LIMITS AND POSSIBILITIES OF INSTITUTIONAL SOLAR COOKING IN MOZAMBIQUE

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Abstract

Solar Cooking is a well-known concept among development agencies. Many different solar cooking technologies, particularly on a household level, have been developed and distributed around the world. Solar cooker promoters advertise the use of solar cookers due to their several benefits for its users and the environment.

However, a widespread implementation of these technologies could not be reached so far. The reasons for this are several, such as cultural, economic and technical dimensions. In order to make solar cooking more acceptable among its users, more research has to be undertaken regarding the social aspects of solar cooking. In academic circles solar cooking has been widely viewed from a "technological-driven approach" (Wentzel & Pouris, 2007) without focusing on the economic, social and cultural factors which vary between the contexts where solar cooking projects are implemented and which thus play an important role for the adoption of solar cooking.

Particularly, there has been a lack of solar cooking on an institutional level. Much focus has been given among solar cooking developers and producers related to household applications while solar cooking technologies for institutional applications have been very limited developed. Solar cooking on an institutional level could be an option particularly for health centers which rely heavily on biomass in their energy supply or which suffer from an unreliable and unaffordable electricity grid.

The most distributed institutional solar cooker presents the Scheffler community kitchen called after its inventor Wolfgang Scheffler. However, a wide range of these solar cooking systems have been implemented in India while in an African context the system is only limited applied.

The question remains why solar cooking is so much more successful in India than in an African context. This paper aims to contribute to this debate with a case study of Mozambique. Mozambique is a country with a high amount of solar radiation and high use of firewood which should make it to an ideal country for solar cooking. However, despite all this, solar cooking has been only undertaken on a very small level within the country and is mainly based on small household applications. In this way I want to examine more of the reasons for why Mozambique has so limited solar cooking activities. The aim is to investigate the possibilities and limitations of institutional solar cooking in Mozambique with focus on health care centers in the closer surroundings of Maputo and Beira.

The data of this paper is based on an extensive fieldwork including interviews with governmental officials, different health care centers and solar cooking promoters in Maputo and the region of Beira. The study provides a first angle of thought of why solar cooking has been limited undertaken in these regions and what are the opportunities for institutional solar cooking in Mozambique.

1. Introduction

Solar Cooking is a well-known concept among development agencies. Many different solar cooking technologies, particularly on a household level, have been developed and distributed around the world. Solar cooker promoters advertise the use of solar cookers due to their several benefits for its users and the environment.

However, a widespread implementation of these technologies could not be reached so far. The reasons for this are several, such as cultural, economic and technical dimensions. In order to make solar cooking more acceptable among its users, more research has to be undertaken regarding the social aspects of solar cooking. Solar cooking has been widely viewed from a "technological-driven approach"(Wentzel and Pouris, 2007) without focusing on the economic, social and cultural factors which vary between the contexts where solar cooking projects are implemented and which thus play an important role for the adoption of solar cooking.

Particularly, there has been a lack of solar cooking on an institutional level. Much focus has been given among solar cooking developers and producers related to household applications while solar cooking technologies for institutional applications have been very limited developed. Solar cooking on an institutional level could be an option particularly for health institutions which rely heavily on biomass in their energy supply or which suffer from an unreliable and unaffordable electricity grid.

2. Research objectives

This paper presents a first part of my research related to the adoption and implementation of institutional solar cooking. The most distributed institutional solar cooker presents the Scheffler community kitchen called after its inventor Wolfgang Scheffler. However, a wide range of these solar cooking systems have been implemented in India while in an African context the system is only limited applied. The question remains why solar cooking is so much more successful in India than in an African context and to identify the factors which lead to an adoption of an institutional solar cooking system.

