

# Solar Energy and Rural Development - an exploration into end-users' impact evaluation

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*A field study conducted in the solar energy village Rema, Ethiopia*

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## **Abstract**

The current thesis addresses the question, in which way solar energy impacts on rural development in off-grid areas. For this a field study was conducted in the village Rema in Amhara region, Ethiopia, which utilizes solar home systems for lighting, phone charging, radio, TV and fridges.

An answering approach towards the question was developed with the special focus on obtaining end-user defined impacts from solar use. According to the Indian economist Amartya Kumar Sen, development can be defined as increasing people's choices in life, referred to as *capabilities* (2001). The capabilities have to be defined by the people themselves, in order to make them agents of their own lives. Therefore, a survey using qualitative methods was conducted in Rema, asking for the impacts experienced by the end users.

The impacts found were the capabilities made available by solar home systems. Those were economical improvements, health, education, self-determined time use, changes in gender relations, social interaction, information, communication, entertainment, security, well-being and changes in the people's state-of-mind.

The thesis results in the conclusion, that the use of solar home system increases the variety of user's choices in Rema. This increase takes place for basic choices like education, health and living standard as well, as for user's inner attitudes towards their ability to make changes in their lives.

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## Abbreviations

CFL = Compact Fluorescent Lamp

E.C. = Ethiopian Calendar

ETB = Ethiopian Birr (Ethiopian currency)<sup>1</sup>

FGD = Focus Group Discussions

G.C. = Gregorian Calendar<sup>2</sup>

GDP = Gross Domestic Product

HDI = Human Development Index

HDR = Human Development Reports

HH = Households

ISES = International Solar Energy School in Rema, Ethiopia

LED = Light-Emitting Diode Lamp

SEF = Solar Energy Foundation

SHS = Solar home system(s)

UNDP = United Nations Development Programme

WHO = World Health Organisation

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<sup>1</sup> Money conversions are made based on <http://coinmill.com/>, using the exchange rate of 1 USD = 17.42 ETB from 3<sup>rd</sup> March 2012.

<sup>2</sup> If not mentioned differently, dates are in Gregorian calendar (G.C.). Otherwise, the E.C. refers to Ethiopian

## 1. INTRODUCTION

Various programs aim to increase rural development in remote off-grid areas by supplying basic electric services to communities. The success of such projects is mainly measured by the amount of traditional energy sources, e.g. kerosene lamps, substituted by improved energy sources, e.g. electricity. This approach has a very limited informativeness, since it leaves out of consideration the impacts which are achieved by the improved energy supply. Thus, a solar system installed in a village can for example create new employment or strengthen the self commitment among the people, while the same system installed in another village may have no effects on the livelihood at all.

In order to evaluate the success of an energy program, first the variety of areas it influences – both positively and negatively – have to be accessed. Based on this, a measurement of changes in these areas can be done, indicating the success of the intervention.

Therefore first at all, a broader evaluation of renewable energy projects is necessary, mentioning not only the substituted fuels, but addressing local development with its various aspects.

For this, it first has to be asked, what the broad term “development” means and implies. The definition of human development taken as basis for the present thesis will be the understanding of development as freedom or expansion of choices (Sen, 2001), as explained in 2.1 Defining Human Development. Moreover, existing literature about the impacts of rural electrification, especially by solar energy, will be surveyed.

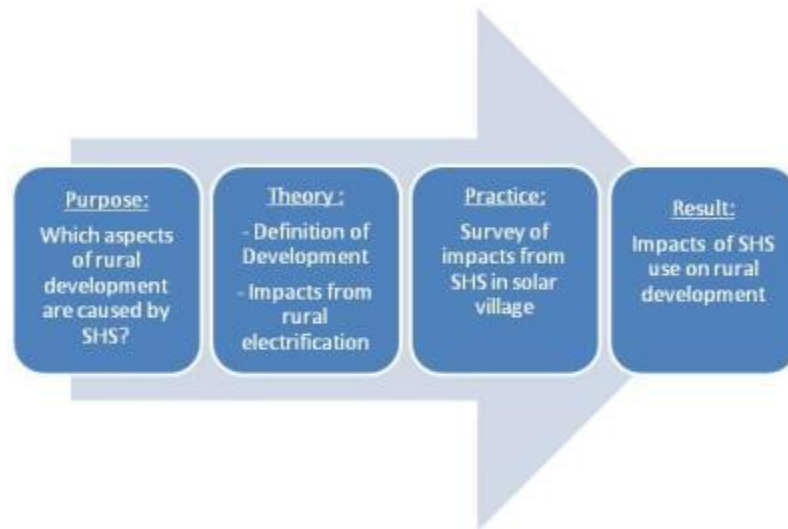
With this theoretical basis, the present thesis aims to answer the question, which aspects of rural development are caused by the provision of solar energy on a practical example (see 3 FIELD STUDY). For this, the village Rema<sup>3</sup>, in Amhara Region, Ethiopia was chosen. Nearly all of its 2500 households were equipped by the Solar Energy Foundation Ethiopia with solar home systems. More information on the Foundation and the Solar Village will be

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<sup>3 3</sup> In the following also referred to as “Solar village”

provided in 3.1 Location. Afterwards, the findings from the field will be integrated into the theory (see 4 DISCUSSION).

Figure 1 summarises the addressed thesis questions and its logical structure:



**Figure 1: Structure of the present study including main questions addressed.**

Even though verifying many of the theory-based impacts (see 2.2 Impacts from rural electrification), the special achievement of this work is that it does not measure impacts on development according to conventional top-down lists of necessities. Instead it relates to the definition of development as expansion of choices, which implies that the purpose of rural energy programs is not the provision of certain appliances, but the provision of greater freedom of choice of different life paths towards the end user. Therefore, end users were asked for their subjective improvement or deterioration from solar use. They were asked what they sense to be good, disregarding of what the literature suggests as being necessary

in life. As an example, this could give a TV which provides entertainment to the villagers in a bar a value, as well as improved income from longer business times.

This approach is dependent on the choice of the survey population. Regarding this, it was not the aim of the study to present a representative sample of Rema's population, but to reflect the variety of voices in the village including more than 10000 individuals. To narrow down the choice, mainly the private sector was observed, adding just few public institutions and small businesses. For the private sector, it was concentrated on three user groups; women, men and children. This differentiation was done, since they were experienced to have significantly different live realities in rural Ethiopia, which will result in different impacts from energy use.

Summarizing, the thesis aims to explore which impacts from SHS end users in Rema experience. From this, conclusions about SHS's impacts on rural development will be made.



## 2. LITERATURE REVIEW

A literature review was done for two reasons: In the first part a definition of human development was obtained. Secondly, a review of impacts from rural electrification stated in literature sources will be done.

### 2.1. Defining Human Development

*Following the Human Development and Capabilities approach from Sen and Nussbaum*

When trying to define successful development, there mainly exist two big contrasting, but still overlapping approaches (Alkire et al., 2009):

- Development seen from an economical perspective, meaning increased economic growth (compare *Conventional Approach* in the following)
- Development as defined in people first approaches (compare *Alternative Approaches* in the following)

The present work follows latter approach. Reasons towards this choice and explanations of the people first approach will be presented in this chapter.

#### 2.1.1. Conventional Approach

Traditional approaches in politics and economy to human development considered terms like income, utility, resources and primary goods (Nussbaum and Sen, 1993). Likewise, the World Development Reports published from the World Bank, measure income and economical growth to quantify the development of states (Alkire et al., 2009).

Since the 1990s, the United Nations Development Programme UNDP offers with its yearly published Human Development Reports<sup>4</sup> another attempt of comparing nation's development. By doing so, UNDP considers what Robert F. Kennedy already stated in 1968 when he pointed out the limitations of the GDP for measuring quality of life:

*The Gross National Product of the United States is the largest in the world, but that GNP, if we should judge our nation by that, counts air pollution and cigarette advertising and ambulances to clear the highways of carnage. It counts special locks for our doors and jails that break them. It counts the destruction of our redwoods and the loss of our natural wonder and chaotic sprawl. It counts napalm and the cost of a nuclear warhead and armoured cars that fight riots in our streets. Yet the gross national product does not allow for the health of our children, the quality of their education or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials. It measures neither our wit nor our courage, neither our wisdom nor our learning, neither our compassion nor our devotion to our country. It measures everything, in short, except that which makes life worthwhile.*

(Goodreads, accessed 21.02.2012)

The main problem UNDP sees in valuing development only by the capita income is that there is not automatically a link between growth in income and human progress, since income can both be used in thriving and in harmful ways:

*Income is a means, not an end. It maybe used for essential medicines or narcotic drugs. Well-being of a society depends on the uses to which income is put, not on the level of income itself.*

(UNDP 1990, p. 10)

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<sup>4</sup> HDR in the following

### 2.1.2. Alternative approaches

An alternative for the monetary centred approaches to human development are those who put the element that makes life worthwhile in their centre: People. They acknowledge the power money has for human beings, but just allow it to have an enabling role for people to realize their potential (Alkire et al., 2009). This idea goes back to Aristotle who argued that *wealth is evidently not the good we are seeking, for it is merely useful and for the sake of something else* (Aristotle, 2009, p. 7) and other philosophers who approach development with terms like happiness, satisfaction of desires, preferences and different kinds of activities that make up a thriving human life (Nussbaum and Sen, 1993).

The leading voice to the ethical approaches to development comes from the Indian economist Amartya Kumar Sen. His core idea of the *capability approach* forms the philosophical base of *human development* as it is used in the Human Development Index, which was developed by the Pakistani economist Mahbub ul Haq and used since 1990 in the Human Development Reports (Alkire et al., 2009).

Instead of focusing on income, like the World Bank does, the Human Development Reports focus on human well-being and poverty reduction. They distinguish human poverty from income poverty by arguing *that the purpose of development is to improve people's lives by expanding their choices, freedom and dignity* (UNDP, 2003, p. 27). Hence, they provide a more holistic view to human poverty, meaning also the lack of basic capabilities to lead full, creative lives and not just the lack of income.

#### 2.1.2.1. *The Capability Approach*<sup>5</sup>

According to Sen (2001), development can be set equal with freedom. In order to develop, people have to be able to expand their *capabilities*, which mean their freedom to achieve *functionings* they value doing or being.

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<sup>5</sup> Unless noted otherwise, this section draws on Alkire et al. (2009)

The two key terms of Sen's Capability approach are:

- *Functionings*

Functionings are *the various things a person may value doing or being* ( Sen, 1999, p.75). This means not a specific commodity, but is not limited in definition and will be different from person to person. Beside material things, also other functionings are included, so the term can as well be interpreted as good nourishment or warm friendships. Other examples for activities or states that lead to human well being could be being healthy, being safe, being educated, having a good job, being able to visit friends and the family, and many more. It focuses not so much on goods and income, but more on what a person is able to do or to be with it (e.g. when people's basic need for food (a commodity) is met, they enjoy the functioning of being well-nourished).

- *Capabilities*

Capabilities describe the real and actual possibilities open to a given person, hence it's freedom to enjoy various functionings. With Sen's words, capabilities are *the various combinations of functionings (beings and doings) that the person can achieve. Capability is, thus, a set of vectors of functionings, reflecting the person's freedom to lead one type of life or another . . . to choose from possible livings* (Sen 1992, p. 40). As a comparison, a person with much money can choose between many different things to buy, just like a person with many capabilities can choose between different functionings. Thus this person is able to choose between different ways to lead its life.

As a memorable example, Alkire et al. (2009) mention a person who has a bicycle (= *resource*). The bike theoretically enables the person to move around, which she would value (= *functioning*). In case, the person is really able to ride the bike (she knows how to ride a bike and is physically able to do so), the ability to move around would be given (=

*capability*). This capability leads to happiness (= *utility*), since the person uses it to make a bike tour at the weekend (see Figure 2).

Likewise, the person could also use the resource “bike” for other capabilities, for example to carry goods to the market. In this case, the functioning would be “transportation”, and the utility “physical relief”, if she otherwise would have to carry the goods on her back.



**Figure 2: Demonstration of the Capability Approach by means of the bike example (Alkire et al., 2009; modified by the author).**

The capability approach is defined incompletely. The people affected have to conclude the definition by choosing functionings which they value. By giving people a large influence in the definition, the central aim of the approach is to enable them to become agents of their own lives and communities.

The Human Development Reports (UNDP, 2003) take a step more to close this definition: They define the most basic (non-political) capabilities for human development, which are

- Living a long and healthy life
- Being educated
- Having a decent standard of living.

Those are addressed in the Millenium Development Goals, as pictured in Table 1.

**Table 1: Correspondence between key capabilities and the MDGs (Source: Deneulin, after Seeta Prabhu, mimeo document; modified by the author)**

Key capabilities for human development	Corresponding MDG
Living a long and healthy life	Goals 4, 5, 6: reducing child mortality; improving maternal health and combating major diseases
Being knowledgeable	Goals 2, 3: achieving universal primary education and promoting gender equality in education
Having a decent standard of living	Goals 1, 7: reducing poverty and hunger and ensuring environmental sustainability
Enjoying political and civil freedoms to participate in the life of one's community	Not a goal, but an important global objective included in the Millennium Declaration

Summarising, the first part of the literature review chooses the Capability Approach for defining Human Development. Key terms like functioning and capabilities have been described, as well as Sen's aim to deliver an open definition, allowing the people addressed to close the definition by choosing their aimed capabilities. As a more closed definition, basic capabilities, as defined in the HDR were named as well.

## 2.2. Impacts from rural electrification<sup>6</sup>

The second part of the literature review aims to approach the question, which aspects of rural development can be caused by the provision of electricity, especially solar energy, for lighting, mobile phone charging, radio/tape, TV, fridge. As later on in the thesis this question will be discussed from a practical experience perspective, the current passage shall serve as a theoretical background.

For this, two main sources were chosen: The impact evaluation *The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits* (World Bank, 2008). It describes impacts from rural electrification in general, and the Solar Energy Foundation Philippines<sup>7</sup> (SEF, last accessed 14.02.2012), which deals in particular with the benefits from solar energy. The latter are visualized in the overview in Picture 1.



**Picture 1: Picture to the heading “How we impact lives” on the Solar Energy Foundation Philippines homepage (SEF, last accessed 14.02.2012)**

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<sup>6</sup> If not mentioned differently, this whole part of the chapter draws on World Bank (2008) and SEF (last accessed 14.02.2012).

<sup>7</sup> SEF Philippines in the following

From the deductive impacts, a list of assumptions was established, which served as a checklist during the field survey. This will be elaborated in 3.2.2.2 Qualitative interview. In the following, these deductive impacts are explained and summarized as assumptions.

### **2.2.1. Economic benefit from domestic uses**

Lighting and TV are the main domestic uses of electricity. The general message from electricity supply for lighting is that it lowers the cost of energy to the user.

→ Assumption: Solar light lowers the cost of energy to the user.

### **2.2.2. Productive uses of electricity**

The World Bank survey reported just rare impacts of electricity on productive activities in villages. Just in cases, when electricity was used for irrigation, or when complementary programs supporting rural production were added, a benefit was achieved. However, there are some indicators for a growing number of small scale businesses and a higher net income of these home enterprises, due to extended working hours. Latter is also mentioned by SEF Philippines, including the generation of local employment.

→ Assumption:

- Growing number of small scale businesses
- Higher net income of home enterprises due to extended working hours

### **2.2.3. Health benefits**

Health benefits are described due to following reasons:



### 2.2.3.1. *Reduced indoor air pollution*

Many people relying on energy from traditional fuels for cooking, lighting and heating purposes, especially women and young children, suffer from indoor air pollution. The use of traditional fuels in poorly ventilated rooms can cause health risks like pneumonia and other lower respiratory infections, tuberculosis, asthma, low birth weight, infant mortality, pulmonary tuberculosis and increased risk of premature death (compare also WHO, 2007). These diseases lead to 1.6 – 2 million deaths per year. Among half of the victims are children below 5 years (World Bank 2008). By this, the soot emitted by kerosene and paraffin lamps is the second biggest cause for child death in African countries (Bröll, 2010)

Additional to indoor air pollution, traditional fuels entail the following disadvantages:

In case of firewood, there is high time burden from collecting the fuels. Open fires and candles involve the risk of fire breakout. Last but not least, poor small range light emitted by traditional fuels damages the eyes of its users. Candles and kerosene oil lamps, as displayed in picture 2, are common light sources in rural areas. They only provide a light intensity of maximal 10 lumens, while a 40W electric bulb delivers the 40fold intensity (compare Table 2).



**Picture 2: Traditional kerosene lamp (source Myclimate, accessed 21.02.2012)**

**Table 2: Lighting capacity of different light sources (Practical Action, accessed 07.09.11)**

Type of Light	Energy Source	Intensity (lumens)	Efficiency (lumen/W)
Candle	Paraffin Wax	1	.01
Oil lamp (wick)	Kerosene	1-10	.01-.1
Hurricane lamp (wick)	Kerosene	10-100	.1-.2
Oil lamp (mantle)	Kerosene	1000	1
Gas lamp (mantle)	1.p.g (eg butane)	1000	1
Filament lamp 3W	Electricity	10	3
Filament lamp 40W	Electricity	400	10
Filament lamp 100W	Electricity	1300	13
Fluorescent 15W	Electricity	600	40
Fluorescent 30W	Electricity	1500	50
Mercury 80W	Electricity	3200	40
Sodium sox 35W	Electricity	4500	128

However, the following limitation has to be made: Since electricity is rarely used for cooking in rural areas, which makes up the main energy use, a change in light source could just reduce indoor air pollution to some extent.

### ***2.2.3.2. Improved health knowledge***

The causal chain how electricity could positively influence health knowledge and fertility is based on the assumption that electrified households will get access to media, e.g. radio and TV. This is visualized in Figure 3.



**Figure 3: Casual chain of impacts from electrification on health (compare World Bank, 2008; modified by the author)**

Variables possibly affected by electrification, which may lead towards decreasing fertility and child mortality, are knowledge about health issues like modern contraceptives and child immunization.

