cash box first and then distributed amongst the group members after a few months by the groups' treasurer. Hence it is easier there to get information about the individual return. This stands in contrast to Ligomba and Matanya, where earnings are individually handled and not easy to sum up. The following information about cash return could be derived from the producers' interviews:

In Ligomba and Matanya producers do not calculate their monthly cash income. At 150MK the prices for good quality stoves in Mulanje are the lowest within the research area. Within these groups stoves sales are paid directly to the respective producer and money is not cumulated in a joint cash box first. Stoves are sold irregularly, usually against

payment in kind or for negotiated low prices that do often undermine the prices agreed in the group. Especially producers in Matanya complain that it is difficult for them to get cash income as they have problems to market outside their own and the surrounding villages.

The producers in Chiwembu did not yet experience continuity concerning their stove sales, as they just started production. Since Concern Universal bought all production of the only firing that was done after the construction training, all producers successfully sold their stoves. The sales money in Chiwembu is administrated within the group by a treasurer. A part of the money earned was shared amongst the group members, while the other part is saved to be used for group activities. By now, each member received 1000MK from the first stove sales.

In Kanama<sup>2</sup> it is quite common amongst the producers to invest the main part of the earned money into the group's lending system, to get it back with interest in the end of the year. Due to that system it was easy for the interviewees to give information about their cash savings which range between 4500 and 4800MK for the last year. This is equivalent to 386MK per month.

Mapanga Group established a very frequent stove production. The group members meet for production on four afternoons per week. Their stoves are usually sold directly at the production centre and after every few months each producer receives her/his money from the group's treasurer. The first payment for 2008 has been done in March. Three of the interviewees stated that they have received between 4800 and 5500MK (equivalent to 1700MK/month), while the village-based trainer even got 9000MK (equivalent to 3000MK/month). All members of the Mapanga stove group contribute 20% of their money earned through stove sales to the CBO's orphanages. The producers of Mapanga appreciate their stove business as a profitable income source.<sup>38</sup>

These differences between the producers groups show that economic benefits resulting from the stove business cannot be generalized or averaged. Not only the production rates differ considerably from group to group, also the agreed selling prices of a good quality stove. Especially in Ligomba and Matanya but also in Kanama<sup>2</sup> stove sales against payment in kind (usually clay or firewood) are common if stoves are sold within the neighbouring villages. This transfer of goods should not be undervalued.

The money earned through stove business is usually invested in food, soap, clothes and households utensils. One quarter of the producers stated to spend the money on school uniforms and school fees for their children. Some producers also invest the money to increase their agricultural productivity by buying seed and fertilizer. Furthermore money earned through stove sales is sometimes invested in drugs for medication.

Asking the interviewees for their plans for the future, all respond that they intend to continue their stove business. Furthermore everyone explained to target an increase of production and therewith of the money earned through stove sales, to later make more investments into fertilizer to improve farming productivity as well as into other households needs. This shows that producers appraise their stove business as worthwhile, even those that do not get much cash return. All producers are furthermore aware about a potential of scaling-up their business. But this seems to be part of future planning which has yet to be realised.

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<sup>38</sup> For comparison: a tea picker in this region usually earns 2700MK for a full-time six-day job.

## 5 Assessment of impacts

### 5.1 Millennium Development Goals

The presented results of this study enable the assessment of impacts of the Chitetezo Mbaula. In the following chapters these impacts will be summarised and presented according to its main impact areas, which are equivalent to the main focuses of the MDGs, namely poverty, health, gender, environment and education

#### 5.1.1 Poverty reduction

The surveyed economic impacts of the Chitetezo Mbaula, and therewith its' contribution poverty reduction and eradication of hunger (MDG1) can be divided into two sections according to the survey's targeted groups: stove users and stove producers.

##### Economic impacts on Chitetezo Mbaula users

Two major impacts concerning the economic situation of the families could be assessed in the course of this study. Both result from the reduced consumption of firewood that is achieved by the use of the improved stove. Within the research area, less fuel consumption leads firstly to a reduction of time spend on collection and, secondly and to a small extend, to a reduction of expenditures on firewood purchase.

Frequent users of the Chitetezo Mbaula benefit from a reduction of time spent on their monthly firewood collections by 42 to 50%. Depending on the research area this implies time savings that range roughly between 6 and 22 hours per month. Furthermore the majority of users (54.6%) perceive to spend less time on cooking with the Chitetezo Mbaula. This release of additional time bears the economic potential to be spent for income generating activities. Actually, parts of these time savings are invested into farming activities by about on third (34.3%) of the users and a small share (8.4%) invests into small scale businesses. It can be assumed that the time savings resulting from the Chitetezo Mbaula usage increase the agricultural productivity of the households and therewith impact - within a small scale - on food subsistence as well as income generation.

Within the surveyed Malawian families firewood is usually collected. Only a small number of households purchases fuel wood exclusively or supplementary. Examining this group of households leads to the conclusion that the frequent use of the Chitetezo Mbaula considerably reduces the expenses on firewood. Hence the stove can improve the households' financial situation by saving money on firewood.

##### Economic Impacts on Chitetezo Mbaula producers:

Stove business is not a full time job. Only 2 out of 20 surveyed producers named the stove business as their main occupation. But still it is an important cash income source for the respective families. 30% of the interviewed producers ranked their stove business as the biggest cash income source within their household.

The actual production rates as well as the selling prices of the stoves differ immensely between the examined producers groups. Hence numbers about profit cannot be generalized. The results show that stove production has the potential to be a profitable income source, as in Mapanga. Still, the majority produces on a very small scale. The money gained through stove sales is usually spend on food, household utensils, and fertilizer but also in clothes, school fees and medication. Therewith stove production contributes to reduce poverty of the producers' households.

### 5.1.2 Health

The traditional cooking on three stone fire leads to severe smoke emissions. The smoke from biomass contains a large number of pollutants that are dangerous for people's health. WHO-statistics show that the large extent of indoor air pollution due to traditional cooking on open fire causes acute respiratory infections in children, and chronic lung disease in adults.<sup>39</sup>

Cooking with Chitetezo Mbaula can be almost smoke-free. The stove design enables a cleaner combustion than the traditional three stone fire place. The results of the study concerning field observations of cooking processes confirm this improvement. The great majority of 86.3% of the frequent Chitetezo Mbaula users that have been found cooking did this without observable smoke emission. Hence the use of the improved stove comes along with a significant reduction of smoke and therewith of indoor air pollution. This is also reflected in the user's appreciations, as they stated the advantage of less smoke second to firewood reduction. Evidently this reduces health hazards caused by smoke, like respiratory diseases and eye infections, which has also been recognised by the improved stove users. This study did not further survey the health conditions.