This paper aims to contribute to this debate with a case study of Mozambique. Mozambique is a country with a high level of solar radiation and high use of firewood which should make it to an ideal country for solar cooking. However, despite all this, solar cooking has been only undertaken on a very small level within the country and is mainly based on small household applications. In this way I want to examine more of the reasons for why Mozambique has so limited solar cooking activities. The aim is to investigate the possibilities and limitations of institutional solar cooking in Mozambique with focus on health and educational institutions in the province of Maputo and Sofala. The major research questions in this paper comprise:

I. What is the current status of solar energy technologies in Mozambique?

II. Why is solar cooking only limited implemented in Mozambique?

III. What are limits and possibilities of institutional solar cooking in Mozambique?

The data of this paper is based on an extensive fieldwork[1] including interviews with governmental officials, different health care centers and solar cooking promoters in the province of Maputo and Sofala. The study provides a first angle of thought of why solar cooking has been limited undertaken in these regions and what are the opportunities and limitations of institutional solar cooking in Mozambique. The paper will start by giving a background of Mozambique and its climatic potential for solar cooking. Furthermore, I will shortly

[1] The paper is based on data collected during the first part of my fieldwork from 14.04 to 26.04.11. Data collected during the second part of my fieldwork undertaken from 17.06-23.08.11 is not included since the paper was written before that time. However, the data is relevant to give first insights to the study.

present the data sources and the three main research questions will be discussed based on the research findings.

3. Background Mozambique

Mozambique is located on the south eastern coast of Africa bordering Tanzania in the north, the Indian Ocean to the East, Malawi, Zambia, Zimbabwe and South Africa in the West and Swaziland in the South. The country comprises a total area of approximately 799,380 km^2. The climate is divided into tropical and subtropical zones and a dry winter from April to September followed by a rainy summer season from October to March (Cuvilas et al., 2010).

Mozambique is considered to have a huge unexploited potential of natural resources. It is estimated a hydropower potential of 12,500 MW and 127 billion m^3 of natural gas reserves and 13,1 billion tons of coal reserves. The energy sector in Mozambique focuses on export. Natural gas and electricity is mainly exported to South Africa while coal is exported to the Brazilian steel industry. The electricity supply in the Southern part of the country is coming from South Africa since there is no direct transmission line available.

In 2008 only 13,2 percent of the population had access to electricity while most of the people with access to electricity are located in the southern part of the country (Cuvilas et al. 2010). This means that a high amount of the population particularly in rural areas live with no access to electricity and it has to be kept in mind that even with access to electricity, the power is mainly used for lightening but not for cooking since the costs for electricity are for many households too high. The major energy source for cooking presents firewood and charcoal. It is estimated that around 80 percent of the population rely on biomass as primary energy source (Mulder & Tembe, 2008).

According to Cuvilas et al. (2010) the use of firewood is not regarded as a cause of deforestation since mainly dead wood is collected. However, the production of charcoal in Mozambique is regarded as unsustainable and as the major cause for deforestation in the country. Particularly the increased consumption around urban areas leads to an increased deforestation in surroundings of the major cities. Cuvilas et al. (2010) reports that in the area around Maputo in the late 1980s forest was located 50 to 60 km around Maputo while in 1993 the situation became worse with a forest location of a radius of 60 to 100 km. In 1999 the increase continued to 150 to 200 km. Today, the charcoal and firewood for Maputo comes mainly from Inhambane and Sofala which leads to that the price of charcoal and firewood in Maputo is the highest in the entire country.

On the other hand to this inadequate energy access Mozambique is characterized by a high solar energy potential. A study undertaken by Cuamba et al. (2006) measuring the solar radiation potential of Mozambique shows that the global average of solar radiation is 5,7 $kWh/m^2/day$[2] while the minimum average of 5,1 $kWh/m^2/day$ was measured in Lichinga and a maximum of 6,0 $kWh/m^2/day$ was measured in Pemba in the northern part of the country.

This picture is also confirmed by Solar Cookers International (SCI). SCI compiled a list of the 25 most suitable countries for solar cooking. Within this list, a country is regarded as suitable for solar cooking if it is characterized by dry climates and at least 6 months of sunshine per year. The countries were ranked according to the following criteria (SCI, 2010):

- Annual average sunlight (NASA)
- National fuel shortages/net energy imports

[2] In comparison Norway (Oslo) has an incoming solar radiation of 2.27 kWh/m2/day. (see http://www.solarpanelsplus.com/solar-insolation-levels/ (20.05.11)).