Moreover, rural health facilities may be improved by improved electricity access.

Summarising, rural energy supply may result in health benefits due to the following achievements:

→ Assumption:

- Reduced indoor air pollution due to less fuel use for cooking, lighting or heating
- Brighter light source reducing eye problems
- Improved health knowledge through increased media access and use
- Improved health facilities

#### **2.2.4. Educational benefits**

Electricity could improve rural education in the following ways:

- a) Improve school quality by allowing electric equipment.
- b) Attracting more and better skilled teachers into rural schools.
- c) Extending schoolchildren's study times at home by providing electricity for light.

So even if there would be the observation of higher educational levels in electrified areas, it should be tested, through which channels education was improved; whether it was by better teaching facilities (schools) or study facilities (households), or both together.

Since normally rural schools lack basics, like enough teachers, books, space and furniture, alternative a), allowing electric study equipment, does not seem as important as alternative b), making rural positions in electrified areas more attractive for well skilled teachers.

Alternative c) deals with the fact that children in un-electrified households would have to study using candles or kerosene lamps, which adds to their family's expenses and endangers their health. The assumption is, that students<sup>8</sup> with solar light would study more at home, probably achieve better grades and thus will be sent to school for more years.

Still, the positive influence of other possibilities (parental education, household income, school facilities) has to be included when making conclusions about electricity's impact on rural education, especially when comparing educational levels in electrified and non-electrified areas.

→ Assumption:

Electricity could improve rural education in the following ways:

- Improve school quality by allowing electric equipment.
- Attracting more and better skilled teachers into rural schools.
- Extending schoolchildren's study times at home by providing electricity for light. They might achieve better grades and be sent to school for more years.

### **2.2.5. Time gain**

Due to its proximity to the equator, days in Ethiopia start around 6am and end around 6 pm. This is the time frame for the rural off-grid population to dispose of all their obligations; including work, school, household chores, etc. Hence light time is very valuable. Leisure

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<sup>8</sup> Both expressions "students" and "schoolchildren" are used in the current thesis for children and teenagers who visit the primary or secondary school in Rema.

and recreation with friends and family has to be done afterwards during the night hours<sup>9</sup>. On the same time, the night darkness inside and outside the houses is oppressing and limits opportunities for social interaction. (SEF, last accessed 14.02.12)

Solar energy allows off-grid villagers to extend their daily light hours. In average, the waking time was reported to be increased by 1-2 additional hours in the evening (World Bank, 2008). Besides watching TV, if available, this time is used for activities like socializing, participation in community activities, reading, children doing homework, and adults spending more time on the family business. Thus, solar energy can strengthen the social life of a rural community or provide time for other important tasks (SEF, last accessed 14.02.12).

According to World Bank (2008), an increase in light time may lead to two oppositional tendencies for the life of rural women:

- a) Spending less time on housework, but more on other activities (especially watching TV if available, as it was reported for Philippine women (compare World Bank, 2008)
- b) Having increased workload due to extended working hours in the evenings.

The same is expected for schoolchildren: They may either have more time for studies, or additional workload from helping their parents.

→ Assumption:

Increased waking hours by use of solar light at night are used for

- watching TV (if available)
- socializing
- participating in community activities
- reading
- family business
- children:
  - do homework at night

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<sup>9</sup>“Night” is related to the “dark” hours after sunset, starting shortly after 6pm.

- help their parents at night  
(contradictory assumptions)
- women:
  - have a less stressful working day and more social interaction, since they can shift work towards the evening
  - have increased workload, due to extended working hours in the evenings  
  
(contradictory assumptions)
- Since people can interact even after sunset, community bonds may be strengthened.

### **2.2.6. Connectivity**

Mobile phone chargers included in SHS releases users from the cost of charging. Thus it increases rural access towards an important means of communication. (SEF, last accessed 14.02.12)

→ Assumption:

- Cell phone charging becomes easier and cheaper

### **2.2.7. Safety & Security**

Portable solar lights make walking outside at night more secure and less frightening, especially when users live in distance to other houses. (SEF, last accessed 14.02.12)

→ Assumption:

- In areas without ambient light, walking outdoor at night may be less frightening and dangerous when using portable solar lights

### 2.2.8. Empowerment

By a lack of financial security, many people at the base of the economical pyramid do not have the power to make changes to improve their lives. Besides the economical side, this includes also the psychological feeling of being powerless. SHS thus may not only make differences in the monetary, education and health areas of user's lives, but also in their self-esteem which again may motivate and encourage them to start innovations helping to climb out of poverty (e.g. using saved money as a start capital for mini home businesses). (SEF, last accessed 14.02.12)

→ Assumption:

- SHS is an improvement in people's life which empowers them to make further changes to their circumstances. They may gain a sense of hope, security and control over their destiny.

Table 3 summarises the mentioned deductive impacts suggested by the literature.

**Table 3: Impacts from rural electrification (by solar energy) summarised from the literature (sources: WorldBank, 2008; SEF, last accessed 14.02.12; modified by the author)**

World Bank	SEF Philippines
Economic benefits from domestic uses	Community building
Health benefits	Connectivity
Time gain	Education
Education benefits	Empowerment
Productive uses	Health
Security	Livelihood
	Safety and security
	Social interaction

In the second part of the literature review, assumptions of impacts from rural electrification (by solar energy) have been formed, which will be revived in the survey part (compare 3.2.2.2 Qualitative interview).



### 3. FIELD STUDY

This chapter includes a presentation of the survey village (3.1 Location), a description of the methods used during the survey (3.2 Methodology), and the results from the survey (3.3 Results).

#### 3.1. Location

The survey was conducted in the Solar Village Rema (see Picture 3), where the Solar Energy Foundation Ethiopia started a solar home system program in 2006.



**Picture 3: SEF sign at the entrance to the survey village Rema (source: If not mentioned differently, pictures were taken by the author or by Hamere Mekonnen).**

In the following, first the approach from the Solar Energy Foundation and the Solar Energy Foundation Ethiopia will be described. Afterwards it will be dealt with the Solar Village Rema.

### **3.1.1. Solar Energy Foundation**

The aim of the 2004 founded German/Suisse based Solar Energy Foundation <sup>10</sup> is to combat poverty which is due to the lack of energy sources. In order to enable long-term development, the Foundation brings together the advantages of charitable organisations and socially responsible businesses by trying both to be economically sustainable in the long-term, as well as to focus on the interests of the rural poor population. *The productive combination of non-profit and for-profit creates the structures and fundamental requirements which are essential for an independent, self-sufficient solar trade*, so the motto of the founder and president Dr. Harald Schützeichel and the country directors of Ethiopia, Samson Tsegaye, and the Philippines, Jim Ayala, where the foundation's activities are settled (Bröll, 2010).

By offering expertise, SEF aims to enable people in partner countries to develop their own skills and initiatives to decrease energy poverty. When the target, the establishment of a sustainable solar-business in the countries, is fulfilled, the foundation will be needless and can withdraw itself as a donor organisation again. (Bröll, 2010).

### **3.1.2. SEF Ethiopia<sup>11</sup>**

SEF Ethiopia has 96 employees (compared to just 2 in Germany and Switzerland).

The basic ideas behind the work of SEF in Ethiopia are:

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<sup>10</sup> SEF in the following

<sup>11</sup> If not mentioned differently, this section draws on SEF (last accessed 14.02.2012)

- In order to enable economic and social improvement for rural Ethiopians, their basic needs (e.g. access to education, electricity/power, clean drinking water and employment/income) have to be fulfilled.
- Since such investments in rural infrastructure would not be profitable for business companies, aid programs and donations are needed for that. (*non-profit*)
- In the long-term view, the initiated development process (e.g. from the dissemination of solar energy use) will result in a self-sustainable and donor independent solar trade in Ethiopia. (*for-profit*)

Resulting from this, the required working steps of SEF Ethiopia are:

1. *Training/Education for self-sustaining solar trade*

In 2007, SEF established the *International Solar Energy School* (ISES) in Rema. The school trains 20-30 electrical engineers in design, application and management of solar technologies especially for rural electrification. Afterwards the graduated solar technicians are able to start up their own small solar businesses in villages.

2. *Establishment of small-scale businesses*

Each year, 5 new Solar Centers are opened in rural areas of Ethiopia without connection to the electrical power grid. Each Center is operated by a fixed team of 4-5 graduates from ISES. The teams will consult with the surrounding inhabitants, install SHS or sell solar lamps. The Solar Centers contribute to the establishment of a solar infrastructure from ground on. They offer work for the solar technicians, bring light to the people and secure their access to reliable service in reachable distance.

By 2010, 10 Solar Centers have been opened, supplying 33 villages with solar energy technology (Locations see map on Picture 4).



**Picture 4: Locations of Solar Centers in Ethiopia. (SEF, last accessed 14.02.2012; modified by the author)**

3. *Market incentive programmes for sales*

*Revolving Fund* microloans are given to households which can not afford paying for the SHS on their own. The purchase cost is amortised over a period of up to three years and the fund will afterwards be available again to finance the next solar system.

4. *Further development of solar trade (including training, research and development)*

Respecting the fact that sustainable development implies more than only the supply of light, but that users may develop additional needs, like being informed and entertained by radio or TV, having cooled drinks at the bar, etc, solar technology must be developed further in order to suit local needs. Therefore, *Solar Valley*, a

competence centre for training, product development, testing and assembling has been built in Ethiopia's capital Addis Ababa, ensuring that know-how will be developed and used in Ethiopia itself (see pictures 5-8).



**Picture 5: The school and office building of the Solar Valley.**



**Picture 6: Solar modules on the roof of the school building, providing electricity for Solar Valley (at present stand alone).**



**Picture 7: Solar systems are assembled at solar valley before installing them on-site.**



### 3.1.3. Solar Village Rema

The village Rema lies about 240 km north of Addis Ababa (see Picture 4 and Picture 8).



**Picture 8: Rema from above. (Google Earth)**

More than 10000 residents live there in around 2500 dwellings. They live from agriculture, farming, handcrafts and small businesses (like butchers, tailor shops, sales shops and bars). After rejecting a diesel generator due to the fear of rising fuel prices some years ago, the villagers got to know about solar energy and decided for that. Since 2006, SEF equipped 2300 households in Rema and its surrounding area with SHSs. Thus, Rema became the first and so far only village in Ethiopia, where nearly each hut was supplied with solar light, which is by far the largest solar program in the country. Besides the huts and small handcraft businesses, 3 mosques, 1 church, the health station, the primary school for 1800 schoolchildren, an administration building and the police station got solar light. Most of the huts use the basic system including lamps and mobile phone charger; some also add radio and tape. Refrigerators were bought in 3 bars and guesthouses and one bar also uses a solar TV.

There are three focus points in the management of the Solar Village Rema:

- *Technical:* Spare parts are available. Maintenance and service work, like the replacement of old batteries and lamps, are done by trained Rural Solar Energy Workers who live on the spot.
- *Socio-cultural:* Solar energy technology oriented on the needs and problems of the villagers gets integrated in their daily lives. Thus, beside solar light, radio, TV and refrigerators, also solar street light, a solar water pump to transport the water from the valley to the high village plateau, and a solar water disinfection system to purify the drinking water, were supplied. Besides these solar applications, a *Solar Club*, where old people without help by their families can get shelter and food, was founded by the Foundation. On the educational side, an evening class using solar light was initiated to allow adult education at night.
- *Financial:* As a preliminary aid measure, SEF has provided the SHS in Rema free of charge. Yet, to ensure sustainable development, solar users have to finance the operation, maintenance and replacements themselves. Therefore a payment system was established, which obliges every user to pay a small monthly fee of 7-14 ETB (40-80 US cents). This amount includes a fixed fee for service and maintenance and a replacement fee for the battery and LED lamps depending on the system size (number of lamps). After the installation, every user gets a user handbook, where the number of SHS, reparations and payments are recorded. In case someone does not pay one month, the system will be switched off for this time. If he does not pay for several times, the system can be uninstalled and used for another hut.

### ***Technical Data***

The supplied system *SunTransfer 10* provides light for totally 4 h per day. It includes:

- a solar module with 10 W<sub>p</sub>
- 2-4 lamps (in former times 1W LED lamps with 25lumen, nowadays 3W CFL lamps with up to 90lumen)
- Mobile phone charger



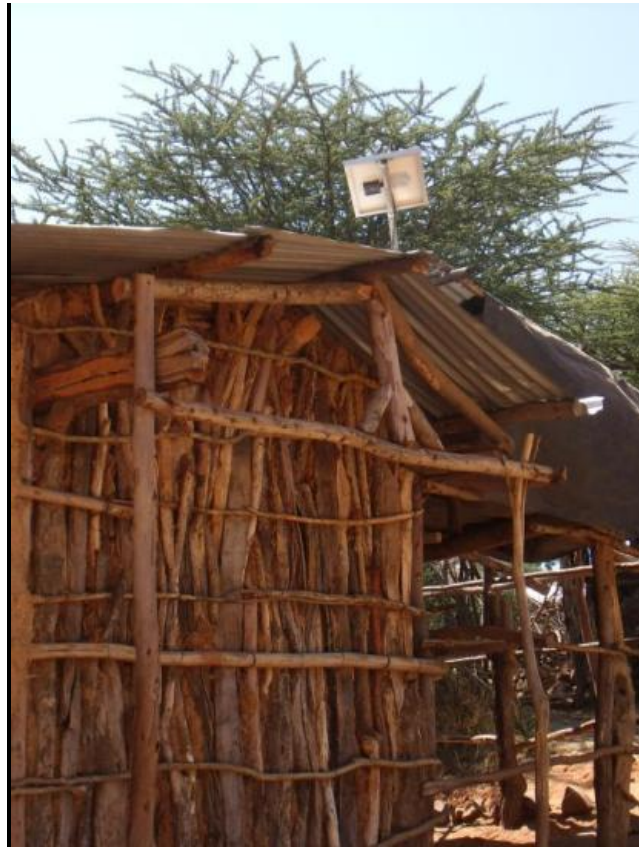
- Optionally: radio / radio and tape , TV, refrigeration
- charge controller with remote control for the pre-payment system (produced in Morocco)
- Maintenance free gel-battery (12V, 18 Ah)
- UV-resistant wires
- Strong housing (produced in Solar Valley, Ethiopia)

Since 2010, SEF also sells *Sun Boxes* in Rema. Those are portable solar lamps including mobile phone chargers. Technical features are 3 light intensities, mobile phone charger and remote control (the lamp can be hang up and switched on/off with a switch on a long cable). Different from the SHS, Sun Boxes are bought and owned from the villagers, so there is no monthly fee to be paid.

The following pictures shall provide a small impression of the solar activities in Rema to the reader (see Picture 9 - Picture 17).



**Picture 9: Hiruth, one of the Rural Solar Energy Workers, installs a new solar module on a roof.**



**Picture 10: One of the 1100 solar households in Rema.**



**Picture 11: The solar households are numbered and recorded.**



**Picture 12: The team from the Solar Center in Rema repairs the power box of one SHS.**



**Picture 13: The light shines again.**





Picture 14: A user friendly short manual on the power box teaches the user how to use the SHS.



Picture 15: Already the school children know about solar energy. The picture shows a board on the school ground, teaching the basics about the energy source.



**Picture 16: Solar street light at day...**



**Picture 17: ...and at night.**

### 3.2. Methodology

The main purpose of the survey was to listen to the villagers of Rema to get to know which impacts they experienced by the introduction of SHS in their village. Hence, they had to be encouraged to tell us about their daily life nowadays and before, their problems and needs then and now. To get an understanding of their life reality not only by words but by own experience, the author spent the three survey weeks in Rema.

As a remark on the limitations of the study, just non-public solar energy use was surveyed. Hence from the described solar energy applications in Rema, only SHS for light, charging, radio, TV and fridges were observed. Public appliances like street light and the water pump were left out of consideration.

The choice of the research method always influences the research results (Heistering, 2006). To minder the effect of result-method dependency, a combination of different methods is useful. Moreover, the use of different data collecting techniques for the same research aim, called *triangulation* in empirical social sciences, minders the danger of overlooking important aspects, since the weakness of one technique is so more probable to be compensated by the strength of another technique. (Olsen, 2004; FAO, 2010)

The thesis question was approached by the following method mix:

- Observations
- Qualitative interviews
- Quantitative data collection
- Focus group discussions (FGD)

Due to their open character, a mix of the methods *observation, qualitative interviews and focus group discussions*, suits the survey purpose (Anyaegebunam et al., 2004). Direct observation is appropriate to study social roles and structures of the study field, interviews to learn from individual biographies and group discussions to see how attitudes and experiences operate within the study group (Kitzinger, 1995). *Quantitative data* were added

in form of demographic data from village offices and to quantify respondents' statements in the interviews.

The survey period was divided into two parts. At first, two weeks were spent in the field for qualitative interviews and observations. After a medium evaluation of the collected data, one more week was spend in Rema to collect additional data and to perform two focus group discussions in order to get the end user's feedback on the results (see Figure 4).