The hazards of air pollution do not only concern the women in charge of cooking and therewith also the health of expectant mothers (MDG 5), but also the children who are involved in cooking or are just present, as they are carried around on their mother's back. According to WHO<sup>40</sup>, a reduction of indoor air pollution prevents child morbidity and mortality from pneumonia, which is the main child killer worldwide (MDG 4). Judging from current research, the reduction of indoor air pollution is furthermore a preventive factor against tuberculosis (MDG 6).

### 5.1.3 Gender empowerment

In the rural areas of Malawi, cooking as well as the procurement of fuel is traditionally women's responsibility. This is also reflected in the gathered data. In almost all surveyed households women or girls do the daily firewood collections and in all households (except one) it was a woman who was responsible for cooking and therefore also the targeted interviewee.

Since these tasks, which are most relevant regarding the impacts of the Chitetezo Mbaula, are chiefly carried out by women, women present the prior target group in all stove implementation activities. Evidently women are also benefiting from the stoves' impacts in the first place.

As explained above, the women's workload in term of firewood collection is reduced considerably by using the improved stove. This comes along with additional time women spend mainly on household chores, farming activities, resting as well as doing small scale business. Hence women invest the saved time in the everyday work activities, but on the other hand they also perceive a relief in their daily workload, which gives them time to rest, and to socially interact by caring for their children, doing community work or just chat with friends.

Another area of impacts presented above is the achievement in stove usage concerning the reduction of smoke and therewith of indoor air pollution. The observations of the survey show that the great majority of frequent Chitetezo Mbaula users are able to cook smoke-free. This is also reflected in the user's perceptions of the advantages of the improved stove, where less smoke was the second most mentioned point. The results show that women also perceive less respiratory problems and eye irritations caused by smoke.

Furthermore women benefit from a safer way of cooking, due to the closed design of the Chitetezo Mbaula. This leads to fewer burns and accidents, which is also reflected in the users appreciations.

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<sup>39</sup> Cf. WHO 2002

<sup>40</sup> Cf. WHO 2006

All these aspects show that the Chitetezo Mbaula improves the daily life of women and therefore contributes to their welfare.

Besides the stove users, also the stove producers represent a gender specific group, since 85% of the 59 stove producers from the surveyed groups are female. These women benefit from the economic achievements of their stove business. But most importantly they gain social prestige and empowerment. The visited groups (except one) are respected within their villages and supported by the village leadership. Producers therewith gain a voice within their community.

It can be assumed that these circumstances as well as the economic impacts associated with the stove business empower women also within their families in terms of self-determination and participation in decision making.

#### **5.1.4 Education**

The effects an energy saving stove can contribute to the goal of reaching universal primary education are small but plausible. However, due to a limited extent of this study these plausibilities could not be followed up further.

As the present study demonstrated, households frequently using Chitetezo Mbaula are considerably saving time in firewood collection. Besides women, the children are benefiting from this achievement, as in 60% of the surveyed households girls are at least sometimes involved in fuel gathering and boys in 16%. This additional time can be spend for homework and also may increase school attendance. Furthermore, economic impacts of firewood reduction may allow families to contribute more to the children's education.

Even more benefiting are the children of stove producers. One fourth of the interviewees stated to invest the money earned through stove business in school fees or uniforms. The parents' stove business therefore helps to ensure the basic education of children.

#### **5.1.5 Environmental sustainability**

Preventing the loss of environmental resources to ensure environmental sustainability is the seventh goal resulting from the United Nations' Millennium Declaration.

The use of the improved stove as well as the adoption of good cooking practices can contribute to this goal. The present study concludes that the extent of firewood consumption caused by cooking, as measured by the time spend on gathering, decreases by 43 to 50 percent. The dissemination of the Chitetezo Mbaula therefore contributes to the protection of natural wood sources by reducing forest degradation caused by cook fuel removal.

### **5.2 Impacts according to BMZ priority areas**

In 2002, the German Ministry of Economic cooperation and Development (BMZ) agreed with the Malawian government about three central areas for Malawian-German development cooperation. These priority areas are decentralisation, health and basic education. The presented impacts of the improved stove do not apply to decentralisation; thus it remains to determine its contributions to the other two focal areas, health and basic education.

The German support in Malawi for the health sector focuses on the enhancement of the health ministry to design and implement health policy strategies, as well as on strengthening the management of health facilities and improvement of training.<sup>41</sup>

The Chitetezo Mbaula does not contribute to improve the Malawian health system itself. However, it has impacts on the health sector. Due to the significant reduction of smoke, the improved stove reduces the health hazards of indoor air pollution (see chapter 5.1.2). It can be assumed that a wide spread adoption of energy saving stoves contributes to a decrease of diseases caused by indoor air pollution, like respiratory infections, chronic lung disease and eye infections, and therewith unburdens the health sector.

Primary education is supported by BMZ in terms of teacher training and backing curricular reforms, to make teaching more pedagogically, psychologically, culturally and contentwise appropriate. Furthermore special emphasis is placed on educating girls, because in Malawi women are less literate than men, as girls do often drop out of school early.

As explained in chapter 5.1.4 there is a visible benefit for children resulting from the adoption of the improved cooking technology. Children's workload is reduced and they gain additional time, due to the significant reduction of firewood collection. Girls profit the most in this context, as they are involved in firewood collection in 60% of the households. The saving of time as well as the economic impacts for the families bears a great potential to improve the children's access and progress in school. Another contribution to the German efforts in terms of children's education can be achieved by the benefits of the stove business that allow producers to afford school uniforms as well as school fees for their children (chapter 5.1.4).