- Estimated populations for 2020 (UN data)
- Estimated per cent of the population living with both ample sunlight and fuel shortages

Mozambique ranks on place 16 and presents in this way a suitable country for solar cooking according to the mentioned parameters. This section showed that Mozambique has a need for an improved energy supply particularly for cooking. Furthermore, the section showed that there is a high potential of solar energy available in the country but the question remains in which way the country is making use of this potential.

4. Presentation of the data

During the first part of my fieldwork from 14th to 26th of April I was able to conduct semi structured qualitative interviews with different institutions implementing energy projects in Mozambique. The institutions include the Ministry of Energy in Mozambique, GIZ and FUNAE. The aim was to find out the energy plans of these institutions and if these plans include any solar energy technologies as for example solar cooking. The interviews were undertaken with focus on the three research questions mentioned before. In the following, I will give a short description of the aims and functions of each of these institutions. This is necessary in order to assist the reader in understanding the importance of these institutions regarding solar energy plans in Mozambique.

4.1 Interview partners

Ministry of Energy

The Ministry of Energy was formed after the elections in 2004. Before 2004 it was called the Ministry of Mineral Resources and Energy. The aim of the Ministry of Energy is to increase the access to energy sources for Mozambique`s population. Particularly focus is on electrification on a household level. This includes the extension of the national electricity grid to all district capitals and the use of renewable energies in areas where no connection to the national electricity grid is possible. The Ministry aims in this way to develop policies and regulations which support the development and use of renewable energies in Mozambique.

GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit)

The GIZ former known as the GTZ (Gesellschaft für technische Zusammenarbeit) was founded on 1st of January 2011. It presents a cooperation of the Deutscher Entwicklungsdienst (DED) gGmbH (German Development Service), the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German technical cooperation) and Inwent - Capacity Building International, Germany. The GIZ represents a federally owned enterprise which assists the German Government "in achieving its objectives in the field of international cooperation for sustainable development."(GIZ, 2010). One of the projects which GIZ started in 2007 is called "Energising Development ". The project is a cooperation of the Dutch and German Government. It comprises 18 countries including Mozambique. The project in Mozambique comprised three different subprojects in the first phase of project until 2009.

1. Connect poor households to the national electricity grid
2. Solar PV project in Sofala province
3. Micro hydro project in Manica province

Furthermore, there are plans for implementing an improved cooking stove project[3]. Since 2010 GIZ is following a new approach where FUNAE was offered a modular service delivery and between both partners it was agreed on six different modules which focus in Manica province on the following tasks:

[3] Data is based on the interview with GIZ (15.04.11, GIZ office Maputo).

The first task includes a micro hydro project which includes the establishment of several operational sites and the establishment of a hydro knowledge and training centre in Chimoio. Regarding solar energy a solar PV training for all actors within the field of solar energy is planned including the establishment of a solar training centre in early 2012 at the Instituto Industrial in Maputo. Additionally a training process is planned to take place for all commercial actors in the field of solar PV. Another module includes the productive use of energy in agriculture. Based on a previous workshop eight different proposals are being analyzed in energetic, technological and commercial effects. Furthermore, the aim is to establish battery charging stations. Currently research is undertaken regarding different available options including stand alone and combinations with existing (FUNAE) power sources.

In addition the project comprises standardized monitoring and evaluation models which are currently under implementation in Chimoio and Maputo. Last but not least the project emphasizes on the support of established (small) companies in their participation with focus on improved stove dissemination.

FUNAE (Fundo Nacional de Energia) FUNAE is the National Energy Fund of Mozambique and an institution subordinated by the Ministry of Energy. FUNAE was founded in 1997. It major tasks comprise the financial assistance for projects that contribute to energy development which lead to an expansion of low cost energy services in rural and urban areas of Mozambique. According to FUNAE (2011) the mission is "to promote great access for energy on a sustainable and rational way, which contributes for the social and economic development of the country". This includes particularly the provision of electricity for people in rural areas. The vision of FUNAE is to become a well viewed institution all over the country with regards to the promotion and dissemination of renewable energy.