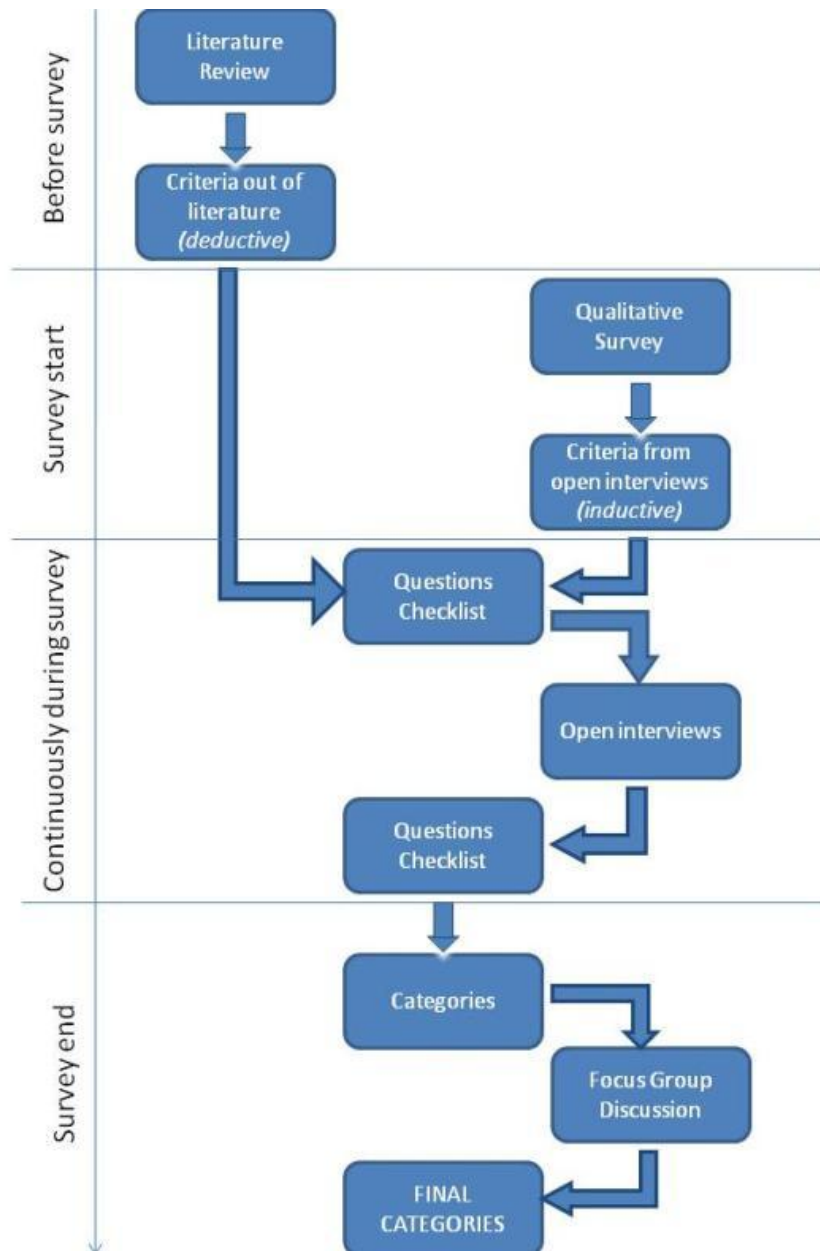


Figure 4: Structure of the Survey

The following chapter shall give more information *why* (Theory) and *how* (Application) the chosen methods were applied. Since mainly tools from the qualitative research were used, it starts with an introduction into this field of empirical social science and then elaborates on the specific techniques.

### **3.2.1. Qualitative research**

Below follows an explanation of theoretical characteristics and its practical implementation during the described survey.

#### ***Theory***

Instead of generating quantifiable and statistically analysable data from random sample surveys, like it is done in quantitative research, qualitative research is applied to specific social cases or settings to explore a focus issue in depth. Its output are contextual data, capturing judgements and perceptions of the population (Garbarino and Holland, 2009 after Holland, 2007).

While the aim of quantitative research is to measure and model population behaviour, relations, etc., qualitative research is done to analyse mostly non-quantifiable cause-and-effect processes (Garbarino and Holland, 2009 after Holland, 2007).

Table 4 contrasts some of the main differences of both research methods.



**Table 4: Comparing tendencies of qualitative and quantitative research (Source: Garbarino and Holland, 2009; after Kanbur, 2003; modified by the author)**

Qualitative Research	Quantitative Research
Non-numerical information	Numerical information
Specific (contextual) population coverage	General (non-contextual) population coverage
Inductive inference methodology	Deductive inference methodology
Explore issues in depth	Measure, model and predict

*Selective sampling* and *flexibility* were the two principles used to choose a survey population sample, as described below.<sup>12</sup>

In qualitative research, the samples should represent the heterogeneity of the research field. Every new feature observed in the field opens up a new category<sup>13</sup> of observations, independent from its frequency of appearance.

Resulting from that, random sampling is not valid for qualitative research. There would be the danger of missing relevant cases (which would be negligible exceptions in quantitative design). Instead, preliminary knowledge about similarities and differences in the survey population is used to pre-define respondent groups which reflect the heterogeneity in the field (*selective sampling*). In comparison, selective sampling has the aim of a conceptual representation, while random sampling aims to achieve statistic representation.

Moreover, beside triangulation (see 3.2 Methodology), *flexibility* is an important aspect of qualitative research. *Flexibility is the absence of a rigid protocol and the possibility to change techniques and tools as needs arise* (FAO, 2010). This means that, depending on the discovery of new important aspects, the sample will be continuously extended during the survey. So the final sample size is not known from the beginning on. When a

<sup>12</sup> If not mentioned differently, this section draws on Lamnek (2005)

<sup>13</sup> The term *category* is explained in 3.2.3 Data analysis

*theoretical saturation* is achieved, which means that no more new aspects are found, the research ends. Flexibility is one precondition to guarantee that the researcher stays open for new observations and realizations during the survey, instead of sticking just to the ideas which were present during research design.

### ***Application***

According to the idea of *selective sampling*, the following respondent groups were chosen in advance to entering the field to give answers about the range of changes solar energy brings to rural life:

- SHS users (main respondent group)
- People without solar light
- People who had SHS, which was removed again

The main respondent group were SHS users in Rema, because they were able to compare their previous to their current life. In addition, some respondents who never had solar light and who could provide insight about their life reality using traditional fuels, were interviewed. Since almost all villagers in Rema have been supplied with a SHS, some respondents without SHS had to be found in a neighbour village with similar infrastructure and living conditions to Rema. Moreover, some former SHS users in Rema, whose systems were removed after they did not pay the monthly fee, were considered. They were expected to have a different view towards their regained lifestyle using traditional fuels after getting to know electricity.

Table 5 displays the distribution of respondents among the three groups.

**Table 5: Respondent groups and number of respondents.**

Respondent groups	No. of respondents
SHS users	66
People without SHS	4
People who had SHS	2

For the main respondent group, it was tried to capture a variety of views from different perspectives, e.g. women, men, schoolchildren, economically more and less well-off persons. Different occasions where these groups were most likely to be found, were visited. For example most interviews with women were conducted at home, men were found on the fields, children on their way back from school, more well-off persons in their businesses and so on. Interviewees were mostly met by chance by walking to these spots and asking people whether they would be willing to participate. If special respondent groups were needed, technicians or locals were asked where to find them.

The principle of *flexibility* was followed during the course of the survey when new society groups like shop owners and community groups were focused on as respondents, to follow questions arising during data collection.

### **3.2.2. Data collection**

Data was collected by the tools of observation, qualitative interviews and focus group discussions, which will be described one after another in this subchapter.

#### **3.2.2.1. Observation**

A theoretical description of the observation method followed by its practical implementation will be explained in this section.

***Theory***<sup>14</sup>

Often what people say they believe and say they do is contradicted by their behaviour (*human inconsistency*). Sometimes for example asking for the duration of daily activities is difficult since people may not keep track about how long they cook, collect firewood, etc., and just provide rough guesses. In these cases observation may provide a second impression to check against participant's subjective reporting. In the case of translated interviews moreover, the researcher is very much dependent on the translator. Here, observation gives him a chance to include his own impressions made in the study field.

Observation can be either done as "passive" observation alone, or by participating actively in the study population's activities. The second option offers the possibility to withdraw the subject-object division between the researcher and the research population. The decision for the best observation form should be based on the circumstances on the spot as well as the researcher's ability to mingle with the local people.

By interacting with the study population outside of an artificial research environment, e.g. at the market, church, bar or on the fields, the researcher suddenly belongs to the field and gets access to informal events. This helps to improve his understanding of the physical, social, cultural and economic context in which the people live. And, since understanding is best possible from personal experience, observation and taking part in the everyday life is the best way to get to know the study population's perspectives.

Of course, this is just possible to some extent, since the researcher will hardly ever really belong to the field. Like Mack et al. (2005) express it, one can just try one's best to *learn what life is like for an "insider" while remaining, inevitably, an "outsider"* (p.13). Especially doing research in other cultures results in language barriers and obviously not being part of the community. Observing at the same time means being observed and catching attention. Still, the cultural understanding gained during observation will be valuable during the following interview period; the design of the interviews can be reviewed and improved and a context is gained for understanding and crosschecking the data collected during further methods. Done prior to other research methods, it makes sense

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<sup>14</sup> If not mentioned differently, this section draws on Mack et al. (2005)

for getting a first picture of the field, building a relationship with future key informants<sup>15</sup> and figuring out possible survey participants.

### *Application*

The method of observation was used in the survey as explained below.

### *Time*

The method of observation was used before and simultaneously to other methods during the whole research period.

### *Checklist*

The following checklist with most relevant objectives for the research topic was kept in mind during observation:

- use of electricity
  - (dis)advantages from having access to electricity
  - (dis)advantages from not having access to electricity
- daily activities of men/women/children
  - who deals when with electricity?
- Who are key informants/stakeholders?

Beside that, it was paid attention to stay open to discover new aspects concerning the survey question.

### *Purpose*

The purpose of participatory observation activity as related to the overall research objective was:

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<sup>15</sup> Key informants are local contact persons who can provide the researcher with background information about the community and thus ease his understanding about their culture, way of living, etc.

- Get to know the social structure and infrastructure of the village (including shops, organizations, health facilities, inhabitants) in order to identify possible study participants and key informants (for example the village administrator).
- Observe or participate in important activities of community life in Rema, including special occasions as well as usual daily activities of the inhabitants. Those were
  - Daily village life
  - Evening life in Rema: Going to the bars and through the street. Observing opening times of shops in the evening, households' use of light and radio at night.
  - Market days twice a week
  - Church and open to public religious celebrations (Christian orthodox and Muslim)
  - Walk to the water well
  - Visits to the neighbour villages Rema Dire and Mejet, where SHS are not as much spread as in Rema
- Get to know the Solar Energy Foundation, the SHS program and other activities
  - Observing frequent visits of customers coming to the SEF compound in order to acquire Sun Boxes, pay fees or get maintenance.
  - Accompanying solar technicians during their maintenance work
  - Learning about the experiences the solar technicians made during their work in the villages.
  - Observing the money collection during the monthly SHS payment days
  - Visiting the Solar Club
  - Attending the evening class

### *Recording*

Observations were noted in a field book.

### 3.2.2.2. *Qualitative interview*

In this part, the method of qualitative interview is described first from theoretical and afterwards from side of its implementation during the survey.

#### *Theory*<sup>16</sup>

*Open, half standardised interviews* were the main survey method. They are more similar to a normal conversation than to a typical interview. This is due to no question answer scheme, but a more open and free talk, so that the normally in interviews typical asymmetry between the asking and the answering person is reduced.

*Open interviews* do not begin with a concrete question requiring a precise answer, but with an invitation by the interviewer to tell in detail about the topic. Afterwards the respondent tells what comes to his mind about it in his own structure and with as little interruptions by the interviewer as possible to guarantee a free narrative flow. This open form aims to give insight in the respondent's experiences and relevancies (Hiermansperger and Greindl after Schnell et al., 1995).

*Half standardised* refers to the interview style: After giving the introduction, the interviewer's role during the conversation is that of an emotionally involved and sympathetic listener. No strictly ordered pre-formulated questions are used. Instead, the interviewer just encourages the respondent to talk more. The only guide is a checklist of questions with which he controls whether all topics of interest have been touched at the end (FAO, 2010). Finally the interviewer serves as a measuring tool himself: his impressions and interpretations are a source of information during the analysis.

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<sup>16</sup> If not mentioned differently, this section draws on Bortz and Döring (2002) and Lamnek (2005).

### *Application*

This section describes the questionnaire used during the interviews, as well as interviewers and respondents which took part in the qualitative survey.

### *Questionnaire*

Besides trying to develop the interviews as open as possible around the topic of interest - impacts of SHS -, a checklist with guiding questions was used, in case the respondents were not explaining their answer towards the introductory question very detailed. The checklist was developed using both theory- and survey based information (*deductive* and *inductive* checklist design), as indicated in figure 4. The deductive part was provided by the assumptions formed in 2.2 Impacts from rural electrification. This was adapted to the findings from the ground, after first insights were gained from the interviews. From then on, the checklist was continuously extended with every new insight gained in the interviews, guaranteeing *flexibility* (see 7.1.1 Questionnaire Development).

The field was exited after a *theoretical saturation* (compare 3.2.1 Qualitative research) was detected after the 2<sup>nd</sup> week.

One factor of inconsistency during the survey was the change of translators, which lead to different interview experiences, as described below.

### *Interviewer and translator*

Due to organisational reasons, the author was accompanied by 3 different translators during the survey. All of them were Ethiopian or Ethiopia-based women with a technical background. Their approach and way of interacting during the interviews varied from reacting very spontaneously towards the respondent's talk towards sticking more fixed towards the question-checklist. In the first case, the interview was recorded and translated afterwards to the author, in order not to stop the flow of speech. In the second case, every answer was translated in key words directly to the author so that she could interfere and slide-in additional questions.



*Respondents*

The following is a list of all respondents during the 3 interview weeks:

1. Farmer family in the neighbour village Mejet, selling self-brewed alcohol to guests (4, 1w/3m)<sup>17</sup>
2. Electro shop owner in Rema talking about the impact of solar light to his business and further wishes he has (1m)
3. Old widow in Rema, whose SHS was uninstalled, after she didn't pay the monthly fee (1w)
4. School teachers, talking about female education and the impact solar light has on schoolchildren's education (2m)
5. Adult evening class, explaining their benefits from this class (15, 1w/14m)
6. Semaine, a not-married woman, who is selling Injera<sup>18</sup> and handcrafts, benefitting from more working and leisure time during the evenings (1w)
7. The village administrator, giving us background information about Rema and possibilities for development by solar energy as well as further needs (1m)
8. The head of the health station, talking about whether lung-eye problems are reduced and providing us data about the top diseases in Rema (1m)
9. A 16 year old young woman, who has to help her dad in the evening which does not allow much time to study, even though they have solar light (1w)
10. An old woman who wishes to stay in the solar club ("Do you have a solar light?" - "I don't have a house.") and her niece (2w)
11. Family mother who lives close to the main road and does not have her SHS any more (1w)
12. Mother who lives more far away from the village centre (1w)
13. Three students coming home from school, who live in rented houses with solar lights (3, 2w/1m)
14. 2<sup>nd</sup> visit of Semaine to ask her further questions and pre-test the evaluation method for the focus group discussions at the end (1w)

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<sup>17</sup> Often more than one person took part in the interviews (for example when families were visited or guests were present). The numbers in brackets indicate the total number of people interviewed and the number of women/men.

<sup>18</sup> *Injera* is the main dish in Ethiopia, produced from the Ethiopian crop *T'eff*.

15. Evening interview with a carpenter and his wife (2, 1w/1m)
16. Children who were working at the field, telling us about their study experiences with solar lights (4, 3w/1m)
17. Two farmers coming home from their fields, using solar lights in their evening hours at home (2m)
18. Mama Trengo, who rents houses with solar lights in Rema (1w)
19. Two farmers in the neighbour village Rema Dire who do not have a SHS (2m)
20. 2<sup>nd</sup> visit to the village administrator, listing us the village groups and organisations existing in Rema (1m)
21. – 24. Shop owners using solar light in their shops (4, 1m/3w)
25. The pharmacist who rents a house with solar light, since light is very important for his business (1m)
26. The youth group's leader using solar energy to power his mini media station to spread social news in the village, telling us about experiences with HIV in Rema (1m)
27. Group discussion: Female SHS users (11w)
28. Group discussion: Male SHS users (10m)

Totally 26 interviews and 2 focus group discussions with 72 different respondents, out of these 30 women and 42 men, were made.

*Additional data and background information*

Additionally to the interviews, data and background information were collected from

- Solar technicians: Information about the survey region and their working experiences
- Village administration: Progress growth plan of Rema
- Health office: List of the top diseases in Rema
- School office: Number of students passing the grade 8 exams since 2005

### *Recording*

All interviews were recorded with a dictation machine, pictures were made if appropriate and observations of the interview situation were noted in the field book after the interviews.

### *Transcription*

Transcriptions were done at the end of each interview day. The respondents often used repetitions during their explanations. These were left out during transcription, if no new information was given.

#### **3.2.2.3. *Focus group discussion (FGD)***

Also the focus group discussions will be described in theory and application below.

### ***Theory***<sup>19</sup>

Focus group discussions are an easy and fast way to collect many data at once, providing an overview about existing opinions in a group.

Among others, FDG offer the following advantages, which makes them appropriate for the current survey:

#### *Encouragement:*

More outgoing participants act as icebreakers during the group discussions. They encourage those people who are shy during the formality and isolation of one to one interviews to engage in the discussion. Moreover, the open discussion about tabooed topics or criticism can be enhanced by extroverted group members.

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<sup>19</sup> If not mentioned differently, this section draws on Heisteringer (2006) and Kitzinger (1995)

*Group dynamic*

Different from face to face interviews, participants do not just respond to the interview questions, but are stimulated by other group member's answers, comment on them and think further. Ideas develop during the discussion. This interaction within the group produces new data and insights.

Furthermore it is not always easy to figure out the "right questions" to ask during personal interviews in order to get access to the desired information. Some information may just not be available as reasoned answers to direct questions. During discussions nevertheless, the flow of the conversation is freer and stronger determined mutually by the participants than by the interviewer. Hence, people's knowledge and attitudes that were undiscovered in interviews may be spoken out.

*Finding out the majority opinion*

Group discussions are a good possibility to test the general validity of statements collected during personal interviews. By introducing a discussion about the survey results, the researcher can find out whether an opinion is carried by the majority or not.

*Group composition*

Most researchers compose homogeneous focus groups out of people who share similarities in their culture with regard to the research topic. They will mutually strengthen the group's believe and deliver a clear opinion to the researcher. Afterwards, a comparison of several FGD results (with different participant groups, like young and old people, men and women) will show the diversity of opinions existing in the community (FAO, 2010).

Even in homogeneous groups, one has to be aware about group hierarchies affecting the data in a way that dominant participants will be more active expressing their opinions, while divergent views may remain unspoken.