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<sup>41</sup> Cf. BMZ 2008

## 6 Conclusions about sustainability

All achievement and impacts resulting from project interventions lose value if the approach does not lead to sustainability. For the examined stove program the following aspects are important to indicate the progress towards sustainability of the emerged stove market: Appreciation for the stove by its users, replacement of the stoves, and stability of stove production.

The results of the present study show that people accept and adopt the improved technology. These users are aware of the benefits arising from stove usage and appreciate them, especially the reduction of firewood consumption (chapter 4.1.4). This kind of valuing of the improved technology is an important precondition for a sustainable stove adoption, as appreciation of the stove comes along with the willingness to invest into replacements when the stove breaks.

The gathered data about stove replacements showed that 39% of the stove users already replaced their Chitetezo Mbaula, mainly because their old stove got damaged (chapter 4.1.4). This seems to be a reasonable share considering that stove promotion in the villages in Ntcheu and Thyolo just started within the last six months to two years; hence many stoves are still young. Field observations, which recorded the conditions of the improved stoves in the surveyed households, pointed out that only a few stoves are still used without replacement if they show damages that may considerably compromise their efficiency.

The share of households that used an improved stove in the past, but did not replace it after it got damaged, is at 8%. These households went back to exclusively using the three stone fire instead. This loss of users since the beginning of the stove promotion does not seem to compromise sustainability, as the average increase of stoves within the research area is roughly around 10% per year (chapter 4.1.1). Still, their concerns should be incorporated into further activities.

In Ligomba and Matanya (Mulanje), the progress towards sustainability proceeded even further than in the other villages, which is due to the long period of stove production in this area. An average of 61% of the stove owners in these villages completely transitioned from cooking on three stone fire to using the improved stove. An average of 37.7% of the stove users in Chiwembu and Kanama<sup>2</sup> and 29% of those in Kabuthu and Chamasowa did completely replace their three stone fire yet. The traditional three stone is actually not a part of the daily cooking habits in these families and it is most unlikely that they return to the traditional habit as long as they can access improved stoves.

Still, the full replacement of the traditional fireplace by the improved stove seems to be a long term process.

Due to the short period of stove promotion in most of the villages it is rather early to judge about aspects of sustainability, but it can be summarized that the prospects for sustainable stove adoption from the users' side seem to be good. However it should be considered that even in most of the stove users' households the traditional three stone fire has not yet been replaced.

In Mulanje villages, where stoves were introduced almost eight years ago, a good progress in terms of stove adoption and thereby towards sustainability has been made.

This good prospect on the demand side is an important precondition for a continuous progress on the supply side, but more aspects needs to be considered. The interviews held with members of all five producers groups active within the research area collected the following information about their progress towards sustainability:

The producer groups in Ligomba, Matanya, Kanama2 and Mapanga established a continuous production, even if the production rates in Matanya and Kanama2 are on a very low scale. The four groups adopted promotion and marketing skills and it is most likely that these groups can proceed with their business without any further ProBEC input (or Africare in the case of Kanama2).

Chiwembu's producers group, Nkonya Wa Abambo, just started with the stove business and could not yet establish a stable production. Producers are still inexperienced in promotion and marketing and furthermore did not yet gain acceptance within their community. These challenges seem to be teething problems, which have also been reported from other groups. Chiwembu's producers will still need advice from Concern Universal to cope with their problems and establish a continuous production as well as promotion strategies. Nevertheless, the numbers of stove adoption in Chiwembu are high considering the short production period.

All interviewed producers showed appreciation for their business and a willingness and attitude towards continuing with production and sales. Many experience an increasing demand for improved stoves due to a rising awareness about its benefits amongst the rural households. This corresponds to the trend of increasing stove adoption in the surveyed areas. A growing market for fuel saving stoves has been established in the last years. However the small production rates of the producer groups indicate that this market is still very small. Producer groups, besides Mapanga, market their stoves mainly within their own and in the surrounding villages. The access to local markets seems to be limited since there are constraints of transport and no distribution chain e.g. by retailers exists to help producers to market their stoves.

Still, the Chitetezo Mbaula did only reach parts of the rural Malawi. Through the mainstreaming approach, both Concern Universal and Africare integrated the objective of disseminating fuel saving stoves into their programs. Especially Africare targets to establish more producer groups within their project area. In this way, the stove interventions have good prospects for scaling-up. Through the ProBEC intervention a sustainable state of stove production was reached in selected parts of rural Malawi, judging from current observations. Remaining open issues however include scaling-up to further parts of the country for a wider coverage of the biomass conservation vision.

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## 8 Annex

### Annex 1: Household Questionnaire

#### GENERAL HOUSEHOLD QUESTIONNAIRE

*The following has to be filled out before the interview:*

Serial No \_\_\_\_\_ Date \_\_\_\_\_ Interviewer \_\_\_\_\_  
 District \_\_\_\_\_ Village \_\_\_\_\_  
 Beginning time: \_\_\_\_\_ End time \_\_\_\_\_

**Introduction:**

Good morning/afternoon. My name is ----- sent by ProBEC. We are carrying out a study in this area on the cooking habits and different types of stoves used by households in the kitchen. We talked to the village chief and he authorized us to talk to see the Families in the village to help us with the questions we have on the cooking practices. All the information given will be treated with confidentiality and be used for the purposes of the study only. Thank you very much for welcoming us!

#### 26. SECTION A: Personal Information

1. Who is the head of the household?  
 Husband ①       Self ②       Grandparent ③       Sister/Brother ④  
 Other ⑤ (specify) \_\_\_\_\_
  
2. What is the occupation of the head of household?  
 Farming ①       Salaried/Employed ②  
 Businessman /self employed ③       Part time employed ④  
 Others ⑤ (specify) \_\_\_\_\_
  
3. What is the highest level of education of the head of household?  
 (Which certificate of education does she/he hold?)  
 None ①       Can read & write (3 years of primary and above) ②  
 Primary ③       Secondary ④       College ⑤       University ⑥  
 -Technical ⑦       Others ⑧ (specify) \_\_\_\_\_
  
4. What is your age? (approximately) \_\_\_\_
  
5. What is your highest level of education?  
 (Which certificate of education do you hold?)  
 None ①       Can read & write (3 years of primary and above) ②  
 Primary ③       Secondary ④       College ⑤       University ⑥  
 -Technical ⑦       Others ⑧ (specify) \_\_\_\_\_
  
6. How many people regularly live and eat in the household? Specify numbers.  
 (Define household to include all the people who take meals regularly from the same pot)  
     - Older people (>64 years)      \_\_\_\_  
     - Adults (>16 years)      \_\_\_\_  
     - Children (<15 years)      \_\_\_\_  
     Total number of household members \_\_\_\_

SECTION B: Stove information

Answers to questions 7 to 10 to be filled in the table below.