5. Discussion

The following section presents a discussion of the conducted interview data with focus on the three research questions.

5.1 What is the current status of solar energy technologies in Mozambique?

Regarding the development, promotion and distribution of solar energy technologies in Mozambique there have not been any regulations implemented from the governmental side. However, the Ministry of Energy is working on an improvement of the situation. According to an interview with the Ministry of Energy[4] the Ministry has been working on a policy regarding the support of renewable energies. The policy has been approved but the strategy plan is still under vision and will not be approved before the end of 2011.

The main focus regarding solar energy technologies from side of the Ministry is on Solar Photovoltaic (PV) technologies, particularly with the purpose of giving light to the people. The emphasis is hereby mainly on rural households which cannot be connected to the national electricity grid. Furthermore, it is intended to make use of solar thermal technologies primary for water heating. In an interview with FUNAE[5] it was stated that solar PV for rural electrification is the major type of solar energy technology which is used.

Regarding solar cooking none of the three institutions is currently making use of any solar cooking technology for improving the cooking situation of households and institutions. Solar energy technologies are mainly applied in terms of solar PV panels for giving access to electricity and in this way light. There is no strong focus given to improve the cooking situation with the use of solar energy. The statements were also confirmed in my visits to different health centres[6] in the province of Maputo and Sofala. Even the more

[4] Interview with Ministry of Energy (15.04.2011, Maputo).

[5] Interview with FUNAE (19.04.11, Maputo).

[6] The interviews with the health centres are part of another paper which analyses the current energy consumption patterns and cooking habits of health and educational institutions in Maputo and Sofala province.

modern health centres/hospitals including access to electricity provided by the national electricity grid or solar PV panels were not making use of electricity for the purpose of cooking. Electricity was primary used for giving access to light and cooling of vaccinations while cooking is often undertaken with gas or very simple in form of a so called 3 stone fire. The only strategy which includes the improvement of the current cooking situation is the use of improved stoves but this intervention is only limited successful. As the following statement by FUNAE shows:

> *When we installed solar PV systems at Muchungue rural hospital although that hospital is a very big hospital… They have high pressure pots. They have maybe three or four items but they are not using because solar PV systems installed there cannot support the power. So that during our survey, myself I was there during the survey, we concluded that we should provide improved cooking stoves. So we hired a company from Manica Province and they went there and they built two institutional improved stoves but people were not using. And maybe after three months we went there to do monitoring and we found out that they were not using*…(FUNAE, 19.04.2011).

The interviews with the three different institutions show that solar thermal energy technologies have not found grip in Mozambique yet. Solar technologies are mainly limited on Solar PV while solar thermal technologies are not widely implemented in the country but discussed to be taken into use but limited to the function of heating of water. However, the government is aware of the limited awareness of solar energy technologies within the country and is trying to improve the situation with its new strategy plan.

5.2 Why is solar cooking only limited implemented in Mozambique?

During the interviews with the different institutions regarding the implementation of solar energy projects in Mozambique a strong tendency towards solar PV technologies became clear. As we could see in the section before solar cooking is a practice which is not included by any of the informants as a further strategy. Among the informants solar cooking is mainly regarded as an activity on the household level and often associated with solar box cookers. Solar cooking on an institutional level is only known in terms of a prototype of a small scale concentrating institutional solar cooking system which is currently developed at Eduardo Mondlane University. Solar cooking has primary a bad reputation among all informants. The problem regarding the cultural acceptance is seen as the overall constraint. It includes issues such as for example cooking outside in the sun, the slow cooking process and the danger of blindness through the reflection of the sun.

However, the Ministry of Energy does not exclude the use of solar cookers but it is not included in the current strategy plan. The Ministry reports that attempts had been done before to implement small scale household solar cookers but were not successful due to cultural problems. According to the Ministry of Energy, a major problem with the use of solar cookers is seen in the people`s habit of using charcoal. People have been cooking with charcoal and firewood over generations and that is not easy to change.