### *Application*

At the end of the survey period, a preliminary evaluation of the interviews was done and 7 categories with impacts from SHS were found (see Figure 4: Structure of the Survey and 7.1.2 Preliminary impact list from SHS). These impacts were still further differentiated during the final evaluation after the survey period. But before, a feedback from the SHS was aimed, to get to know whether they agree with the findings and whether they can add additional points. Hence the FGDs were done to obtain their communicative validation of the interview results.

### *Groups*

The FGDs took part in a relaxed atmosphere in the classroom of the SEF compound (picture 19). Two groups with each around 10 SHS were formed with female and male users. This was done since daily activities differ significantly between the gender in rural Ethiopian society and an insight into both life perspectives was aimed. Moreover, women were considered to be freer in explaining themselves in the patriarchal survey society<sup>20</sup> when being asked in an environment without men.

### *Procedure*

As it can be seen in picture 19, the preliminary results were written in Amharic<sup>21</sup> language on cards which hang on a rope in the classroom. During the FGDs, the findings were read out and explained to the participants. Then they were asked whether there are things they disagree with or whether there are points to add. Moreover, an attempt was made to let the participants order the impacts from most important to least important, in order to get the user's weight of SHS impacts.

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<sup>20</sup> Müggenburg (2011) stated in her diploma thesis that *the Ethiopian society can be classified more as a patriarchal one* (p. 91).

<sup>21</sup> Amharic and English are the official languages in Ethiopia.

*Recording*

The focus group discussions were recorded and additionally filmed so to know who of the participants is speaking. Like for interviews, the recorded material was transcribed and observations of the situation were noted in the field book.



**Picture 18: The classroom was prepared for the FGDs with cards presenting the survey findings in Amharic language.**

Above, the data collection methods of observation, interviews, and group discussions have been described. In the next subchapter follows an explanation of the method used to analysis the obtained data.

### 3.2.3. Data analysis<sup>22</sup>

The collected data was evaluated with the qualitative evaluation method *Qualitative content analysis* after MAYRING. Working with the amount of data was eased by the help of the computer program *MaxQDa* for qualitative text analysis.

Qualitative content analysis means assigning parts of the interview texts towards categories. The process started with defining the smallest (*coding unit*) and the largest text part (*context unit*) which can be assigned to categories (Hiermansperger and Greindl; Bortz and Döring, 2002). As coding unit, one sentence was used in this thesis, while a context unit was defined as one coherent text passage in which the respondent talks about the topic of interest.

Then the units were assigned towards *categories*. The categories' name is a subject heading for the codes it represents (for example "Benefits from SHS", when the respondent describes positive impacts he experienced). If one category is mentioned very frequently and is explained in more details, it can be further differentiated with *subcategories* (e.g. "Economic benefits", "Health benefits", etc.). The arising *category scheme* (including all categories) serves as a base for interpretation (Wiesinger, accessed 16.11.2011)

The described and used way of forming categories is called *inductive*, since the category scheme has been won out of the material, instead of using a theory based scheme . Thus, the category scheme which was formed out of the interviews in Rema presents the impacts from SHS, which were described by the villagers.

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<sup>22</sup> If not mentioned differently, this section draws on Bortz and Döring (2002).

### 3.3. Results

The qualitative content analysis of the collected data resulted in the following categories of impacts from SHS, which were reported by users in Rema (see Table 6).

**Table 6: List of SHS impacts reported from end users in Rema. The numbers indicate the headings used in this chapter.**

Impacts from SHS			
Application	Category	Subcategory	
3.3.1 Light	3.3.1.1 Economics	Savings	
		Income	
	3.3.1.2 Education	3.3.1.3 Expanded light time	Workload
			Social interaction
	3.3.1.4 Health	3.3.1.5 Light Quality	Eye and lung
			Birth control
			Health care
	3.3.1.5 Light Quality	3.3.1.6 Security	Bright
			Clean
			Comfortable
			Safe
	3.3.1.6 Security	3.3.1.7 Inner changes	Reliable
			Empowerment
	3.3.1.7 Inner changes		Skill development
			Motivation
			Satisfaction
			Creativity



3.3.2 Mobile charger		
	3.3.2.1 Economics	
		Savings
		Income
	3.3.2.2 Communication	
3.3.3 Radio/Tape recorder		
	3.3.3.1 Economics	
		Savings
	3.3.3.2 Information and Entertainment	
3.3.4 TV		
	3.3.4.1 Economics	
		Income
	3.3.4.2 Entertainment	
3.3.5 Fridge		
	3.3.5.1 Economics	
		Income
3.3.6 General		
	Inner changes	
		Self-esteem

As shown in the table, impacts were separated after each application (light, mobile charger, radio/tape, TV and fridge). Also some general changes from SHS were found.

In the following, the categories of each application are discussed in detail and documented with citations from the interviews.

### 3.3.1. Light

Obvious from Table 6 is that most impacts were found for light, which seems to represent the most significant impact to user's lives. The seven categories found are explained below.

### 3.3.1.1. *Economics*

Economic improvements were the main changes mentioned from SHS users. They can be divided into savings and increased income:

#### *Savings*

Mainly, users reported to save some money which they otherwise would have to spend for traditional fuels for lighting.

- Fuel

9 respondents were able to quantify their change in expenditure on kerosene and other fuels for lighting before and with SHS nowadays. In average they spent 45 ETB (2.6 USD) per months on fuels before, and 9 ETB (0.5 USD) per months for SHS nowadays, resulting in a saving 80% of their monthly fuel expenses.

The monthly amount the end users in Rema have to spend on the SHS is sensed as much less compared to the daily fuel expense. One woman, who had lost her solar system after not being able to pay the monthly fee, explained:

*R(w)<sup>23</sup>: Solar light is like a gift of God. I just had to pay 12ETB/month, which felt like a gift. Now I have to spend so much money each day for kerosene, which is not comparable with the cost for solar. (7.2.1.11 Near the mill, §38-39)*

Still, she was not able to afford the monthly fee for her SHS, since she lacked basic needs:

*R(w): When I had a solar system, I spend money for sugar, sorghum, etc. But I did not save the money for the battery [monthly replacement fee]. Therefore they took away the system. Now I have to spend much money for kerosene and there is not enough for food. (7.2.1.11 Near the mill, §37)*

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<sup>23</sup> R = Respondent (w=woman, m=man, g=girl below 16 years, b=boy below 16 years)

Often, respondents were not able to quantify the savings, since mostly it got directly spend for their daily needs:

*R(w): I don't save money on a bank account. But I have profit, even though I don't count how much I have more per day. (7.2.1.12 Edge of Rema, §37)*

*R(m): We have more money now, which we spend for food.(7.2.1.18 T'eff farmer, §37)*

*R(m): Even though we don't save but use the money, we experience an economical benefit. Now we have money to spend for our basic needs, like food and clothes. (7.2.1.16 Carpenter and his wife, §39)*

Savings in fuel expenses therefore represent an important economical plus, which is then often directly used for daily needs.

Besides saving money for fuel expenses, another source for savings was detected.

- Handcrafts

Users get the possibility to use the light in the evenings at home to produce goods by themselves, which they otherwise would have to buy at the market. This was mentioned by Semaine, who saves money by producing handcrafts by her own.

*R(w): I made all these handcrafts that you can see here and I was able to make them thanks to solar light.*

*I<sup>24</sup>: Do you sell your handcrafts?*

*R: I used to, but not any more. Instead I make it for my use. So that I can save money. (7.2.1.6 Semaine, §32, 42-43)*

From the past section on savings, it could be seen that besides saving money directly by having less fuel expenses, also savings in other areas get initiated, which seem not directly connected to solar light at first sight. The following section deals with the other side of monetary benefits, meaning the income side.

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<sup>24</sup> I = Interviewer

### ***Income generation / Business improvement***

Economic improvements regarding people's income was impacted by solar light both for small-business people, as well as for private households. This section will start by examining the first sector:

- Improved business

Before, business people in Rema had to evaluate whether opening their businesses at night was worthwhile, since they would have to spend additional money on kerosene or candles. Solar light on the other hand makes them free to decide how long they want to open their shops:

*R(w): Moreover, with solar I am free to open as long as I want. (7.2.1.22 shop 2, §31)*

Likewise, both shop owners claiming to open longer at night, as well as owners continuing their previous schedule, were interviewed:

*R(m): Previously we just opened the shop for a short period of time: until 8pm. It was not profitable using wood and kerosene for lighting the business at night. Now it's profitable to work over night. (7.2.1.28 Men group, §83)*

*R(w): Moreover, with solar I am free to open as long as I want.(7.2.1.22 shop 2, §31)*

Another improvement on the business side, especially for the gastronomy, is the smoke free light, making restaurants and food shops more healthy and customer-friendly:

*R1<sup>25</sup>(m): Before, with kerosene, no one had the appetite to stay long in the bar. But now, people forget what time it is, because they enjoy getting of the cold there.*

*R2(m): Previously when we sold meat, the smoke covered the meat, which is unhealthy. Now we sell clean meat and also alcohol. Therefore our service is improved. (7.2.1.28 Men group, §80-81)*

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<sup>25</sup> R1, R2, ... indicates different respondents in interviews with more than 1 person responding.

Generally, villagers and the village administrator mentioned an improved economy and increase in numbers of small scale businesses in Rema, e.g. small shops or kiosks. But a direct and exclusive influence of SHS encouraging more people to start businesses seems unlikely:

*R(m): The economy has improved, but that doesn't necessarily have to be caused by solar. There are so many other factors. Of course solar has contributed to the growth along with other factors. No one has studied the effects of each of the parameters. (7.2.1.7Administrator, §47)*

Summarizing, solar light impacts small-businesses by enabling longer opening times and improving the business quality. How much this impacts economic growth and rising business numbers in the area is not clear, since this will be affected by broader national economic trends.

Looking towards the private sector, the income of SHS households was affected as described below.

- Productive night work

Solar light at home enables people to do productive work in the evening hours and by this improve their family income. Activities like producing and selling *Injera*, bread, condiments, sewing and making handcrafts and clothes were mentioned or observed. Here, a gender separation can be done: Producing handcrafts at household level is mostly done by women, while men were often observed being tailors and thus also benefit by the increased light time at night, as stated in the following quote:

*R1(m): Women can work at night. They produce Gabi [traditional cloth out of cotton], weave and knit.*

*[...]*

*R2(m): I am sewing clothes. If 3 people order for tomorrow, I can finish the work at night. Previously it was not possible. (7.2.1.28 Men group, §68, 84)*

Moreover, villagers reported to sell tea in the evening hours and to prepare and sell food to bus travellers who stop late at night in the village:

Like already observed in 3.3.1.1 Economics → Savings, the achievement of economic benefits was again hard to quantify:

*I: How much more income do you have by this now?*

*R(w): I don't have an exact figure. But I have a benefit now. (7.2.1.15 Semaine 2, §42)*

Still, it was apparent that family income often got improved by solar light, since users started or increased productive activities at night.

Summarizing for the economic part, improvements were mentioned in the saving and income side. Latter could be separated into business and household income. Common for all aspects was a difficulty in giving exact values for improvements achieved.

### **3.3.1.2. Education**

Many respondents claimed an improvement in their kids' study situation as an important impact from SHS. Before, families were often not able to buy kerosene for study purposes at night. Nowadays students indicated to study around 2-4 hours more each night (from 8 up to 10/12pm), using solar light which does not cause additional costs:

*R: When you compare in contrast, after solar there is a high number of students who increased their study habits and use the light effectively. But before the students were not voluntary to study because maybe their family economic situation did not allow them to buy kerosene for study purpose. (7.2.1.4 Teachers., §114; compare also 7.2.1.14 Three Students and 7.2.1.17 Children on the field)*

Some parents and students mentioned an improved performance due to increased studies at night (compare 7.2.1.17 Children on the field and 7.2.1.28 Men group), but this could not be proved by data received from the school office in Rema. The data provided in Table 7 gave information about the number of registered students and the number and performance of grade 8 exam takers.

**Table 7: Data from the school office about the total number of students registered and the grade 8 exam takers from 2005-2011. 2005 was also the year, SEF started with the installation of SHS in Rema.**

Year		Overall students registered			Grade 8 regional examination takers		
E.C.	G.C.	Total	Male	Female	Exam takers	Score above 50%	% passed
1998	2005	1449	711	738	119	no data	96.6
1999	2006	1444	732	712	92	11	11.9
2000	2007	1558	735	823	72	17	23
2001	2008	1532	738	794	115	22	19
2002	2009	1511	703	808	101	29	29
2003	2010	1531	721	810	87	15	17.2
2004	2011	still registering					

The data series starts in 2005, the same year when the SHS programme in Rema was initiated. Another important happening the teachers reported from that year was the change of the exam language from Amharic to English. As it can be seen in the right column, there was a dramatic decrease of exam passers from around 95% to 10% between 2005 and 2006. This was explained by the teachers as a result from the language change, since many of the rural schoolchildren would not be familiar enough with the English language. From 2006 onwards till 2003, the percentage of passers varies around 20%.

After such significant structural change in the educational system of Rema, possible performance improvements by solar energy use can not be distinguished out of these data.

Besides a change in the study quantity (more time to study), also a qualitative change was reported by the students. This was caused by the characteristics of solar light, which is bright and safe of fire accidents. Both will be discussed in detail under 3.3.1.5 Light Quality.

Summarizing, educational improvements were achieved by SHS due to the student's possibility to study longer at night and to study better with an improved light source.

### 3.3.1.3. *Expanded light time*

The 2<sup>nd</sup> frequently mentioned impact (after economic improvements) connects to the economic side. People valued the increased light time they gain by being able to use solar light at night. When not considering this aspect from the economic, but from the side of individual life, before getting access to solar, people were forced to either go to bed early or to spend more money in order to “expand their day”.

As the teacher Ayele Mengesha explains:

*R(m): During the times of kerosene lamps, the lamp once filled with fuel extended the time with light one hour after sunset. Then either additional fuel would have to been used to fill the lamp again, or the people would have to go to bed or at least were unable to study longer. (7.2.1.4 Teachers, §32)*

This is also shown in the interview with a farmer in the neighbor village Rema Dire:

*I: Do you use the kerosene for lighting?*

*R(m): Yes.*

*I: What is your schedule at night?*

*R: After dinner we go to bed. (7.2.1.20 Farmer in Rema Dire, §42-43)*

Of course with solar light people may still decide to go to bed early when they are tired:

*I: What time do you go to bed?*

*R(w): Between 9 and 10pm.*

*I: And before solar light?*

*R: The same time, because we went to bed when my husband was tired. There is not a big difference in the time of going to bed. (7.2.1.12 Edge of Rema, 54-56)*

But the big difference is that people can decide what they want to do, like one woman explained during the focus group discussion:

*R(w): We are really enjoying doing activities at night. Previously we were not able doing that. (7.2.1.27 Women group, §62)*



Summarising, solar light widens people's freedom of choice by having more time at their free disposal. Depending on people's need and interest they do work (leading to economic improvements as described in 3.3.1.1 Economics), use it as leisure time or maintain their previous schedule and do not change their sleeping time.

Resulting from that, more light time can either lighten or increase people's workload. As explained in 3.3.1.1 Economics and 3.3.1.2 Education, latter is true for business people opening longer at night, for women doing productive night work at home, as well as for students studying at night.

The current section aims to discuss whether an increase in workload is observed by the individuals and whether this is sensed as a positive or negative change by them.

Most of the male inhabitants in Rema spend the whole day on their farms and just come back for dinner and to sleep (compare 7.2.1.18 T'eff farmer and 7.2.1.20 Farmer in Rema Dire). Solar light just impacts the lives of those men who are shop owners or craftsmen, which are few compared to all villagers. Different to the men, women and young children spend much of their day time indoor. And also older children and teenagers experience a change by solar light, regarding their study behavior at night. These considerations lead to the decision to concentrate on women and children when discussing a change in their workloads. Moreover, a possible change in the gender relation will be addressed.

To link up with 3.3.1.2 Education, first the attention is drawn on possible changes on children's workload by longer study times at night.

### ***Children's workload***

Regarding the workload of children, the following statement of a woman tells how busy children in Rema are, even apart from going to school:

*R(w): Now they can study at night. The whole daytime is occupied with farm work, fetching water and so on. (7.2.1.27 Women group, §43)*

The teacher Ayele described the daily schedule of a schoolchild in Rema, which is able to study longer at night using solar light. He neglected the question raised, whether children would be very tired after working the whole day and still studying at night:

- I: Are the students who study at night tired?*  
*R(m): The students are not very tired. They go to school 4 hours: From 8am to 12:30. Afterwards they help their family and return back to their home and study. Up to 8, 9 or 10pm. We guide the students to avoid them becoming tired. (7.2.1.4 Teachers, §122-123)*

As expressed above, solar light on the one hand enables students to study at night. On the other hand, it makes them available to spend additional time for helping their parents at night. This was mentioned by the following children, who were met on the fields watching for their animals:

- I: How did you spend your evenings before solar?*  
*R(b): We studied as well at night, but less than now.*  
*I: When did you go to bed?*  
*R(g): At 9pm. And now between 10 and 11pm.*  
*I: Do you just use the additional time in the evening for study, or also help your parents?*  
*R(g): Yes, we do both more now: Homework for school and housework for our parents. (7.2.1.17 Children on the field, § 38-42)*

Also the following 16 year old student expresses the competition, which household tasks and studying have during the light time at night. This is valid especially for girls who are obliged with household chores:

- R(w): I go to school until 12:30. Then I go to fetch water. I cook and do house chores. I finish my house chores at 8pm. My dad comes home, I serve him dinner, finish washing the dishes by 9 and study for like half an hour. Then I'm too tired and go to bed by 9:30.(7.2.1.9 Student; §39)*

During this section it became visible, that not only the availability of achievable light at night is necessary to enable students to study longer. The logical chain of more light time

leading to increased study time is only valid, if the children's workload will not be increased as well.