7. What stoves are present in the household? (*question and own observation*)
8. For how long have you had these stoves? (*in months or in years for each stove*)
9. What stove do you use everyday for cooking?

	7. Stoves present (number of stove)	8. Age of stove (several options per stove type in case several are used) -in years				9. Stove used daily: cooking
Traditional firewood stoves						
Three stone fire						
Improved firewood stoves						
Chitetezo portable						
Fixed mud with ceramic liner						
Fixed mud without liner						
Improved charcoal stove						
Kenyan ceramic Jiko						
Other						
(specify)						

10. Condition of the improved stoves present (*own observation; several answers possible*):

- Chitetezo portable:  Good condition ①  
 Cracks on the body ②  Broken door/combustion chamber ③  
 Broken pot-rest ④  No pot-rests ⑤

- Fixed mud with ceramic liner:  Good condition ①  
 Cracks on the body ②  Broken door/combustion chamber ③  
 Broken pot-rest ④  No pot-rests ⑤  
 Cracks on the liner ⑥  Broken liner ⑦

11. Do you use a fireless cooker?  Yes ①  No ②

12. For all households where there is a **3 stone fireplace**, ask the following questions:

- A) Do you use this fireplace:  Every day ①  Often ②  
 Sometimes ③  For special occasion ④  Never ⑤

- B) For what purpose do you use the 3 stone fire? (*several answers possible*)  
 Cooking food ①  Boiling water ②  Space heating ③  
 Making local brew ④  Other ⑤ (specify) \_\_\_\_\_

13. For all households where there is **no improved firewood stove** in the household, ask the questions:

- A) Do you know improved firewood stoves?  Yes ①  No ②
- B) If yes, which type of stoves do you know?  
 (Please show pictures of the following models):  Chitetezo portable ①  
 Fixed mud with ceramic liner ②  Fixed mud without liner ③  
 Others ④ (specify)\_\_\_\_\_
- C) Did you use an improved stove in the past?  Yes ①  No ②  
 If yes, which one?  Chitetezo portable ①  
 Fixed mud with ceramic liner ②  Fixed mud without liner ③  
 Others ④ (specify)\_\_\_\_\_
- D) Why don't you use an improved stove?  No interest ①  No money ②  
 Don't know where to find ③  Don't use firewood ④  
 Other ⑤ (specify)\_\_\_\_\_  It's not durable ⑥

SECTION C: Cooking information

14. A) Do you cook:  inside the house ①  inside a separate kitchen ②  
 outside ③
- B) If cooking is done inside (the house or in a separate kitchen), is it:  
 Throughout the year ①  Only during the rainy season ②
15. Do you cook your meals on one stove (*one dish after the other*) or on two stoves at the same time?  One stove ①  or two stoves ②  
 On more than two stoves at the same time ③ (specify the number)\_\_\_\_  
 One stove as well as two stoves ④
16. How many times do you cook food for your family per day? (*morning, noon, evening*)?  
 Morning  Noon  Evening  More (specify)\_\_\_\_
17. A) *Own observation on cooking practices: if the woman is found cooking, does she*  
 - use dry firewood?  Yes ①  No ②  
 - use few sticks?  Yes ①  No ②  
 - use split firewood/small sticks?  Yes ①  No ②  
 - use a lid on the pot?  Yes ①  No ②
- B) *Observe also, whether there is smoke in the kitchen*  Yes ①  No ②

18. *Own observation in the kitchen:*

A) Construction of the roof:

- Single-pitch roof ①       Saddle roof (gable) ②       Conical ③

B) Ventilation: opening are positioned:

- ... up to standing height ①       ...above standing height ②  
 ... below and above standing height ③       No openings ④

C) Soot on the walls:

- None ①       Within standing height ②       Above standing height ③  
 Within and above standing height ④

SECTION D: Fuelwood information

19. What fuels do you use to cook? (*several answers possible*)

- Firewood ①       Maize cobs ②       Maize/sorghum/cassava stalks ③  
 Twigs ④       Sawdust ⑤       Charcoal ⑥  
 Pigeon pee stalks ⑦       Bamboo ⑧       Other ⑨  
(spec.)\_\_\_\_\_

20. A) What is the primary fuel used for cooking? (1 – 9) \_\_\_\_

B) What is the second important fuel used? (1 – 9) \_\_\_\_

C) What is the third important fuel used? (1 – 9) \_\_\_\_

21. If **firewood** is used, do you split firewood for cooking?     Yes ①       No ②

22. If **firewood** is used, is it:

- Collected ①       Bought ②       Both (collected and bought) ③

23. If firewood is **collected**:

A) Where does it come from? (*several answers possible*)

- Own farm ①       Open land ②       Public forest/bush ③  
 Private woodlot ⑥       Others ⑤ (specify)  
\_\_\_\_\_

B) Who collects the firewood? (*several answers possible*)

Women:     Always ①       Sometimes ②       Never ③

Girls:       Always ①       Sometimes ②       Never ③

Boys:       Always ①       Sometimes ②       Never ③

Men:       Always ①       Sometimes ②       Never ③

Others

(specify)\_\_\_\_\_

C) How often do you collect it?     Every day      \_\_\_\_times per week  
\_\_\_\_times per month      Other

(specify)\_\_\_\_\_

D) When do you usually leave the house for firewood collection?\_\_\_\_\_

E) When do you usually come back?\_\_\_\_\_

F) (*Fill in the time used for collection:* \_\_\_\_\_ hours)

*Alternatively ask for the time spent in average on firewood collection (per day, per week or per month)*

24. If the firewood is **bought** how much money do you spend:  
per day: \_\_\_\_\_ or per week: \_\_\_\_\_ or per  
month: \_\_\_\_\_
25. If you **collect and buy** firewood, how much is bought and how much is collected?  
 Half / half ①       more firewood collected ②       more firewood  
bought ③

***For those households without an improved firewood stove the questionnaire ends here***

*As you are coming now to an end, please ask the Mama, whether she would like to add anything to this interview:*

.....