During the interview the Ministry reports from other interventions of implementing natural gas stoves or improved stoves which did not succeed[7] and which let conclude that the use of solar cooking can be an even more challenging intervention.

[7] It was reported of a project which offered a community kitchen for free to its people which uses natural gas for cooking. The community kitchen is not used due to cultural reasons. The main issue is that cooking is regarded as something private while cooking on a community natural gas cooker requires that a person leaves his/her house with her/his cooking equipment and ingredients to another place. This means that other people as for example the neighbours can exactly see the quantity and what type of food is available or not available for a certain person. This is a huge insight in a person`s private life which most of them do not feel comfortable about.

> *I have to be honest, we did not consider that. Even before 2003 I learnt that the ministry at that time, we tried to promote solar cooking stoves and I know that there are some NGOs trying to promote solar cooking stoves but even with the gas stoves and electric stoves we are still facing problems. I am telling you that because I know here in Maputo for instance people tend to use charcoal instead of gas because of cultural problems. So as you know solar cooking stoves, I mean the technology is there but people should first be educated to understand, you have to use this in this way and if you go to the rural areas no one has time to…definitely if you put the stove there no one will go and use it* (Ministry of Energy, 15.04.2011).

Another issue the Ministry of Energy mentions is the fact that the solar cookers have to be placed in the sun and it has to be cooked in the sun while the traditional way of cooking is undertaken in the shadow which is much more comfortable regarding Mozambique`s dry and hot climate.

Furthermore, the government has not yet implemented any regulations which enhance the investment of solar energy technologies such as for example tax reductions for solar equipment which could support the use of solar cookers. However, according to the Ministry the use of these kinds of incentives is planned to be included in a future regulation as soon as the strategy regarding the use of renewable energies is approved. A further obstacle not only related to solar cooking but to the implementation of new technologies in general presents the *resistance* of rural people of using new technologies. FUNAE emphasizes on the importance of demonstrating new technologies to the rural people in order to make them using the technology.

> *…When we want to start a new technology we must go to the community and give them one, two or three prototypes just for them to look and when we see…and when they saw someone with some new thing, when you go at another time, they are more open for the technology. Even for the solar system they were very resistant…* (FUNAE, 19.04.2011).

There is a general attitude of people which states the importance of seeing something in order to believe it. FUNAE reports that in their assessment procedure of visiting different households to find out who is interested in a solar PV system, people are normally more suspicious but when FUNAE returns with the Solar PV for people who signed up on the list, the other ones who refused an adoption in the first place suddenly are also interested in obtaining a Solar PV panel.

> *We ask people "who wants kit A goes to this queue but you will have to pay it". But some people say that they (FUNAE) are lying they will not come here again and they don't want to give their names and those are the people with some conditions to pay the systems but they don't want. They say they lie but when we go there to install they say they want a system "because I have my business there because I can pay I have money". But why did not they come in the beginning?* (FUNAE, 19.04.2011).

5.3 What are limits and possibilities of institutional solar cooking in Mozambique?

Regarding institutional solar cooking probably one of the major limitations is the limited knowledge of existing technical functioning institutional solar cooking technologies and in this way the lacking market in the country. As mentioned before solar cooking has been widely undertaken around the world with a primary focus on household applications. However, there are technologies which operate on an institutional level but it seems that these technologies have not reached the Mozambican market. The biggest limitation is the lack of knowledge and information and in this way the lacking availability of these technologies as the following citation by FUNAE reflects:

> *You know that is the main reason why we are not using here. We don't see the availability of this kind of solar cookers. Maybe if it is available in the market you should try to implement a project for institutional level first for schools.* (FUNAE, 19.04.2011).

Furthermore, one of the major limits are the earlier mentioned lacking strategies and regulations regarding the import, development and distribution of solar energy technologies which could also contribute to an increased knowledge of different solar technologies including institutional solar cooking in the country. The Ministry of Energy is working on an improvement with its new strategy and in a statement by the Ministry it becomes clear that the government is aware of this limitation and trying to change it.