### ***Women's workload***

As explained in 3.3.1.1 Economics → Income → Productive night work, women increasingly use the light time at night to do productive works, partly for sale. That would entail an increase of their former workload. On the other side there is the possibility not only to add additional work in the evening hours, but also to relieve the daily schedule. Women described how they are unburdened by having some breaks during the noon and shifting some of their tasks towards the night. This leads to the general observation of a more relaxed but longer working day of women.

The following three examples strengthen this observation. The first one is an example of a woman starting her daily work earlier, followed by two women explaining working later at night nowadays.

*I: Who mainly benefitted from SHS health improvements?*

*R(w): All of us. Also our husbands benefit. Before, they had to leave early without breakfast because it was too dark to prepare food. After the sun rose, we prepared their breakfast and carried it to the fields. Now we can use the light early in the morning and make them breakfast which they take along to their fields. (7.2.1.27 Women group, §53-54)*

Others were happy to be able to do some of the next-day's work already the day before and thus release the next day's workload:

*R(w): Before we had to finish all the work at daytime. But now we can take a nap during the hot noon and finish work at night. There is no hurry any more, we have enough time. (7.2.1.27 Women group, §58)*

*R(w): Before solar, [I went to bed] at 9 to 10pm. With solar, I went to bed between 9 to 11pm, because sometimes I already prepared the breakfast for the next day. (7.2.1.11 Near the mill, §33)*

Concluding from above, the observed tendency was mainly that women's working days start earlier and last longer. Regarding the amount of work, it may either be decreased (woman does not have to carry the breakfast to the field any more), be unchanged (women just add breaks at noon) or increased (women add additional work at night).

These are more factual observations regarding changing working schedules. Until now, the women's self-conception about those changes was left out of consideration. Likewise was that of their husbands, who possibly may sense a change in the gender relation when their wives take greater share in earning the family's income. The following two statements refer to this consideration.

With Semaine, who was happy about the possibility to work more, a female respondent expressing herself about the change in workload, is cited in the following.

*R(w): At night I sell Injera. Then I use the solar light to make handcraft. When I still have time, I do other houseworks.*

*I: What about before solar?*

*R: Before kerosene, I did not work in the evening, due to my lung disease. I did not sell Injera or prepare handcraft.*

*[...]*

*I: Does it mean you have more workload nowadays?*

*R: Yes, since I don't have health problems, I am able to do more work now. This is good for me. (7.2.1.15 Semaine 2, §38-44)*

During the focus group discussion, one of the participants took position about the change in women's share in the family income:

*R(m): Before, women were busy with important works all day. But now they have additional time to do handcrafts at night. They can use the additional time for productive works.*

*I: Do you like and support when your wife has income?*

*R: Life is like a stretcher. You can't carry it just on one side. You need support. It's helpful if they make money for the family. It helps to increase our family economy. (7.2.1.28 Men group, §70-72)*

From latter statements, the importance of women acquiring a part of the family income was stressed out. A woman was cited who was lucky about her increased ability to do so. Also a male voice acknowledged this change. Both seem to support a possible gain in women's autonomy by solar light, which would be a positive way of interpretation. A higher share of women's work on the family income could strengthen the women's position in the family's gender relation. The negative site could be still higher expectations towards the already high work burden of women in rural Ethiopian families (since women have the new possibility to work at night, they may be expected to do so, instead of taking rest).

Summarising, solar light both makes people more flexible to determine their daily schedule as they like, but also offers the opportunity to load them with additional work. This can be valid for all; students, women doing handcraft and men owning small businesses. Regarding students, there was a clear tendency of increased study times at night, but also some cases where studies were hindered by more household tasks at night. For women, respondents mentioning more relaxed working days as well as women with increased work amount were interviewed. Up to now, the possibility to work more rather seemed to represent a positive impact from women's point of view.

In the following, a further impact from increased light time, different from influences in the working area, will be discussed. Meant are possible effects in the social activities of study participants.

### ***Social Interaction***

Additional to above described observations of people using the plus in light time for breaks or additional works, users also reported to increase the social time they spend with their family and friends. For example a group of women, who was met during the afternoon producing handcrafts in front of their houses, explained that they preferred to do the handcrafts at daylight. The solar light in the evening they would rather use to come together with friends at home. (7.2.1.13 Women making handcrafts )

The following parents gained time for family discussions at night:

*R(m): Previously, to save wood or kerosene, everything was dark and we would [just shortly] discuss in the dark, or we would sleep. Now we can discuss with light and stay a bit longer. (7.2.1.28 Men group, §65)*

*R(w): I don't work at night, because I finish cooking and make Injera before evening. So there is no work left at night. But I spend the evening talking with my children. (7.2.1.19 Mama Trengo, §44)*

Additional light time in the evenings may was used to spend time with the family and socialize with their friends. This observation opposes and softens down the apprehension of higher female responsibilities, which was made before.

#### **3.3.1.4. Health**

The third frequent mentioned impact from solar light was the improvement of user's health. The mentioned health impacts were mainly decreased eye and lung problems, but also changes in fertility and health care. All three effects will be described in this chapter.

##### ***Eye and lung problems***

By avoiding the health endangering smoke from kerosene lamps, solar light leads to significant relief on people's eyes and respiratory system, which the village administrator and the head of the health centre constitute as the most relevant health impact:

*R(m): The biggest impact on health is the reduction of lung and eye problems that used to be caused by the kerosene lamps.(7.2.1.7 Administrator, §30)*

*R(m): When it comes to smoke caused lung diseases, we have seen tremendous decline in the number of cases. (7.2.1.8 Health station, §31)*

From the health officer, a list with the ten most frequently occurring diseases in Rema between 2006 (year when SHS were introduced) and 2010 was provided. The list included intestinal parasites, pneumonia, malaria, malnutrition, diarrhoea, skin diseases, lack of

amniotic fluid (AFI), gastrointestinal tract disease (GIT) and urinal tract infections. Out of the listed diseases, the lung inflammatory pneumonia can be caused by indoor air pollution<sup>26</sup>. The numbers of pneumonia cases recorded in Remas health station are listed in Table 8.

**Table 8: List with top ten diseases in Rema**

Year		Pneumonia cases	
E.C.	G.C.	Absolute numbers	Percentages relative to year before
1999	2006	678	-
2000	2007	505	74%
2001	2008	509	101%
2002	2009	485	95%
2003	2010	281	58%

Visible is first a one year rise in diseases, followed by a quite significant two year decline from 2008 to 2010 of around 40%. This may be related to a decrease in indoor air pollution achieved by the substitution of kerosene with solar light. But this can not definitely be concluded out of the data. In order to interpret the rising and sinking tendency in reported cases of pneumonia diseases, other influencing factors (e.g. other causes of pneumonia besides indoor air pollution, health prevention programs, etc.) have to be known and considered as well.

Even though solar light's impacts on lung diseases can not clearly be proved by the obtained data, the responses obtained from solar and kerosene users in and around Rema speak for itself. That statement of a priest, claiming that *every woman in the village has similar eye problems* (7.2.1.1 Mejet, §60) was confirmed by many women who reported the health aspect during the personal interviews:

<sup>26</sup> “ A recent review concluded that there is strong evidence for indoor air pollution as a cause of pneumonia and other acute lower respiratory infections...” (see WHO 2008, p. 3).

*R (w): I have lung problems. Before the arrival of solar light, I couldn't do any work at night. Whatever I was doing, I had to finish it during daylight. When I was using kerosene lamps, every morning I used to spit out black smoke and I used to get sick a lot. But once the solar light came I started feeling a lot better and I was able to make all these handicrafts you see. Whenever solar light is mentioned, I get so excited that I can feel my heartbeats. (7.2.1.6 Semaine, §33)*

*R (w): Before, I had eye and lung problems. Now this is no problem any more. (7.2.1.16 Carpenter and his wife, §78)*

*R (w): Also my children have problems with their breathing system; with their eyes and noses. (7.2.1.11 Near the mill §41)*

From the last quote, it becomes apparent that especially those people who spend much of their time indoor, like women and small children, are affected by diseases caused by indoor air pollution. This was also proved by agreement during the women focus group and their weighting of “health” as most important impact from SHS (compare 7.2.1.27 Women group).

Apart from the important health improvement by solar lamps, still the main indoor smoke source is retained with traditional stoves or 3-stone fires. Towards this problem the health officer drew attention to:

*R(m): Solar had make an impact in reducing difficulties caused by smoke from kerosene....but what can make even a better impact is smokeless stove. (7.2.1.8 Health station, §31, 34)*

### ***Birth control***

During the women focus group discussion, men were asked to leave the room in order to encourage the women to talk freely about possible changes in the behaviour of birth control in the families. Just one woman responded to that question:

*R(w): Previously I would work on home activities and I couldn't find it [birth control pill], because it was dark. I would bring the pills from the clinic, put it somewhere and not find it when I would need it at night. Now I can find it easily [and take it before having sex]. There is a big change in our life. (7.2.1.27 Women group, §80)*



Even though an effect of quick and easy useable solar light on contraception was just reported by one participant, the fact of sexuality being a tabooed topic has to be considered. Hence, the later on discussed characteristic of solar light being comfortable to use (compare 3.3.1.5 Light Quality) should not be underestimated. Related to fertility, it can lead to a more self-determined contraception of women and ease family planning.

### ***Health care***

What was mentioned more frequently than the former aspect was the improvement of public health service due to having light at night. Different from before, a health assistant is now available at night in the health centre. Before, people had to search for the assistants at home when they became ill at night. Nowadays emergencies can be treated at night, and women can deliver in the health centre, which was presented as an important change:

*R(w): We believe that now there is a big improvement to our health, because we have 24h service, unlike before. Especially before giving birth, it's a big help to have 24h service. (7.2.1.27 Women group, §103)*

Besides that, the microscope at the health station, which was used with light from a kerosene lamp before, can now take advantage of the brighter solar light, which improves disease diagnosis.

Likewise, the private treatment of old or ill people is eased with solar light:

*R(m): If somebody is sick at night, it is easy to treat him. You can easily give him water and so on. Even the light gives him some relief. (7.2.1.28 Men group, §68)*

Summarising this subchapter, important health impacts from solar light were observed. Starting with improvements of the severe danger of pneumonia in off-grid areas, also other less obvious effects have been reported with changes in birth control, safer delivering at night and eased care for ill or old people.

### 3.3.1.5. *Light Quality*

As already mentioned related to education and birth control, SHS users benefitted from the quality of their new light source. The following characteristics of solar light were reported as advantageous compared to kerosene or candle light (and compared to grid power): Light from SHS was described as bright, clean, comfortable, reliable and safe. Those reported characteristics will be elaborated below.

#### ***Bright***

Users, who already use the brighter 3W CFL lamps which provide more lumens, benefit during light demanding activities, as to mention handcrafts;

*R (w): During kerosene times, sometimes I used to produce traditional clothes, like weaving. After getting solar light, I had brighter light. I started works which need more light to see, like other handcraft and sorting the sorghum out from the chaff. (7.2.1.11 Near the mill §30-31)*

... reading;

*R (b): Solar light is brighter. I'm happy with that. Before, the kerosene was not bright and I had problems to study.*

*R (g): The solar light is good. I can read better with it. (7.2.1.14 Three Students, §34-36)*

... or also when just sitting together at night and talking:

*Afterwards we still sat a bit inside and waited that the rain stops. Faleka said that before it already used to be very dark at that time at home and he could not even recognize his wife at the other side of the room. (7.2.1.16 Carpenter and his wife)*

***Clean***

Not only business people profit from the clean characteristic of solar light (compare 3.3.1.1 Economics, Income). Also private households enjoy living in a soot-less surrounding:

*I: What was the advantage of solar?*

*R(w): In the wall and ceiling of the house, there was no smoke. It was clean. With kerosene, the wall and ceiling is dirty. (7.2.1.11 Near the mill, §40,41)*

***Comfortable***

As it was already explained related to birth control in 3.3.1.4 Health , electric light is faster and more comfortable to use by just switching it on. This is a big difference in user-friendliness compared to traditional fuels. In the following statement a woman gives another example for benefitting from this aspect:

*R (w): Before solar, we used wood and kerosene. When I wanted to make light during the night, I couldn't find the kerosene or wood in the dark. That was a problem. But with the solar, that's not a problem any more. For example when my baby is crying, I just have to switch on the light and can see. That's a big difference. (7.2.1.12 Edge of Rema, §32-33)*

***Safe***

Many severe accidents up to death cases happened in Rema from fires which broke out by upset kerosene lamps. This was explained by the administrator and a family father in the following:

*R(m): There used to be a lot more fire accidents caused by spilling kerosene. Especially while students are studying they would knock off the lamp and fire would start.*

*I: How often did that incident happen?*

*R: At least two or three [large accidents] per year. For example there was a girl that got badly burnt. But thanks to a lot of medical attention she is a lot better now and she is studying engineering at the university. (7.2.1.7 Administrator, §30-32)*

*R (m): Previously we were afraid that a fire will break out from the kerosene lamp, which is now not scaring us any more. We were scared for the children and old people. Some people died from these accidents. (7.2.1.28 Men group, §39)*

Contrasting to past experiences, students now study without having to take care of fire dangers:

*R (g): Before, I sometimes worried that the kerosene lamp may spill and a fire may start. Now, I don't have to worry, because the solar lamp is safe. (7.2.1.14 Three Students, §36)*

### ***Reliable***

Power cuts are a common problem in grid-connected areas in Ethiopia. Solar users in Rema did not face this problem. They were happy for the reliable electricity source and would not like to exchange it in order to become grid-connected. (compare 7.2.1.16 Carpenter and his wife, §90)

Summing up, the substitution of traditional fuels with bright, clean, comfortable, safe and reliable solar light bears various improvements for the user's well-being; reaching from cleaner housing interiors towards saving lives by avoiding accidental deaths by fire accidents.

### **3.3.1.6. Security**

Linking up towards the above mentioned safety aspect, another effect was observed, making rural people's life more secure:

Respondents explained that thieves and wild animals are more afraid of entering the huts at night when light is shining inside. Even though the 10Watt SHS are just lighting 4h daily, people additionally reported reduced crime rates since the introduction of solar in 2006/07:

*R: The crime rate is reduced, not only by the street light, also because of light inside the houses, which scares thieves from breaking inside. Moreover the hyenas don't come. (7.2.1.28 Men group, §76)*

The impacts addressed here lead towards a change in security feeling by SHS users. Other inner changes are explained in the following.

### **3.3.1.7. Inner changes**

With economical; educational and health related impacts, as well as those related to user's time use and light source, already a variety of more or less tangible and measureable changes in end users' lives have been discussed. Contrastingly, this passage now deals with changes in the user's attitudes. Different from former "outer changes", those "inner changes" are abstract and thus not easily tangible or quantifiable. Reported were impacts in creativity, empowerment, motivation, satisfaction and skill development, as described below.

#### ***Empowerment***

Ayele expressed light as a basic need, which is necessary in order to change life:

*R(m): The aim in this world is to change life [in order to escape poverty]. But you can't change your life without light.*

*I: What do you mean by "you can not change life without light"?*

*R: Light is what? It's the basic need*

*I: What do you consider basic needs?*

*R: For example health: When you don't have to use kerosene any more, health problems are solved. (7.2.1.28 Men group, §45-50)*

The same was explained by an old woman who lives without solar light:

*R(w): I need lights to run chores and do whatever I have to do until I go to bed. How can I live without light? (7.2.1.10 Old woman without SHS, §37)*

Both respondents sense the access to light as a necessary means to improve their life.

### ***Skill development***

The access towards enabled and motivated Semaine to further develop her skills in handcrafts:

*R (w): I always knew how to make it, but my skills have improved since solar. Now I experiment more with coloured strings and new designs. (7.2.1.6 Semaine, §47)*

Generally spoken, a skill development due to improved light at home or in craft-workshops may lead to better products and improved incomes.

### ***Motivation***

The village administrator observed a change in motivation of the villagers to finish their tasks at home:

*R (m): When you don't have light, you don't even feel like going home. But when you have light, you like going home and do your work. (7.2.1.7 Administrator, §56)*

This statement does not deal with the ability to work at night, but with the motivation to do so. If this can be improved by having access to an improved light source, an increase in user's life satisfaction can be assumed.

**Satisfaction**

Related to the assumption above, Mama Trengo reported the solar light to be a cause of increased satisfaction in her life:

*MH: Are you satisfied in your life?*

*R: I was not as much satisfied before I got the solar light. But now, I am satisfied in my life. (7.2.1.19Mama Trengo, §28-29)*

**Creativity**

Semaine was the only respondent telling about creative activities comparable to hobbies in her leisure time:

*HM: So you told us about your health and your future plans. But tell us more about your feelings and thoughts.*

*R: Well, I have been to school...until grade 10. I had to quit school because of my eyes. But after solar, I have been able to use my brain more. My brain that had forgotten about school work is now creative... I like to write poems....so at night, I take time to write lots of poems as a way to express my feelings. I even wrote a poem about the impact of solar. Not only that I write poems about the impact of solar but also a lot more poems...spiritual poems. (7.2.1.6 Semaine, § 53-54)*

Having time for creative activities which are not related to income generation exceeds basic needs as defined in the HDRs (compare 2.1.2.1The Capability Approach). Exactly because of that, this interview response is emphasized as the sign of a SHS user having achieved a state of life allowing the freedom to do activities beyond the scope of struggling for basic needs.

Concluding, with above stated inner changes, impacts of solar light on productive works, people's power to improve their lives, their motivation to work, their life satisfaction and self fulfillment were indicated out of the interview responses, finally leading towards positive changes in the user's state of mind.

Herewith, the main part of the current chapter, presenting results of the field study is closed. Impacts of solar light, including economic, education, health, light time and quality, security, as well as inner changes of SHS users, were discussed.

In the following, impacts reported from other SHS applications, including phone charger, radio, TV and fridge will be addressed.

### **3.3.2. Mobile charger**

Besides light, most of the solar systems in Rema include a cell phone charger. End users reported the following economical impacts from this, leading to improved possibilities in communication.

#### **3.3.2.1. Economics**

Economic savings and increased income were stated, as explained below.