.....

***!!! Zikomo Kwambiri !!!***

*Please continue for those households with an improved firewood stove with the following questions:*

SECTION E: Improved firewood stoves (households where  Chitetezo portable ① or  fixed mud with ceramic liner ② is used)

26. Do you use this stove:       Every day ①       Often ②  
 Sometimes ③       For special occasion ④       Never ⑤
27. For what purpose do you use the stove? (*several answers possible*)  Cooking food ①  
 Boiling water ②       Space heating ③  
 Making local brew ④       Other ⑤ (specify) \_\_\_\_\_
28. *How was it in the past, when a 3 stone fire was used:*
- A) Was there any difference in the amount of firewood used?  Yes ①       No ②  
If yes, did your household use  more firewood ① or  less ② firewood?
- B) How many times did you go for firewood collection per week, when you were cooking on the 3 stones? \_\_\_ times
- C) How much money did you spend for firewood, when you were cooking on the 3 stones? Per day: \_\_\_\_\_ or per week: \_\_\_\_\_ or per month: \_\_\_\_\_
- D) Did the price per unit of firewood change since the time you mainly used the fireplace?  Yes ①       No ②  
If yes, how did it change? Firewood was...  
 less expensive ①       more expensive ②

29. A) Did you ever replace one of the improved firewood stoves?  Yes ①  No ②  
B) If yes, which stove has been replaced?  
 Chitetezo portable ①  Fixed mud with ceramic liner ②  
C) Why did you replace it?  Damages ①  Stove got stolen ②  
 Other ③ (specify) \_\_\_\_\_  
D) Did you replace it with the same model?  Yes ①  No ②
30. Please estimate the lifespan of your stove (or if replaced, how long has the last stove been in use?): \_\_\_ years
31. What do you see as an advantage of the improved firewood stove? (*several answers possible*)  
 Fuel saving ①  Cooks fast ②  Reduced smoke ③  
 Saves money ④  Clean kitchen ⑤  Less burns, accidents ⑥  
 Less respiratory diseases ⑦  Less eye diseases ⑧  more comfort ⑨  
 Better taste of food ⑩  Other (11)  
(specify) \_\_\_\_\_
32. What is the most important advantage for you? (1-11)  
\_\_\_\_\_
33. If one answer of question 32 is „cooks fast“: Can you please give an example?  
\_\_\_\_\_
34. Did you recognise any changes in health, eg. cough or eye diseases?  
 Yes ①  No ②  
If yes, what changed? Concerning...  
- respiratory diseases:  Less problems ①  More problems ②  No change ③  
- eye diseases:  Less problems ①  More problems ②  No change ③
35. If “fuel saving”, “cooks fast” and/or “saves money” have been mentioned among the answers given above, please ask:  
A) What do you do with the time saved (through fuel saving or faster cooking)?  
\_\_\_\_\_  
B) What do you do with the money saved (through fuel saving)?  
\_\_\_\_\_
36. Does the improved firewood stove have any disadvantages for you?  Yes ①  
 No ②  
If yes, which ones? (*several answers possible*)  
 Not possible to sit around the fire ①  Not possible to roast maize / meat ②  
 Takes more time to cook ③  Can't cook on big pots ④  
 Needs maintenance/not durable ⑤  Can't cook certain meals ⑥  
 Can't use wet wood ⑦  Other ⑧ (specify)  
\_\_\_\_\_

37. What is the biggest disadvantage for you? (1-8) \_\_\_\_\_

38. How much did you pay for your improved stove? \_\_\_\_\_ MK /  Payment in kind

Self-made  Gift/ for free

39. How did you know about the improved stoves? (*several answers possible*)

Radio ①  TV ②  calendar ③  brochure, leaflet, newspapers ④

Neighbours, family, friends ⑤  public meeting, field days ⑥  NGOs

⑦

Producers ⑧  Local leader ⑨

Others ⑩ (specify) \_\_\_\_\_

40. *Please ask the interviewee to show you their stock of firewood and observe:*

Firewood is dried ①  Firewood is split/small sticks ②

Firewood is dried and split/small sticks ③  No stock of firewood ④

41. *As you are coming now to an end, please ask the Mama, whether she would like to add anything to this interview:*

.....  
.....

***Zikomo Kwambiri***

**Annex 2: Types of stoves present in households**

	Three stone fire	Chitetezo Mbaula	Fixed with ceramic liner	Fixed without liner	Kenyan Jiko	Other type	Total
Ligomba	35	32	6	2	2	0	50
	70,00%	64,00%	12,00%	4,00%	4,00%	0,00%	
Matanya	21	32	8	3	9	1	44
	47,73%	72,73%	18,18%	6,82%	20,45%	2,27%	
Chiwembu	51	23	0	0	5	0	65
	78,46%	35,38%	0,00%	0,00%	7,69%	0,00%	
Kanama 2	45	27	0	0	2	0	51
	88,24%	52,94%	0,00%	0,00%	3,92%	0,00%	
Kabuthu	49	10	0	0	3	0	52
	94,23%	19,23%	0,00%	0,00%	5,77%	0,00%	
Chamasowa	48	7	1	0	7	2	50
	96,00%	14,00%	2,00%	0,00%	14,00%	4,00%	
Total	249	131	15	5	28	3	312
	79,81%	41,99%	4,81%	1,60%	8,97%	0,96%	

[312 valid cases; 0 missing cases]

**Annex 3: Occupation head according to possession and use of improved firewood stove – Ligomba & Matanya (Mulanje)**

	Random sample	HH with at least one improved wood stove	HH exclusively using improved wood stove
Farming	68,68%	72,06%	59,36%
Salaried/Employed	19,04%	17,65%	18,72%
Businessman/self employed	10,27%	8,82%	21,92%
Part time employed	2%	1,47%	0%
Total	100%	100%	100%

**Annex 4: Occupation head according to possession and exclusive use of improved firewood stove – Chiwembu & Kanama2 (Ntcheu)**