> *South Africa, Kenya, Brazil, India, China they have successful examples of interventions. I mean these interventions are successful because they put in place incentives and we try to do the same although we recognize we have some constraints but we will try to do that.* (Ministry of Energy, 15.04.2011).

In general, solar cooking on an institutional level was by the informants more positive viewed than on a household level. Solar cooking on a household level is characterized by its bad reputation among the informants while the idea to build a solar system for the use of public institutions is more supported and regarded with a higher success.

Among solar cooking opponents the relatively high prices of simple technologies are often seen as limiting factor for the implementation of solar cookers. However, the interview with the Ministry of Energy shows another picture. With focus on the example of solar PV the Ministry reports that they expected that the application of solar PV would be limited in Mozambique due to its high costs. There is no question that the use of solar PV is still quite expensive for an average household in rural Mozambique but people are willed to spend this high amount of money for the technology because the benefits of the use of solar PV are visible to them. People have a strong desire for light and that is what they can get through this technology. This shows that a high price does not always present a major obstacle if people have a need for this technology and see the benefit of it then they are willed to pay for it.

> *Well, I will talk of solar PV. The case of PV is very interesting. In the beginning we thought that the price of the technology was too high. I mean it is in fact but when we started the programmes in the rural area. We realized that people, they are form to pay and they want to have it, you see they want to have light for other things. In that case as you say it is easy you can convince an inventor to put a factory here and then the product will come in our market in relatively low price so that`s what we are considering for the study.* (Ministry of Energy, 15.04.2011).

Furthermore, I tried to find out through the interviews what my informants see as the most common reasons for not adopting solar technologies. With focus on solar PV the Ministry of Energy emphasizes on two major constraints which include the already mentioned problem of *availability* and the problem of *education.* The materials for building certain solar energy technologies have to be locally available. The Ministry reports from a solar PV project in Manica province which mainly made use of imported materials but which is more and more trying to produce the equipment locally. Particularly in the case of Solar PV the problem of education is visible. People have to be trained on how to use the technology and how to maintain it in order to adopt it in a long term perspective. However, people see the opportunity and benefits of electricity and their desire for energy is that strong hat they start overloading the solar PV system so that it breaks down.

> *In the case of PV mainly is the problem of education. If you are taught how to take care of the system, then it should not be a problem. But you know what is happening there? Even in places where people were supposed that people should keep it, what happened is that they break it. Because they see the electricity, they were taught how to use it but they don't follow*

the rules. They overload the system…another problem is theft you probably have heard about. it. (Ministry of Energy, 15.04.2011).

The argument was also confirmed in the interview with FUNAE. People are taught about the use of solar PV but tend to abuse its capacity after FUNAE left the place. The problem of availability goes along with a lacking market. In the interview with the GIZ in Maputo the problem of availability and having a market is compared with the chicken and egg problem that you do not know what should be at place first.

> *"It is a chicken and egg problem that you have in the beginning (when developing a market) because if you don't have a big PV market and there are not a lot of systems installed, then there is not yet a market for companies specialized in operation and maintenance; but on the other side if you don't have these companies then there will hardly develop a really big market because the systems installed will not be well maintained."*(GIZ, 15.04.2011).

The problem GIZ mentions here for solar PV can be in the same way applied for thermal institutional solar cooking systems. Institutional solar cooking systems are not well known in Mozambique and therefore not available on the market. This leads to a lack of companies which are in charge of the installation and maintenance of this technology. However, without having these companies in place, it is difficult to build up a market for institutional solar cooking.

Through the interviews it became clear that the use of solar energy in Mozambique has been mainly applied in terms of solar PV panels for producing electricity while solar thermal technologies are limited to use of water heating. As mentioned before solar cooking is only known on a household level and often associated with solar box cookers. The reasons by the informants for focusing mainly on Solar PV instead of solar cooking can be drawn back to two major points. First of all, solar cooking is regarded as an activity which is difficult to be adopted by people due to cultural reasons. As earlier mentioned there is a strong tendency by people for using charcoal or firewood.