##### ***Savings***

The following user does not own a charger himself and hence still has to pay for charging his phone. Nevertheless charging became much easier, because instead of having to bring his phone to the neighbour village for charging or having to ask in some special places using generators (e.g. mills), he nowadays can ask nearly everyone to charge his phone for him.

*I: How did you charge your cell phone before and since solar?*

*R (m): Before, we either gave it to houses with generators [e.g. the miller] or we sent it to Alem Ketemah [neighbour town] to be charged. Since we*



*don't have a cell phone charger in our SHS ourselves, we now give it to neighbours who charge it.*

*I: Do you save money now? If so, how much?*

*R (m): Before we spend 3ETB for charging, and now 2ETB. Depending on how much we use the phone, it has to be charged every 3 or 4 days. (7.2.1.16 Carpenter and his wife, §57-60)*

Hence, users save money for charging. On the other side, small business people have an increased income, as explained below.

### ***Income generation / Business improvement***

Shops and some private people in Rema use the phone charger as an income generation source. Others charge families' and friends' phones.

*R (m): It's been 4 years for me since I got solar. Since then, business improved. Before, I only repaired tapes and sold tape players. No I have 3 power boxes to charge cell phones.*

*[...]*

*To charge mobiles, I charge them 3 ETB/cell phone.*

*I: How many cell phones do you charge per day?*

*R (m): About 20.*

*(7.2.1.2 Electro shop owner, § 32-34;45-47)*

*I: What about the farmers without any phone, do they come here?*

*R1 (m): Yes, they come to use my phone or if they have phones they come to charge their phones.*

*I: Do you charge them a fee?*

*R1(m): No, I don't. Most people are related to me, so I don't feel like charging them.*

*R2(m): Actually it's good that they come and see what he has and how he benefits from solar and then they want one for themselves too. (7.2.1.1 Mejet, §81-85)*

From the economic section, the observation can be made that mobile phone chargers add up to the economic improvements of SHS for rural families.

### **3.3.2.2. Communication**

According to the following statement, communication is improved by more mobile phones since more and more farmers use the new availability of chargers as incentive to decide to buy a cell phone:

*R (m): There is one thing left to add: We now keep in touch with the outside world by communicating with cell phone technology. If there is no charger, we can not use mobiles at all. Therefore SHS is a really big improvement to keep in touch with our relatives who are far. Now every farmer buys a cell phone to communicate with others. (7.2.1.28 Men group, §62)*

Resulting, impacts on household's and small business' economics was observed, as well as increased reachability of the villagers since more and more people use cell phones.

### **3.3.3. Radio/Tape recorder**

Many SHS users run a radio or tape recorder with solar electricity. They reported impacts in the economical area, as well as information and entertainment, as explained below.

#### **3.3.3.1. Economics**

Economical impacts were observed in the saving side, as elaborated in the following.

### *Savings*

Comparably to saving fuel for light, those SHS user who included a radio or tape recorder in their system, save money for batteries, as it was mentioned in the following by a private user (first citation) and the owner of a grocery (second citation):

*R(m): Now the batteries for radios etc are getting expensive, and we are freed of these expenses by using solar. (7.2.1.28 Men group, §40)*

*R(m): [He is an owner of a grocery] My customer want to listen to music. Therefore I have to play tape. It would be expensive to buy batteries for it. Therefore the SHS really helps me economically. (7.2.1.28 Men group, §77)*

Since many villagers used radios run by batteries before, this impact was quite significant in Rema.

### **3.3.3.2. Information and Entertainment**

When asking which users use the radio/tape for what, the experience was made, that women prefer to listen to music from tapes, while men listen to the radio. Responses during the women group discussion towards the question whether they own and listen radio, were the following:

*R1(w): We have radio, but don't normally listen to it. We are too old for that.  
[...]*

*R2(w): I don't have time listening to the radio, but my husband does. Sometimes I listen to the tape, both to church music and cultural music. I'm happy.  
[...]*

*R2 (w): I have but don't listen to it, because I am busy.*

*R3 (w): My husband is listening to it. He really follows it much, until midnight. (7.2.1.27 Women group, §50-74)*

Summarizing impacts from frequently used radio or tape players were observed on the economical and information and entertainment side. For latter, indications towards a division between information by radio, used by men, and music entertainment by the tape player, used by women, have been observed.

### **3.3.4. TV**

TVs are rarely used in Rema, compared to the former described radios. Still, as described below, having access towards television seemed very popular. Impacts were found on the economical and entertainment side.

#### **3.3.4.1. Economics**

Economical impacts were related to the income side (see below).

#### ***Income generation / Business improvement***

TVs are in Rema only used in gastronomies. One bar was observed, owning a solar TV and showing music clips with it. It was obviously stronger visited than other neighbouring bars. This observation is strengthened by the administrator:

*R(m): Some bars did also buy solar TVs and that had increased their income.  
(7.2.1.7 Administrator, §53)*

Hence, even though TVs do not satisfy basic needs, they improve business and thus lead to an increase in income of the bar.

### 3.3.4.2. *Entertainment*

Being asked for the community's need, the owner of the electro shop emphasizes the desire of the villagers for entertainment:

*R(m): A big change that I saw was that people that never experienced entertainment with televisions before, are now enjoying it at the bars. Even my two kids are excited to watch TV. All the community people would love to have their own TV sets in their houses.*

*I: Do they like TV because of the entertainment factor, or do they listen to the news?*

*R(m): Purely the entertainment, because they have radios to listen to the news. (7.2.1.2 Electro shop owner, § 85-87)*

However, during the ordering of the SHS after importance, men agreed in their focus group discussion, that entertainment generally does not belong to their primary needs yet:

*R(m): Entertainment is on the interest or future need, but is not a basic need now. (7.2.1.28 Men group)*

Concluding from above, people value the entertainment supplied by TVs, but define it as an “advanced need”.

### 3.3.5. **Fridge**

Comparable to TVs, fridges are utilized in some bars or guesthouses in Rema. Impacts by fridges are on the economical side, as expressed below.

#### 3.3.5.1. *Economics*

An improve in income generation was reported.

***Income generation / Business improvement***

Besides 3 kerosene run fridges in Rema, 3 bars owned a solar fridge. Other bars sold warm drinks. Those were not as frequently visited by guests than gastronomies offering cold drinks. The economic benefit was also marked by the administrator:

*R(m): The bars and restaurants that have fridges make better business. (7.2.1.7 Administrator, §51)*

Thus, having cold drinks in the evenings are a popular refreshment among the inhabitants of Rema, leading towards an increase in guests and income.

**3.3.6. General**

Independent from the different appliances included in the SHS, one general observation was made, which will be explained here.

***3.3.6.1. Inner changes***

The inhabitants of Rema were proud of getting attention by the program and of being a destination for change and improvements. This is concluded under the following heading.

***Self-esteem***

Not negligible seemed also the impact in self-esteem the use of solar energy brought to the inhabitants of Rema. After feeling like not getting much attention from national and regional politicians and being neglected with their problems and needs, the change which happens now in their village improves the villagers' self-esteem:

*R(w): They [government, administration] don't care about us, don't listen to us, respond no answers to our problems. (7.2.1.27 Women group, §88)*

*R1(m): The people from neighbour villages admire our technology when they pass through Rema.*

*R2(m): We are really lucky and proud to be the first user of solar technology in this area. (7.2.1.28 Men group, §46-47)*

This last point adds up the observations of inner changes described in 3.3.1 Light.

## 4. DISCUSSION

This section integrates the findings into the underlying theory and serves as a critical examination of the results and the way they were obtained.

### 4.1. Discussion of Results

In this section, a relation between the impacts presented in 3.3 Results and listed in Table 6, and the definition of development made in 2.1 Defining Human Development will be drawn.

Summarising the findings from Chapter 3.3 Results, the investigated SHS appliances impact the following areas of user's lives (see Figure 5).

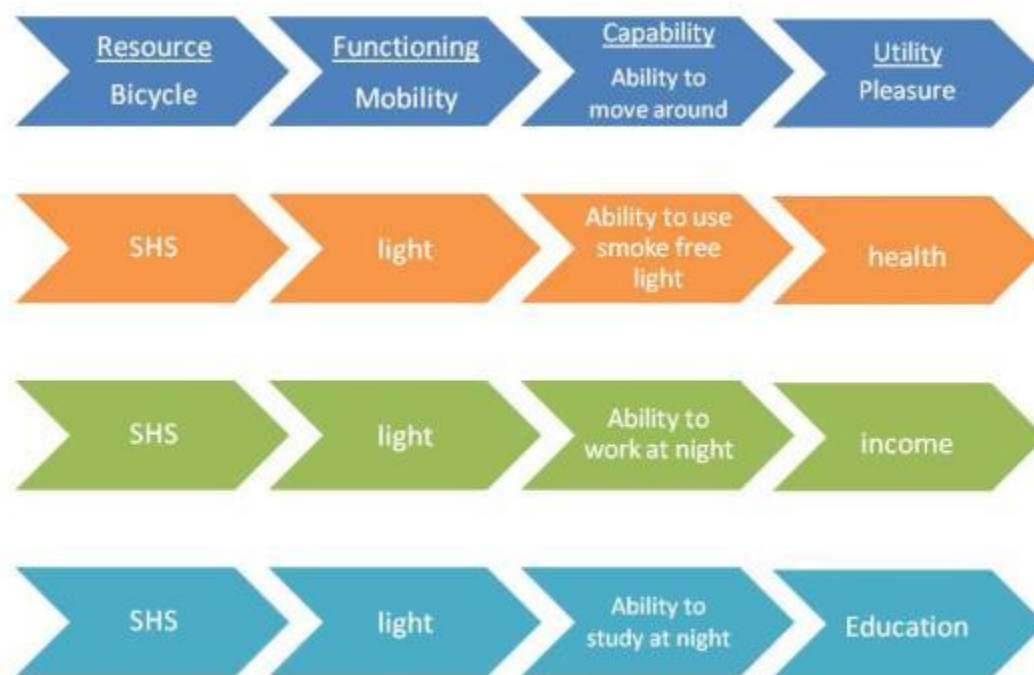


**Figure 5: Impacts from SHS experienced in Rema.**



The impacts can be interpreted according to Sen's and Nussbaum's definition of Human Development (compare 2.1 Defining Human Development). As the bike is the resource which can be used for different capabilities, for example moving around or transporting goods, SHS deliver functionings (light, charger, TV, ...), which increase people's choices or capabilities (for example the ability to work at night). As a result, several new utilities can be achieved. Those utilities can be identified as the impacts shown in Figure 5.

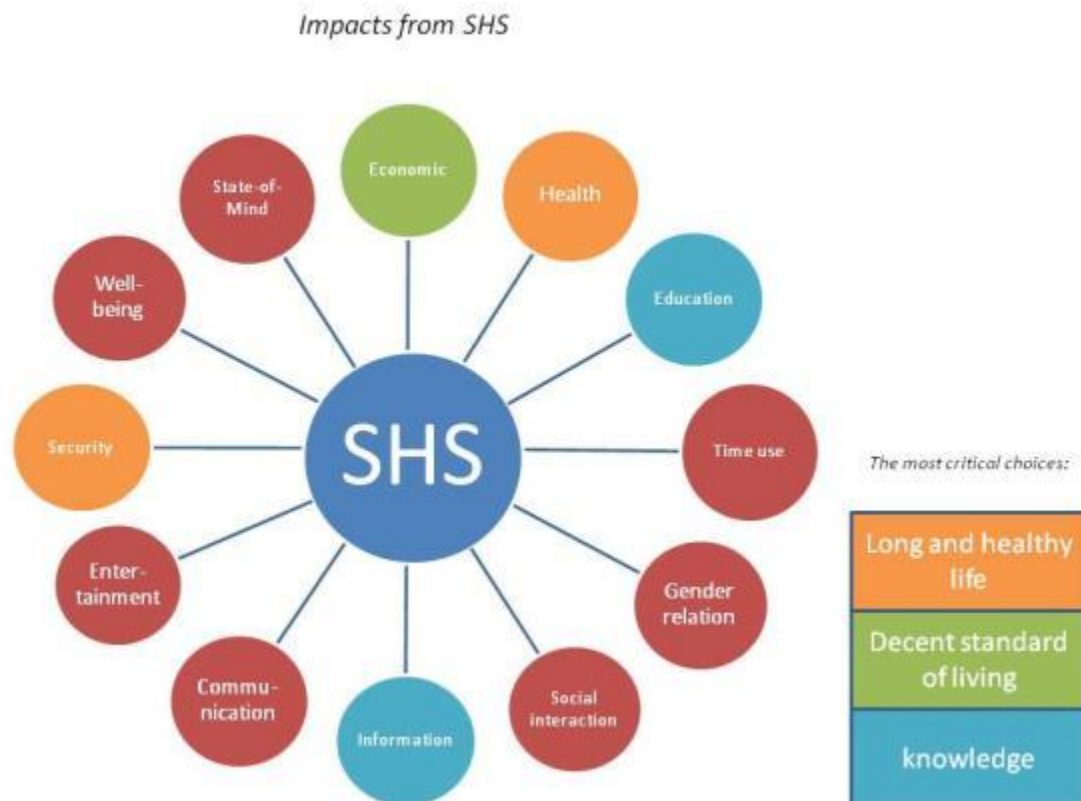
The next illustration visualizes the described train of thought by transferring the bicycle-example from figure 2 towards SHS. It demonstrates the Capability Approach on the impacts from SHS exemplarily for three capabilities (having access to smoke free light, working and studying at night).



**Figure 6: Basic utilities improved by SHS in Rema**

The three basic choices of *living a long and healthy life, being educated* and *having a decent standard of living* (compare 2.1 Defining Human Development) are fulfilled by the SHS impacts on economics (→ *decent standard of living*), health (→ *long and healthy life*) and the light time at night which can be used for education (→ *being educated*).

Figure 7 shows that, besides these basic choices, additional choices were made available to the SHS users (marked in red colour).



**Figure 7: Diagram of impacts from SHS in Rema indicating the achieved choices (Orange, green and blue mark critical choices achieved. Red marks choices beyond these basic needs).**

As it can be seen from Figure 7, not all of the observed impacts can be related towards the basic choices. Impacts like having more autonomy when deciding about one's time use, a shift in the gender relation, social interaction, communication, entertainment and especially well-being and a change in user's state of mind, exceed those basic choices. That means

that the use of SHS in unelectrified areas opens many new choices towards the end users, which go beyond the scope of improving the most basic needs in life.

As a conclusion it can be said that SHS for rural electrification fulfil Sen's (1999) definition of development by enlarging the variety of capabilities that user can choose (see 2.1 Defining Human Development).

Examples illustrating this conclusion can be given by the following two observations from the survey, which lead to improved freedom of choices:

As mentioned in 3.3.1.1 Economics, shop owners with SHS are independent from fuel cost calculations, when deciding whether to open their shop longer at night or not. The real advantage solar energy makes here, is not to increase their business times, but to make them free to choose every night, whether it is more important for them to earn money, or for example to spend time with their family.

The same is valid for SHS users having more time at their free disposal. Instead of being forced to spend the night hours in the dark or go to bed early to avoid additional costs for kerosene, they nowadays can do what they like (compare 3.3.1.3 Expanded light time).

Thus, besides all quantifiable improvements (e.g. economic and health impacts), the mentioned examples represent an increase in freedom, which Sen (1999) equates with development.

## **4.2. Discussion of Methods**

Many lessons have been learned as well as problems experienced with the methods used. These shall be discussed in this section. If possible, recommendations for further steps in impact evaluation are formulated.

### **4.2.1. Interviews**

Quantitative interview results should be independent from the interviewer. Whereas during qualitative research the interviewer is free to shape the conversation depending on the situation. Hence, the results will be different from interviewer to interviewer. For comparison of results, one interviewer who conducts all interviews during one survey period is advisable. This was not possible in the current survey and is also not possible during larger surveys. Hence it is important to brief all interviewers exactly and in the same way. In the current case, this was not done accurately, since the author was also new in the research field. This led to the following observations and recommendations:

The aim of the thesis was, among others, to detect impacts from SHS not only in the user's life environment, but also in their minds, which is a typical case for very open and qualitative questions, encouraging the respondent to talk freely. It was tried to get insights towards the question by asking about the respondents' attitude towards life, dreams and trust in achieving them, as well as whether they feel powerful to make changes in their life. Respondents rarely knew how to answer this question, either because they did not know what was meant or because they had no opinion about the topic of interest. When this happened, the survey team tended to give more closed questions, which would influence the respondents' answers. On the other hand, during field talks with solar technicians, interesting observations were reported. For example, technicians talked about SHS users cleaning and painting the walls of their rooms white after getting solar light, so that the light gets reflected and the room looks cleaner, since everything is more visible with brighter light. This and other stories from technicians showed, that innovations caused by

SHS were present in the villages, but often the tool how to address them during the interviews did not succeed in going further than querying rather rationale facts.

Another aspect leading to the described problem may be that users simply do not relate all the impacts towards the new obtained access towards solar energy. For example, a change in family sizes does not directly seem connected to electric light. Probably also end users do not relate both effects. Likewise it was just mentioned once during the group discussions, after the interviewer led the discussion towards this topic (compare 3.3.1.4 Health → Birth control). Resulting from this, besides interviews, also observation and quantitative data should be considered as further information sources.

#### **4.2.2. Group discussions**

Many valuable and new aspects were found out during the guided discussions. The attempt, to get the user's weight of the importance of different SHS impacts, however, resulted in both cases in the statement, that all impacts would be very important. Just the health impact is most important for women (see 7.2.1.27 Women group), and the impact on entertainment is not yet relevant in men's opinion, since there would presently be more important problems to deal with (see 7.2.1.28 Men group). Each group discussion took around 2h, from which most of the time users were adding points towards the findings and just some minutes at the end were spend on weighting the results. From this, Kitzinger's observation that *the final layout of the cards was less important than the discussion that it generates*, can be verified (1995, p. 3),

#### **4.2.3. Data**

Data from health and school offices were collected to get quantitative data proving qualitative statements about improvements in health or student performances. During data

analysis however, information about other possible influences on the data were lacking. Therefore, two steps are necessary for data collection:

1. Identification of all related influences on the desired data (for example other causes leading towards pneumonia diseases).
2. Making sure that these indirectly related data will be recorded additionally to the data which are directly related to SHS.