	Random sample	HH with at least one improved wood stove	HH exclusively using improved wood stove
Farming	87.33%	82.37%	64.29%
Salaried/Employed	6.23%	7.73%	20.24%
Businessman/self employed	4.48%	9.90%	15.48%
Part time employed	1.96%	0%	0%
Total	100%	100%	100%

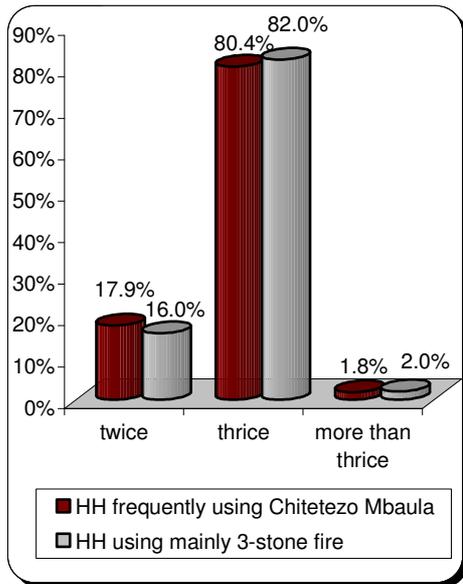
**Annex 5: Occupation head according to possession and exclusive use of improved firewood stove – Kabuthu & Chamasowa (Ntcheu)**

	Random sample	HH with at least one improved wood stove	HH exclusively using improved wood stove
Farming	64.73%	77.86%	66.67%
Salaried/Employed	24.58%	17.14%	16.67%
Businessman/self employed	7.77%	5%	16.67%
Part time employed	2.92%	0	0
Other	1%	0	0
Total	100%	100%	100%

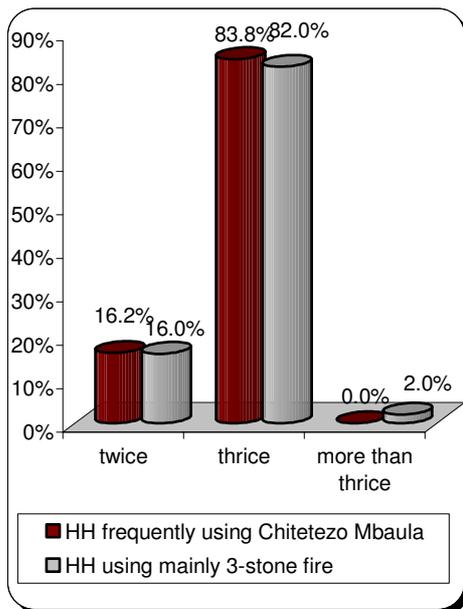
**Annex 6: Knowledge about improved firewood stoves by households not using them**

	HH not using portable and fixed with liner	Non-users knowing improved firewood stoves	Non-users knowing Chitetezo Mbaula	Non-users knowing fixed with liner	Non-users knowing fixed without liner	Non-users knowing Rocket stove
<b>Ligomba</b>	(16) 32.00%	100.00%	100.00%	43.80%	37.50%	0.00%
<b>Matanya</b>	(10) 22.73%	100.00%	100.00%	40.00%	20.00%	10.00%
<b>Mulanje</b>	- 27.37%	100.00%	100.00%	41.90%	28.75%	5.00%
<b>Chiwembu</b>	(42) 64.62%	100.00%	100.00%	0.00%	0.00%	0.00%
<b>Kanama-2</b>	(24) 47.06%	100.00%	100.00%	0.00%	0.00%	0.00%
<b>Ntcheu</b>	- 55.84%	100.00%	100.00%	0.00%	0.00%	0.00%
<b>Kabuthu</b>	(42) 80.77%	90.50%	90.50%	2.40%	5.30%	0.00%
<b>Chamasowa</b>	(43) 86.00%	93.00%	90.70%	7.00%	2.30%	0.00%
<b>Thyolo</b>	- 83.39%	91.75%	90.60%	4.70%	3.80%	0.00%

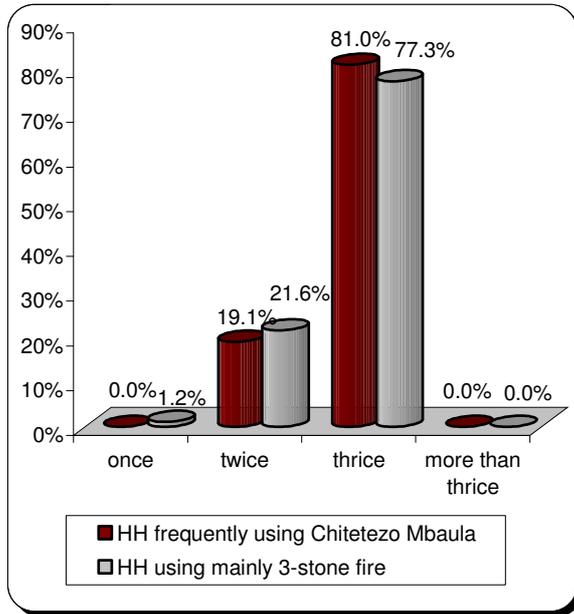
**Annex 7: Cooking times per day - Mulanje**



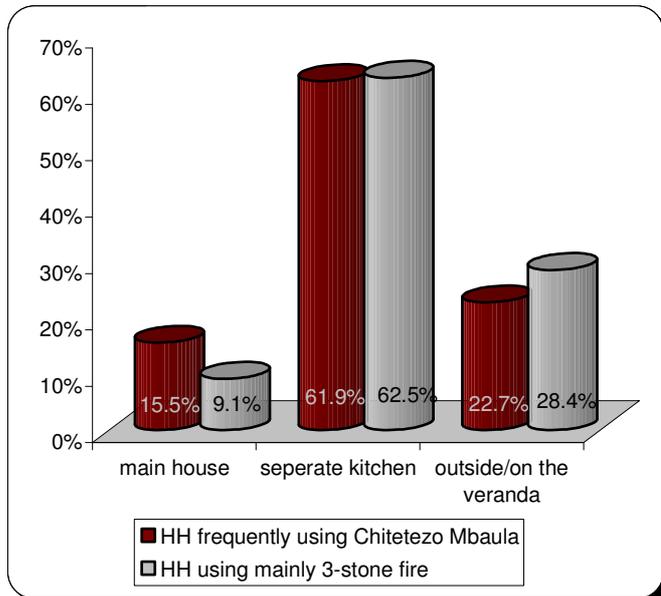
**Annex 8: Cooking times per day - Ntcheu**



**Annex 9: Cooking times per day - Thyolo**



**Annex 10: Usual cook place - Thyolo**



Share of households that stated to cook inside (main house or separate kitchen), but only doing this in rainy season:  
 HH frequently using Chitetezo Mbaula 25%, HH using mainly 3-stone fire 6.7%.