However, there is another reason standing behind the cultural problems which is even more important and that is the lack of knowledge regarding the possibilities of solar cooking. With lack of knowledge, I mean here a lack of knowledge among organizations that are able to implement this kind of technology and the intended users. Solar PV in comparison is known among both groups and the intended users have a strong desire for getting access to electricity because of its several benefits such as having light in the evening hours and having electricity for using the TV or radio and charging cell phone batteries. Having in mind these benefits people are even willed to pay comparable high prices as the example by the Ministry of Energy showed. In comparison to Solar PV, people do not seem to see the same benefits of solar cooking. They do not really know what solar cooking includes and what are its potential benefits. This makes people more suspicious and resistant to invest in this technology. Why investing in a relatively pricey technology when not even knowing the benefits of it? Back to the original question on what are the limits and possibilities of institutional solar cooking, we can state that there are opportunities in form of external environmental variables (solar radiation and high use of biomass) but that there has to be created knowledge and awareness of the technology in the society in order bring it to the people. Institutions have to be aware of the benefits of solar cooking in order to use it.

It was shown that the main focus of the three interviewed institutions working on energy within the country is mainly placed on Solar PV. This fact reflects the current lack of awareness and this way market regarding (institutional) solar cooking in Mozambique. However, the knowledge of the informants regarding the implementation of solar PV is helpful to assess possible limitations of solar cooking. It can be expected that solar cooking faces many of the same constraints in implementation as solar PV panels.

6. Conclusion

The aim of the paper was to find out the current status of solar energy technologies in Mozambique. In addition, particularly focus was given to solar cooking. The reasons for the limited use of solar cooking in Mozambique and its potential on an institutional level were investigated. Mozambique presents a country with suitable solar cooking conditions, the level of solar radiation is high around the whole country and the current energy supply is limited and regarding cooking mainly based on the use of biomass (e.g., charcoal, fuelwood) which has several negative impacts on the environment and its users. However, solar cooking has only be limited undertaken in the country and the interviews conducted with GIZ, FUNAE and the Ministry of Energy showed that the reasons for a limited implementation lie mainly in a limited awareness and market of existing institutional solar cooking technologies. Solar cooking is mainly known in terms of small scale household cooking while available technologies on an institutional level are limited known and not available in the current market. Due to this lack of implementation the benefits of solar cooking are not visible to its potential promoters and intended users.

We could also see that solar PV panels are the main solar energy technology so far promoted in the country. There are ideas of using solar thermal energy for water heating but there are no current plans of including solar thermal energy for cooking in the plan of all three organizations.

References

Cuamba, B., C., Chenene, M., L., Mahumane, G., Quissico, D., Z., Løvseth, J., O\Keefe, P., 2006. A solar energy resource assessment in Mozambique, Journal of Energy in Southern Africa, 17, 76-85.

Cuvilas, C., A., Jirjis, R., Lucas, C., 2010. Energy situation in Mozambique: A review. Renewable and Sustainable Energy Reviews, 14, 2139-2146.

FUNAE. 2011. About FUNAE. Available: http://www.funae.co.mz/funae.php?__target__=about_long [Accessed 10.06 2011].

GIZ. 2011. About GIZ. Available: http://www.giz.de/en/profile.html [Accessed 10.06 2011].

Mulder, P., Tembe, J. 2008. Rural electrification in an imperfect world: A case study from Mozambique. *Energy Policy,* 36**,** 2785-2794.

SCI. 2010. 25 countries with the greatest potential benefits from solar cookers. Available: http://images3.wikia.nocookie.net/__cb20080215000726/solarcooking/images/1/18/25_countries_with_most_solar_cooking_potential.pdf [Accessed 23.11 2010].

Wentzel, M., Pouris, A., 2007. The development impact of solar cookers: A review of solar cooking impact research in South Africa. Energy Policy, 35**,** 1909-1919.