Regarding the face-to-face interviews, one observation from quantitative questions (e.g. “How much money did you spend on kerosene before?”, “How much more money do you save by using solar?”) was, that users were often unable to give numbers.

This would probably be the same if the reader should spontaneously provide information about the minutes she/he spends on answering mails each day, or how much money is spend for the weekly shopping, unless a record was kept. Therefore, for evaluating the impact of rural electrification programs, the observed group of beneficiaries should be asked to keep track of the data of interest. Those should be regularly collected. An exacter measurement would be provided if asked for which (amounts of) goods users spend money and to get the prices for these goods. For comparison, also data like the earnings of shops and bars could be recorded.

As a final recommendation for impact evaluation, information should be collected both among program participants and a comparison group without SHS. Evaluation should start even before the program start, in order to have baseline information. A combination of observation, quantitative questions and data collection together with qualitative interviews should be used as evaluation tools. While some impacts from SHS (e.g. an increase in family’s income) may be easily measureable, changes in the user’s mind will just be detected during open interviews. Also negative impacts should be addressed (for example an increase in workload instead of more freedoms, breaks or study time). Those have to be subtracted by detected improvements.

## 5. SUMMARY

The present work aimed to give answer to the questions, in which ways rural electrification by SHS impacts rural development. Following Sen's capability approach, development can be understood as the *freedom of choice*, with the people addressed being agents of their own life and thus choosing the choices they need.

The people surveyed in the current thesis are using SHS, which provide the *functionings*: light and phone charger, sometimes radio and or tape, TV or fridge.

During the mainly qualitative survey, the users reported the achieved *capabilities*: economical improvements, health, education, self-determined time use, changes in gender relations, social interaction, information, communication, entertainment, security, well-being and changes in their state-of-mind.

The capabilities were divided into *basic choices* (long and healthy life, decent living standard, knowledge) and choices *exceeding* those related to basic needs (time-use, gender relation, social interaction, communication, entertainment, well-being and state-of-mind).

The observed results represent an *increase in choices* available to the users, which Sen (1999) equates with development.

The motivation of the thesis was to provide ideas for evaluating the success of SHS programs not just by the number of traditional fuel sources substituted and also not from top-down perspective. This was achieved by taking Sen's approach as a basis and exploring end user views. The result can be used to develop evaluation questionnaires. For this, first recommendations have been made in the Discussion part of the thesis.

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## 7. APPENDIX

### 7.1. Methodology

#### 7.1.1. Questionnaire Development

*7.1.1.1. Literature Assumptions (World Bank, 2008; SEF Philippines, accessed 21.02.2012) and deductive questions*

##### 1. Economics

Assumption:

- Solar light lowers the cost of Energy to the user.

Question:

- How much money did you spend for lighting before and after solar?

##### 2. Health

Assumptions:

- Reduced indoor air pollution due to less fuel use for cooking, lighting or heating
- Brighter light source reducing eye problems
- Improved health knowledge through increased media access and use
- Improved health facilities

Question:

Are there changes in

- Health (frequency and type of diseases)
- Health knowledge
- Health facilities

If yes, please explain why.

##### 3. Time gain

Assumption:

Increased waking hours by use of solar light at night are used for

- watching TV (if available)
- socializing
- participating in community activities
- reading
- family business
- children:
  - do homework at night
  - help their parents at night(contradictory assumptions)
- women:
  - have a less stressful working day and more social interaction, since they can shift work towards the evening
  - have increased workload, due to extended working hours in the evenings(contradictory assumptions)
- Since people can interact even after sunset, community bonds may be strengthened.

Question:

- When did you use to go to bed before and since solar?
- If you go to bed later nowadays, how do you use the additional time?
- Did your daily workload change?

#### 4. *Education*

Assumption:

Electricity could improve rural education in the following ways:

- Improve school quality by allowing electric equipment.
- Attracting more and better skilled teachers into rural schools.
- Extending student's study times at home by providing electricity for light. They might achieve better grades and be sent to school for more years.

Question:

- Was there a change in the education level since solar?

If yes, what do you think may be the cause?

- Was there a change in school quality?
- Was there a change in the teaching staff of schools? (number of teachers/local teachers or teachers who came from the towns?/educational level)
- Did the student's grades change? Can you prove this with data?
- How many years did students join school before and now?  
How many students joined primary and secondary school before and since?

### 5. *Productivity*

Assumptions:

- Growing number of small scale businesses
- Higher net income of family enterprises due to extended working hours

Questions:

- How many small scale businesses were there before and now?
- Compare their opening times at night before and now.
- What was the HH income before and since use of solar?

### 6. *Connectivity*

Assumption:

- Cell phone charging becomes easier and cheaper

Question:

- How did you charge your phone before and after SHS? How much did/do you spend?

### 7. *Safety and Security*

Assumption:

- In areas without ambient light, walking outdoor at night may be less frightening and dangerous when using portable solar lights

Question:

- Do you walk outside at night?
- Which lighting source do you use?

- How do you feel when walking outside at night?

8. *Community*

Assumption:

- Since people can interact even after sunset, community bonds may be strengthened.

Question:

- Did the living together /amount of social interaction in the community change?

9. *Empowerment*

Assumption:

- SHS is an improvement in people's life which empowers them to make further changes to their circumstances. They may gain a sense of hope, security and control over their destiny.

Question:

- Do you have trust in your life and destiny?  
Do you feel that you have the power to make changes in your life?  
→ Compare before and since solar
- Did your attitude (towards life)/ feelings/thinking/behaviour change? Please explain how and why.
- Which dreams and plans did you have before? What about now?

### 7.1.1.2. Final interview questionnaire

This questionnaire served as a checklist during the interviews.

#### *Solar system*

- Since when do you have the solar system?
- What does it include? (how many lamps, radio,...)
- **What changed in your life by the solar system?**  
(encourage the respondent to give a detailed answer)
- Which energy source did you use before?
- Can you tell us the difference between solar energy and the energy source before solar?

#### *Economics*

- Can you compare the price of the solar system and your old energy source?
- How much do you pay for the solar system in a month?
- How much did you pay for the energy source before?
- Do you save money now? If yes, how much?

#### *Street light*

- How do you feel when you walk outside at night?  
(If no answer: How does the street light influence your life?)

#### *Children*

- How many children do you have?
- Are they students?

*Work and use of light*

- What is your work?
- What is your daily schedule? What do you do at night? When do you go to bed?  
→ask further questions depending on their answers (e.g. changes in income and opening times, if they do business..)  
→also ask woman and students
- What did you do in the evenings before solar? When did you go to bed?  
→women: Do you have more or less work now?  
→students: How was your performance over the last 5 years? Did it change? How was studying before and now?
- Did your social life change (like meeting friends, talking with family,..)?

*Radio*

- Do you listen to radio or tape by using solar?
- What is the advantage of the radio program?

*Cell phone:*

- How did you charge your cell phone before and since solar?
- Do you save money now? If yes, how much?

*Health*

- Did you have any health problems during using other energies?
- What about now?

*Future*



- What do you want in the future?  
→ For you, your family, for Rema?
- Are you satisfied in your life?  
→ why or why not?
- What means *Edeget*<sup>27</sup> or *Lemmat*<sup>28</sup> (Amharic for *improvement* and *development*) for you?

*Feeling*

- Do you have hope and trust in your life? Do you feel powerful to improve your life?
- Was it different before solar?

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<sup>27</sup> Amharic for *Improvement*

<sup>28</sup> Amharic for *Development*

### 7.1.2. Preliminary impact list from SHS

The list presents the findings during the interview period, after preliminary analysis. They were evaluated during the FGDs.

IMPACTS OF SHS
<b>Economics</b>
Less expenses for lighting
More income due to new/increased business times
<b>Education</b>
Improved child education due to studies at night
Adult education in the night class
Information by TV/tape/radio (?)
<b>Health</b>
Health improvements by smokeless light
<b>Quality of Light</b>
Safe light (no danger of fire accidents)
Bright light
Cleaner house due to smokeless light
Easy to use (just switch on/off)
<b>Social Life</b>
Spending more time with the family at night
Meeting friends in the evening
Stronger community bonds due to more social interaction
Time to follow personal interests (reading, praying, writing, etc)
<b>Entertainment</b>
Entertainment by TV/tape/radio
<b>New possibilities</b>
New opportunities in life which lead to start of new initiatives

## 7.2. Results

### 7.2.1. Interviews

Legend:

[...]: remarks for understanding; descriptions of the situation or of proper names

*Cursive*: proper name and descriptions of situations

**Highlighted**: main topics

**7.2.1.1. Mejet**

Archival No: R1

Site: Village Mejet (neighbor village of Rema), State: Amhara

Type: **Personal Interview**

Data collector + translator: Hamere Mekonnen (HM)

Typist: CB

Date: 26.10.2011

Start: 12:28

End: 13:17

Duration: 49m:32s

*Respondents:*

H=Husband

W=Wife

D= Neighbour's daughter

P=Priest (Guest)

S=former Soldier (Guest)

*Other people present:*

T=5 Technicians

*Situation:*

The husband has lived in the city before. His business is a mill, selling alcohol at home and renting rooms. He is handicapped on his legs. The families SHS includes 2 lights and a cell phone charger. There are 2 guests at their home, who are drinking alcohol. Two pictures at the house wall show the husband.

---

*Interview:*

HM: How long do you have the **solar light**?

H: Since 2 months. We were one of the first people in Mejet who received it.

HM: How do you like the lighting?

H: It's great.

HM: How many more people would be interested in solar light?

H: There are plenty.

T: Lots of people would like to have solar light, but they are frustrated because the batteries don't work well sometimes.

*P says, he is drinking because he "is also a Human being". When HM asks why they don't have to work at that time of the day, the guests say, they are drinking and not working, since they already worked that day.*

HM: How many **kids** do you have?

H: I have two grown sons and one little son.

HM: Has **solar light** changed your life?

H: Of course. A lot. I used to spend 2ETB/day for kerosene and I don't have to worry about that any more.

HM: What else would you like?

H: We are much better off with **water** than Rema. It's flowing everywhere.

P: Instead of wasting it, we should build irrigations and grow vegetables.

H: The water from the rainy season is also wasted. An irrigation dam should be built.

HM: Rema already has solar lighting. What would Mejet want?

H: We need a new **road**.

P: *Menschen für Menschen* built the **water** pump, but the water is flowing non stop. It's being wasted.

P: It would be nice if there would be street **light** and a light in each house. After all light is like heaven.

One worry that we have since our village is low land [low altitude] and dry we are having a hard time growing trees [eucalyptus] or wood. I want the government to know about that.

HM: What would you need the wood for?

P: For **cooking**.

HM: Instead of using coal or wood, would you rather use a stove?

[To W]: Would you like to cook in an environment without smoke?

H: The **light** is a relief because we don't have kerosene smoke any more.

W: I have **eye problems** from the smoke [kerosene and cooking wood]

P: Every woman in the village has similar eye problems.

HM: [To W] What about the women, do you want to get educated?

P: She is taking all the information to the government and will help us out.

*Long dialogue of P about the difficulties of growing trees, that could be used for burning and cooking, because it's too dry in Mejet.*

P: As for lighting, the rich are the only one who can afford it. And since as we all know it, God and the government do not discriminate between rich and poor and treat all equally. Government should find a solution and disseminate the solar products to those that can't afford it.

HM [To P]: Do you have a cell phone?

P: I don't have one, but the Husband has one. Besides, he was one of the first people to afford solar lighting, which means that he's rich. But me, since I don't have any money, I don't have a phone.

H: Actually people here may have money, but they rather keep it and save it rather than sharing it or helping even their own blood-brother when he is in need. Money is not a problem here, but **ignorance and lack of awareness** are the issues.

HM: So you're saying the people have money here?

H: Yes.

*P and H are discussing about the villager's lack of awareness and envy against each other (\*see remark).*

HM: Okay, so what can one do to make the villagers more aware?

H: For example a road is needed here. And when I suggested during a town-meeting with village administrators for a road to be built here, the villagers complained that I'm only suggesting it so that my business can flourish. They're not aware that they too can benefit from a new road.

HM [to P]: Since you're a priest, and you are in contact with a lot of people, why don't you take the task of raising awareness?

P: Yes, it's true, I can do that, but I insist that the government still needs to provide aid to those without money.

They can survive without solar light for now by just using the kerosene lamps, but what is most important and immediately needed in their community is either wood or replacement stoves.

HM: I am not promising anything. I can only convert the message.

HM [to W]: Why do you have tears in your eyes?

P: It's because of the smoke. Lot's of women here have the same problem.

*Many schoolchildren are watching us from the door.*

HM: What about the farmers without any **phone**, do they come here?

H: Yes, they come to use my phone or if they have phones they come to charge their phones.

HM: Do you charge them a fee?

H: No, I don't. Most people are related to me, so I don't feel like charging them.

P: Actually it's good that they come and see what he has and how he benefits from solar and then they want one for themselves too.

---

*Pictures:*



**Picture 19: The wife who has smoke caused eye problems. Here she prepares coffee with charcoal, which causes the smoke visible in the picture.**





**Picture 20: The husband with his son and the neighbours' daughter.**



**Picture 21: The two guests: The priest (left) and former soldier (right).**



**Picture 22: The Power box and lamp of the SHS. The family keeps it in a plastic bag to protect it from smoke and dust.**

*Remarks:*

From the police and from the technicians, we get to know that 4 people were killed in fightings about land in Mejet and Rema the last months.

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**7.2.1.2. *Electro shop owner***

Archival No: DM2

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Hamere Mekonnen (HM)

Typist: CB

Date: 27.10.2011

Start: 10:58

End: 11:25

Duration: 27m:58s

*Respondent:*

R = electric shop owner Andualem

*Other people present:*

Solar Technicians: Getaw, Getaw, Hiruth, Bizunesh

*Situation:*

The shop sells tapes and tape recorders. There is a SHS including 1 light in the store and 3 chargers. Moreover, Andualem still owns another house with a SHS.

During the interview, people are coming in and watch and listen us the interview.

---

*Interview:*

HM: Can you tell us a little bit about yourself?

R: I'm 33 years old.

Before **solar** I used to spend so much money on kerosene or batteries: For batteries I spend 16ETB/day. For kerosene 2-3ETB/day.

HM: How late is the store open?

- R: If I have a lot of work, I stay until 8 or 9 pm. It's been 4 years for me since I got solar. Since then, business improved. Before, I only repaired tapes and sold tape players. Now I have 3 power boxes to charge cell phones.
- HM: How did you start your business?
- R: I always had the desire to work on electronics. Before I used to be a mechanic. I was born in Addis and came to Rema 11 years ago.
- HM: Why did you come here?
- R: I came to visit someone in Rema and I stayed. Then I started repairing people's electronics [radio+tape recorder] and opened up a shop.
- HM: When did people start having cell phones here?
- R: About two years ago. So I started repairing cell phones as well. During the summer season [=rainy season from June-Sept] I go to Addis to get more training.
- HM: What of kind of repair do you do on cell phones?
- R: I change the IC [chips] or change batteries.
- HM: Do you have a stock of supply and parts for cell phones here?
- R: Yes I do, and most people have the same brand of cell phones [Nokia]. To charge mobiles, I charge them 3 ETB/cell phone.
- HM: How many cell phones do you charge per day?
- R: About 20.
- HM: Do you have CDs?
- R: No, no one knows about CDs here.
- HM: Do you sell or repair TVs?
- R: No. I know how to repair them, but no one has some.
- HM: Are you married?
- R: Yes I am.
- HM: Does she normally cook during the day or at night?
- R: Both, day and night.
- HM: What is your definition of life satisfaction?
- R: At my level of living condition, I can't say that I have many problems. I am healthy. I do relatively well. So I can say that life is good.

- HM: Have you reached your life goals?
- R: I can not say I reached my goals. There are many more things that I want. And if one works hard, he should be able to accomplish his goals.
- HM: So you mean you work that hard right now?
- R: No no, that was not what I meant. I work hard now, but I expect more progress from day to day.
- HM: What specific things do you want?
- R: I don't know, I can't give you details right now
- HM: Who's generator were you fixing when we came?
- R: The neighbour's fridge is powered by a generator.
- HM: How comes they are not using solar to power their refrigerator?
- R: They wanted to, but there wasn't any available when they asked. So they decided to get a generator.

*A explains: The generators up front cost is a lot cheaper than the Solar system. However, the daily cost of fuel makes power derived from generators a lot more expensive. Currently, diesel fuel to power generators cost about 30ETB per litre.*

- R: Even I was interested in a solar powered AC charge box, but it was not available from the SEF. I have lots of tools requiring AC power and also computers, but can not use them because power is not available.
- HM: What was the response of SEF?
- R: They don't have any products available right now. But will check on it and let me now when it's available.
- HM: So that [if it's available] would make an impact on your work?
- R: Yes, that would make a huge impact.
- HM: So you can repair computers too. And where did you learn it?
- R: Yes, I learned it in Addis at *Satcom school* over the summer.
- HM: Do you worry that you may forget what you learned since you don't use it right now?
- R: I do worry, but I try not to forget.

HM: Okay...so when you repair cell phones, do you need the soldering tools [AC powered]?

R: Yes I would need the soldering tools. But since I don't have them, I try to only do easy repairs not requiring these tools.

HM: Up to how much are you willing to spend to get the AC power box?

R: Whatever it costs. I am willing to sell my two generators to finance it. With 30ETB per litre for diesel fuel [for the generators] I will need to spend about 90ETB [for 3 litre] to complete a repair job. And that's not profitable. So, I am turning down such jobs [and just do the easy jobs where charcoal soldering heater is sufficient].

*A is showing us the tools. The cost of the soldering tool is 1500ETB [87USD]. He explains how they work.*

HM: In your opinion, what would this community here need?