**Annex 11: Main fuels used for cooking - Mulanje**

		firewood	agricult. residues	bamboo	charcoal	twigs	not applicable
<b>1. fuel</b>	Frequently using Chitetezo Mbaula	97.50%	2.50%	0.00%	0.00%	0.00%	0.00%
	Mainly using three stone fire	94.00%	4.00%	2.00%	0.00%	0.00%	0.00%
<b>2. fuel</b>	Frequently using Chitetezo Mbaula	4.29%	76.79%	7.86%	8.57%	0.00%	2.50%
	Mainly using three stone fire	6.00%	78.00%	2.00%	7.00%	5.00%	2.00%
<b>3. fuel</b>	Frequently using Chitetezo Mbaula	0.00%	75.36%	1.79%	3.57%	4.29%	15.00%
	Mainly using three stone fire	0.00%	84.00%	5.00%	0.00%	0.00%	11.00%

**Annex 12: Main fuels used for cooking Ntcheu**

		firewood	agricult. residues	bamboo	charcoal	twigs	not applicable
<b>1. fuel</b>	Frequently using Chitetezo Mbaula	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Mainly using three stone fire	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
<b>2. fuel</b>	Frequently using Chitetezo Mbaula	0.00%	62.94%	2.18%	5.00%	27.72%	2.16%
	Mainly using three stone fire	0.00%	66.72%	3.57%	5.20%	21.59%	2.92%
<b>3. fuel</b>	Frequently using Chitetezo Mbaula	0.00%	38.59%	9.35%	2.18%	4.35%	45.53%
	Mainly using three stone fire	0.00%	35.56%	5.36%	3.41%	5.20%	50.47%

**Annex 13: Main fuels used for cooking - Thyolo**

		firewood	agricult. residues	bamboo	charcoal	twigs	not applicable
<b>1. fuel</b>	Frequently using Chitetezo Mbaula	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Mainly using three stone fire	94.32%	1.14%	0.00%	0.00%	4.55%	0.00%
<b>2. fuel</b>	Frequently using Chitetezo Mbaula	0.00%	69.05%	0.00%	3.57%	27.38%	0.00%
	Mainly using three stone fire	0.00%	75.00%	3.41%	2.28%	10.23%	9.08%
<b>3. fuel</b>	Frequently using Chitetezo Mbaula	0.00%	72.62%	0.00%	3.57%	11.91%	11.90%
	Mainly using three stone fire	0.00%	72.73%	4.55%	0.00%	7.96%	14.76%

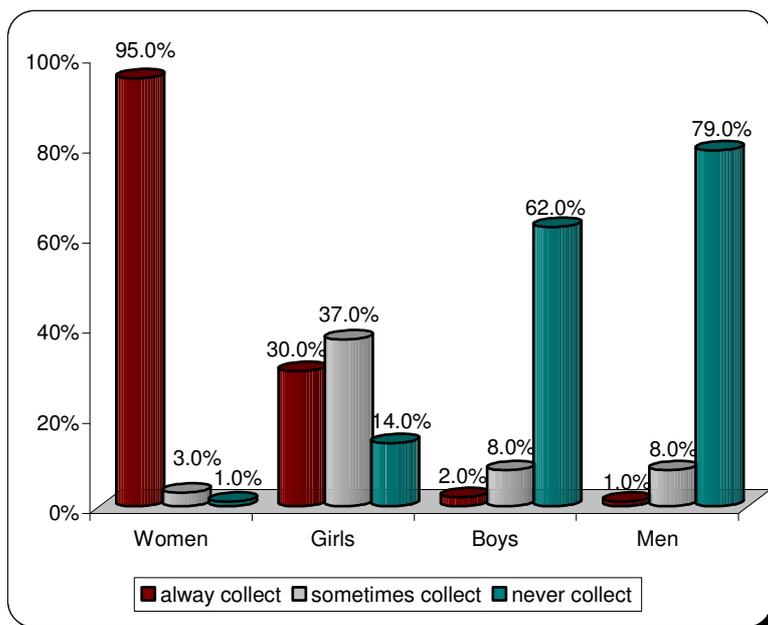
**Annex 14: Average frequency of firewood collection**

Households frequently using Chitetezo Mbaula					
	N	Minimum	Maximum	Mean	Standard deviation
Ligomba	20.00	0.50	8.00	3.23	2.03
Matanya	20.00	0.33	8.00	2.74	1.81
Mulanje				2.98	
Chiwembu	20.00	0.50	4.00	3.13	1.19
Kanama2	23.00	0.33	30.00	4.75	5.88
Ntcheu				3.94	
Kabuthu	12.00	1.00	8.00	3.92	2.61
Chamasowa	12.00	2.00	8.00	4.58	2.19
Thyolo				4.25	
Households mainly using three stone fire					
	N	Minimum	Maximum	Mean	Standard deviation
Ligomba	24	0.5	30	5.90	6.16
Matanya	8.00	1.00	4.00	3.38	1.19
Mulanje				4.64	
Chiwembu	44.00	2.00	30.00	6.59	4.84
Kanama2	28.00	1.00	13.00	6.61	3.54
Ntcheu				6.60	
Kabuthu	42.00	1.00	30.00	6.87	4.77
Chamasowa	43.00	1.00	30.00	9.00	7.51
Thyolo				7.93	

**Annex 15: Average hours spend per firewood collection**

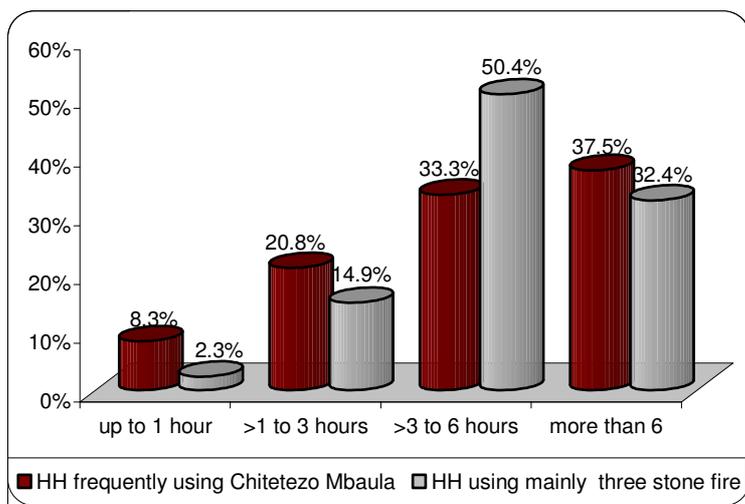
Households frequently using Chitetezo Mbaula					
	N	Minimum	Maximum	Mean	Standard deviation
Ligomba	19.00	0.33	5.50	1.88	1.58
Matanya	21.00	1.00	10.00	5.10	2.45
Mulanje				3.49	
Chiwembu	20.00	1.00	4.00	2.00	0.78
Kanama2	23.00	0.33	5.00	2.34	1.20
Ntcheu				2.17	
Kabuthu	12.00	1.00	10.00	5.35	3.22
Chamasowa	12.00	1.00	8.00	5.08	2.07
Thyolo				5.22	
Households mainly using three stone fire					
	N	Minimum	Maximum	Mean	Standard deviation
Ligomba	23	0.33	6.5	2.70	1.80
Matanya	9.00	0.50	10.00	5.11	3.29
Mulanje				3.91	
Chiwembu	43.00	1.00	4.00	1.86	0.82
Kanama2	28.00	0.50	6.00	2.61	1.29
Ntcheu				2.23	
Kabuthu	43.00	0.50	10.00	6.16	2.26
Chamasowa	44.00	1.00	10.00	4.91	1.99
Thyolo				5.54	

**Annex 16: Person in charge for firewood collection – Thyolo**

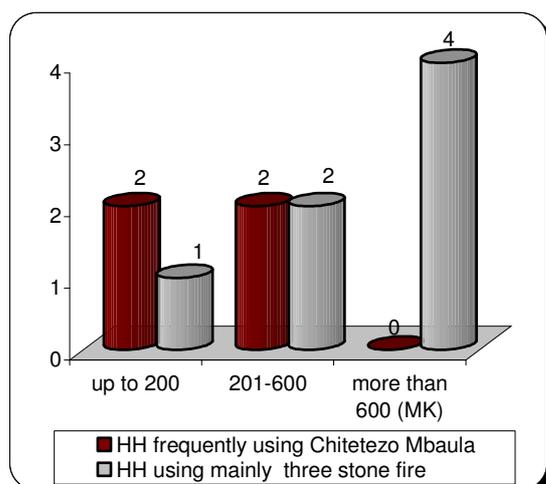


[percentages in each category may not add up to 100, because not in all HH all categories apply]

**Annex 17: Time spend per firewood collection - Thyolo**



### Annex 18: Money spent on firewood per month - Thyolo



Valid cases (group 1/group 2): Ligomba 4/3; Matanya 0/4

### Annex 19: Perceived disadvantages of Chitetezo Mbaula

	Count	Percent of responses	Percent of cases
can't use big pots	37	32.46%	52.11%
not durable	35	30.70%	49.30%
takes more time to cook	10	8.77%	14.08%
can't cook certain meals	10	8.77%	14.08%
can't use wet wood	9	7.89%	12.68%
other	5	4.39%	7.04%
not possible to roast	4	3.51%	5.63%
not possible to sit around the fire	2	1.75%	2.82%
takes long to light fire	2	1.75%	2.82%
<b>total</b>	<b>114</b>	<b>100.00%</b>	<b>160.56%</b>

[71 valid cases; 0 missing cases]

### Annex 20: Perception about use of saved time

	Count	Percent of responses	Percent of Cases
doing household chores	65	34.03%	45.45%
farming	49	25.65%	34.27%
resting	39	20.42%	27.27%
doing small scale business	12	6.28%	8.39%
take care of children/family	11	5.76%	7.69%
doing community work	6	3.14%	4.20%
others	4	2.09%	2.80%
chatting with family/friends	3	1.57%	2.10%
food precessing	2	1.05%	1.40%
<b>total</b>	<b>191</b>	<b>100.00%</b>	<b>133.57%</b>

Others: doing part time employment, drinking beer, playing games, going to part time school  
[143 valid cases; 0 missing cases]

### Annex 21: Perception about the use of saved money

	Count	Percent of responses	Percent of cases
buy complementary goods e.g. sugar, salt, soap	9	39.13%	47.37%
buy food	5	21.74%	26.32%
buy clothes	2	8.70%	10.53%
invest in business	2	8.70%	10.53%
pay school fees for children	2	8.70%	10.53%
buy households utensils/kitchen assecoires	2	8.70%	10.53%
pay milling	1	4.35%	5.26%
total	23	100.00%	121.05%

[19 valid cases, 124 missing cases] only in Mulanje

### Annex 22: Cash payment on Chitetezo Mbaula

	less than 150 MK	150/200 MK	250/300 MK	350/400 MK
Ligomba	3	1	-	-
Matanya	-	12	-	-
Chiwembu	-	4	-	-
Kanama 2	1	4	3	-
Kabuthu	1	3	3	3
Chamasowa	-	-	2	1
Total	5	24	8	4

### Annex 23: How did HH get to know about Chitetezo Mbaula

	Count	Percent of responses	Percent of cases
producer	68	28.94%	47.55%
NGO/ProBEC	62	26.38%	43.36%
public meeting, field days	35	14.89%	24.48%
neighbours, family, friends	29	12.34%	20.28%
local leader	28	11.91%	19.58%
radio	7	2.98%	4.90%
brochure, leaflet, newspaper	4	1.70%	2.80%
other	2	0.85%	1.40%
total	235	100.00%	164.34%

Other: calendar, market  
[143 valid cases; 0 missing cases]

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