R: A big change that I saw was that people that never experienced entertainment with **televisions** before, are now enjoying it at the bars. Even my two kids are excited to watch TV. All the community people would love to have their own TV sets in their houses.

HM: Do they like TV because of the entertainment factor, or do they listen to the news?

R: Purely the **entertainment**, because they have radios to listen to the news.

HM: What would you want your **kids** to have, that you don't have?

R: More education, better life.

HM: What about your **wife**? Do you want her to get education?

R: Yes. She doesn't have much education. And I would like her to continue.

HM: Do you teach her how to repair electronics?

R: Yes, I showed her the easy things, because she has to keep the shop whenever I'm not around.

HM: I'm not supposed to say this, but in case something happens to you, have you trained someone to replace you?

R: Yes, I hope that my kids will take over but I also hope that my wife can handle it. I can't give her full training right now, because she is too busy with the kids.

HM: Do you know about the adult school ?

R: Yes I know about it, but it is inconsistent. It's not well organised.

HM: Alright, thank you so much and see you around.

---

*Pictures:*



**Picture 23: Anduaem in his shop.**





Picture 24: Charcoal soldering heating



**Picture 25: Generator run soldering tool**

*Remarks:*

Maybe he was shy talking bout very personal issues since villagers came in from time to time.

**7.2.1.3. Old widow without SHS**

Archival No: R3

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Hamere Mekonnen (HM)

Typist: CB

Date: 27.10.2011

Start: 11:50

End: 12:00

Duration: 10m:11s

*Respondent:*

R: Ayelech

*Other people present:*

T: Technicians (Getauw, Getauw)

*Situation:*

Interview with an old widow [around 60 years], who's system was uninstalled because she couldn't afford to pay the missing 230 ETB [13 USD] to replace the old battery. She has 5 kids and none of them help her out. They are out of Rema and her husband has passed away. She doesn't own land. She had tears in her eyes [sadness or eye problems]. She is very thin and looks hope- and helpless.

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*Interview:*

*Arrival, introduction to us.*

T: How is your solar light?

- R: I don't have any. I'm poor, I don't have anything. My own income is this pot.  
[showing a pot, see picture]
- HM: I don't understand..
- T: She brews *Tella* [traditional beer] and sells it.
- T: Since you cannot afford to pay for it, does it mean you have to live without light?
- R: What else could I do? I don't have a choice.
- T: So now what would you like to say to the organisation?
- R: What can I say? Thank you for giving me and thank you for taking it back. I had and I lost.
- HM: Do you do any work at night, concerning *Tella* brewing?
- R: No, but I need **lights** to run chores and do whatever I have to do until I go to bed.  
How can I live without light?  
Actually at first they told me that I had to pay 100ETB, but now they increased it and they are saying that I have to pay 200ETB.  
And I was really expecting that my daughter would help me out to pay off the money. But she says she doesn't have any.
- HM: Is your daughter a student?
- R: She is a government employee and lives in the next town.
- HM: How many kids do you have?
- R: You might as well call me *Mehan* [word for a person without children]. I have 5 kids. And none of them helps me out. They don't check on me, or ask if I have this or that [she often repeated this during the talk]. I am really hoping that my children would give me money, but she says she doesn't have it, she is married and has kids and lives in a town called *Merra*.
- HM: What exactly does she do? Is she a teacher? Is she a permanent employee?
- R: They call them *DA* [agricultural district assistant: Person from the government who assists farmers].
- HM: You should be proud that you were able to educate her, because she is independent today. What about the other kids?
- R: No other kids [she doesn't know what they are doing now].

- HM: What happened to your husband? When did he die?
- R: It's been a while since he died.
- HM: Did he have a farm? What happened to the farm?
- R: Yes, we had a farm. But they took it away [T: probably it was illegally used land, which the government took back]. The judges took it.  
It's been six years since I don't have a farm [probably husband died 6years ago].  
My only source of income is this pot here.
- HM: How is the business? Do you sell a lot?
- R: No, maybe I sell one [cup/pot?] per week.
- T: Government employees will be paid on Saturday. How comes that she doesn't give you 200ETB? It's really not that much. Her husband has money, she has money, how comes she doesn't give you some?
- R: Really no one helps me out. Didn't I already tell you? I spend 12ETB/week to buy a cup of coffee beans. And also 15 ETB/week for wood. And I don't have any left over. What else can I do? It's just too much.
- T: Well we can pass the message to the organisation so that they can help you out.
- R: Even last night I didn't have 2ETB to buy kerosene for the gas lamp. This year everything is expensive. [food prices have increased]
- HM: If that's the case, how can you afford to eat then?
- R: I don't eat much, I'm alone. 5 cups [of Teff for Injera] will last for 8 days.  
All my income goes to coffee, wood and the 5 cups [of Teff]. I eat when I can and don't eat when I don't have something.
- HM: If you have all these problems and can't even eat, why would you care about light?  
Is light better than food?
- R (giggles): Yea, of course it's better than food.
- G: That means you had greatly benefited from solar light.
- R: Of course, I didn't deny that. It's just that I don't have any.  
I swear I'm telling the truth. I don't like lying.  
It's been 7 months since the loss of power [battery taken away from SEF].  
[Sighs]
- T: Let's go.

*Pictures:*



**Picture 26: Ayelech**



**Picture 27: The battery of the SHS was removed after Ayelech couldn't afford to pay the new battery and the pot for T'ella brewing.**

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#### 7.2.1.4. *Teachers*

Archival No: R4

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Interviewer: HM, CB

Translator: (HM)

Typist: CB

Date: 28.10.2011

Start: 18:39

End: 19:17

Duration: 38m:47s

*Respondents:*

R1=Ayele Mengesha

R2=Beyene Yemane

*Other people present:*

T: Technicians (Getauw, Bizuneh, Girma)

*Situation:*

By chance we met a teacher (Beyene Yemane) when we went to the primary school in Rema. He asked me what I was doing in Rema. I told him I am studying RE with a focus on rural village electrification and am doing my research in Rema. He invited us to see the classrooms, which use solar light. Together with Ayele (a younger teacher around 25-30 years old) and Beyene (who was older and the father of Hiruth a SEF helper in Rema) we went to the classroom, which was empty except two tables, a blackboard and a lot of cartoons with school laptops for children. There was no SHS in the room, but solar panels installed on the roof in order to charge the laptops, even though they didn't work and hence the solar panels weren't used. The teacher explained about the laptops and we took notes



until the talk developed into a recorded interview. Since both were speaking English, CB was also able to ask questions and HM just had to translate some few Amharic sentences.

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*Explanations:*

4 years ago, the government ran a ‘General Capacity Building Program’: By the technical help of SEF they installed solar modules for electricity generation on the classroom roofs (other classrooms also have solar panels but to generate electricity). A NGO donated laptops for the school children, which should have been charged with the solar electricity. Since the school had a shortage of school books, the idea was to replace the books by laptops which both serve as a library and exercise book and to improve the information source by this. Still, nowadays the laptops are stored in cartoons and not in use. From the statements of the teachers it was unclear whether they never have been used at all, or whether they were in use but stopped working since the children did not recharge them properly. Now no one knows how to repair or handle them and they don’t get information from the donor organisation how to do so. →both laptops and solar modules of this classroom are useless.

Then our topic switched to solar lighting which is used in the other classrooms. Ayele talked about the **benefits from solar lighting**:

- Students and teachers can study at night.

During the times of kerosene lamps, the lamp once filled with fuel extended the time with light one hour after sunset [around 7:30pm; burning time=1h]. Then either additional fuel would have to be used to fill the lamp again (→cost), or the people would have to go to bed or at least were unable to study longer. Ayele stated that he used to go to bed at 8pm during kerosene times and now during 12pm with solar light (Hamere noted that then he deep charges the battery for 1h which just has a capacity for 4h light).

→student’s performance increases

- Ability to work at night.

Ayele for example sais he works at night selling tea and has an additional income of 200ETB/month [ → ~7ETB/day, that makes ca. 3 teas sold per day].

- Heath problems (eye and lung) from inhaling kerosene exhaust gases are avoided.
- Evening classes were established to teach adults English and to read and write Amharic

Last year [goes up to Sept] there were up to 50 students per night.

About SHS:

- One problem of the SHS is just that they can not be used to generate mechanical energy.
  - TVs for entertainment. In Rema before SHS were just around 4-5TVs. Now there are more [numbers from administrator: 6TVs in Rema: 1solar/5generator].

Other statements:

- R1: Poor and rich people use light equally.
- R1: Light is one of the basic needs of life.
- R1: The aim in this world is to change life [in order to escape poverty]. But you can't change your life without light.

*Interview:*

CB: What do you mean by “you can not change life without light”?

R1: Light is what? It's the basic need

HM: What do you consider basic needs?

R1: For example **health**: When you don't have to use kerosene any more, health problems are solved.

And also SHS distributes televisions for families and others.

HM: How many **TVs** are here in Rema?

- R1: Before there were 4 or 5 TVs. But when the solar came, the number of TVs increased. [there's 1 solar TV in Rema] These TVs work by solar energy by absorbing the sun transfer.
- HM: Why do you like watching TV? Do you learn from watching TV or do you just like to be entertained?

*R1 seem not to understand the question, R2 goes on talking:*

- R2: We use **night teaching**. Before solar, there was no night teaching.
- CB: How many students come there?
- R2: Last year [up to Sept 2011] there were up to 50 students per night, this year I didn't count yet.
- CB: They are all adults, right?
- R2: Yes. They have to contribute a small amount of money for the chalk.
- CB: Are they women or men?
- R1: Last year there were more men than women. This year I didn't count yet.
- CB: Is it because **women** are afraid of going out at night or because men are more important to be educated? What is the reason that there are more men than women?
- R1: There is a big problem in this area. I don't know how this problem will be solved.
- HM: What is the problem?
- R1: The problem is: Women are shy in this area. And also the society has no idea for education. The society has a backward idea for women. Still this problem wasn't solved. The government tried to solve it but didn't get a final decision.
- When you look to the evening classes you see the same: There is a higher percentage of men attaining it. The society gives priority to men. Also early marriage is a problem. There must be a solution from government. Teachers try to address these problems, others as well, but up to now there is no solution.
- R2: During Haile Selassie's government women were very afraid to claim their rights and aims. That was a big problem. Now after 20 years some women start to ask their needs and right to learn, to work like a man. Before that they were not allowed to ask any right. So there was a social formation.

R1: By the way, without women there is no change in this world. The women have political, economical and social ability. But in this area there is no *preference* on women. The society has a backward view on women. Still now.

HM (to R1): Do you have any sisters?

R1: I don't have any sisters.

HM (to R2): I know you have a daughter.

R2: Yes...

HM (to CB): He is *Hiruth*'s [women who works as a technician for SEF] dad.

R2: I have two daughters and one son.

R1: How to avoid this problem we struggle day to day but we didn't achieve a great change.

HM: There is some change, but it's not great, it's not good enough, that's what you're saying, right?

There is some change since Haile Selassie, is that right?

R2: Yea. During Haile Selassie's and Derk's time, there was a bad situation.

R1: When you contrast early times and now, there is a little change.

HM: Very little..

R1: Yea. In early times, women hadn't any time to work, to participate and others. But now, women have the right to work, to participate equally, and others.

HM: Okay..

R1: But this area is back totally, it is back of the world, okay? Women participate less economically, socially and politically. Simply they are married, they hold a house and follow their next life. This is the purpose.

CB: Why would it be important that they are educated?

R1: ... Well äh...I don't know... Ähh

CB: I mean they just have the family right? They just care for the family. So why do they need education?

R1: Äh, the family has one attitude: What is the purpose that women learn? There is no change. This idea is created in the society. There is no change.

- HM: What she means is I think: If she ends up taking care of the family, why do you want them to get educated? Education would not make that much of a difference anyways. Do you understand?
- R1: Okay...If females are educated or not educated in this society, they just hold the household. In this area there is a religious believing. If females learn or not, there is no change. This assumption is created in the society. There is a big problem in general in this area.
- CB: Imagine all women in this area would be educated, how would it look like? How would it be different from now?
- R1: If there would be educated women in this area, they wouldn't live here. So other people in this area don't see them.
- HM: They don't have examples.
- R1: Yes. And also in this society there are different tasks like looking for the children for example, fetching water, collecting wood. These activities are done by women. So doing these activities, women stay in the house and don't get education. Just the men can attend education.
- CB: So you want men to look for the children, fetch water and collect wood? That's what men should do from now on, and women should get educated? Or how does it look like, the future that you want?
- R1: These activities have side effects on women. Just everything is carried by women.
- HM: You kept saying that women should be educated. If all women get educated, they will not stay in Rema, right? They might go to Addis. So how will you find a woman to marry and do all these tasks? Are you not worried about that?
- R1: Some women fight this problem and attend education and achieve their visions; their academic purpose. Like for example becoming a doctor or a teacher. But they don't live here, they left.
- CB: If women are going to be educated, will men stay the same, or will the role of men change as well?
- R1: By the way, women and men are equal according to our country constitution. But the role of men in this area is greater. The society's awareness is less for females.

This problem comes from the society's believing or awareness. That's the difference between the role of men and women in this area.

CB: So do you think it's important to change the role of women or the role of men too?

R1: To change this problem, the Woreda female's office tries to do effect work, like giving education and rights to women, as well as other work. And also the NGOs like *Menschen für Menschen* and *Nurture* develop female education. So the Woreda and NGOs try to address this problem.

HM: What is your future plan?

R1: I try to distribute equal education for men and women. Also I try to get a diploma. But I want to stay in Rema.

A big problem is the student extension by teacher. There is no peace relation between teachers and students. Every morning the teachers wake up early and collect the students from their home to come to school. But when you compare to other areas like Addis, the students are voluntary to learn. This is a big problem.

R2: Because the students are otherwise probably working in the farm..

R1: Female children are asked by their parents to fetch water, look for the babies, gather wood. Boys are in the farming systems and do productive work.

HM: Is your father a farmer?

R1: No, my father is a policeman.

HM: So you didn't have problems going to school?

R1: No, but I have many friends who had problems attending education. One day they might come to school, the other day not. That's the problem, still existing today.

HM: Do you think it's better or not after solar?

R1: When you compare in contrast, after solar there is a high number of students who increased their study habits and use the light effectively. But before the students were not voluntary to study because maybe their family economic situation did not allow them to buy kerosene for study purpose. But since SEF came, this problem is solved. Before, the students were below 1000 up to around 1000. Now there are from 1000 to 1300. There is night education as well. Some children attend this, other attend regular class. At the regional exam, there were more students passing

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grade 9 after solar came. This year, 80/90 passed, while in 1996 E.C. [2004 G.C.], around 8/90 students only passed.

HM: Did solar energy make an impact on your **health**?

R1: Solar energy has no side effects on our health. It is healthy for our eyes, other than kerosene. Also kerosene has side effect on the lungs, solar not.

CB: Are the students who study at night tired?

R1: The students are not very tired. They go to school 4 hours: From 8am to 12:30. Afterwards they help their family and return back to their home and study. Up to 8, 9 or 10pm. We guide the students to avoid them becoming tired.

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*Pictures:*



**Picture 28: The Higher Primary School in Rema was built by Menschen für Menschen in 2008 G.C.**



Picture 29: Plates installed from SEF on the school compound teaching the children about solar energy.





**Picture 30: We are surrounded by school children leaving the school after the classes end that day.**

*Interpretation:*

I have the feeling that Ayele tried to exaggerate benefits from light (like telling us higher numbers for longer study hours or increased income. Also his explanations about the importance for women education seemed to be a bit learned by heart and just said over and over because we stuck to this topic and he thought we as two educated women will be pleased to hear.

Ayele since he is younger, just knows the current state of women rights, which in his opinion is not good enough. Beyene saw a longer development and can compare worse times with nowadays.

**7.2.1.5. Evening class**

Archival No: R5

Site: Village: Rema, State: Amhara

Type: **Group Interview**

Interviewer: HM

Translator: (HM)

Typist: CB

Date: 28.10.2011

Start: 19:14

End: 19:21

Duration: 7m:36s

*Respondents:*

R1: Teacher

R2: Male adult students

R3: Female adult student

R4: Boy (student)

R6: Male adult student

*Other people present:*

Technicians (Getauw, Getauw, Bizuneh, Girma), Teachers (Ayele, Beyene)

*Situation:*

After the teachers interview, we visited the evening class at the school in Rema. This evening were 2 English classes, one with 6 (2 or 3 women) and one with 15 students (1 woman, one 14 year old boy). We entered in latter and watched the lesson for 15 minutes. They learned how to greet in English. The teacher first said the sentence and let the students repeat. Then he called one or two students in the front and let them say the sentences in a small role play. Then we disrupted shortly in order to ask whether we could ask them some questions.

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*Interview:*

HM: When did you start running this evening class?

R2: Two years ago.

HM: Why don't you go to school DURING the day? Why is it a night school?

R2: During the day all of us have work, so there is no time to attend school. So we have to complete the work and come afterwards.

HM: I only see one girl in the class. Why is that?

R1: This night school is for people who voluntarily want to learn. Women attendance is by will and has always been low.

HM: So are you saying that the females have low interest in education?

*Agreement.*

HM: You are dedicating your time after works. Why do you put all this effort? What is your goal in life?

*No answer. Teacher explains question again so that students understand it better.*

R2: Yes, there are difficulties attending school after work. There are times when it was not convenient so we stopped going to school. But we kept on coming back because we came to value the importance of education and the need to improve ourselves.

R2: Our ancestors did not give value to education. Even though life is getting in the way today [family and work], thanks to the night school, we are learning basic things like reading and signing our names. And our future goal is to continue learning.

HM (to the boy): What about you, why don't you go to school during the day?

R4: I would go...

R1: He has difficulties with his parents, that wouldn't allow him going to school during the day.

HM: Okay, what about an answer from a woman?

R3: We missed out on school, because our parents didn't allow it. But now even though attending night school is hard with work during the day, when they told us about the

night school 2 years ago, we were so happy. And in the future I want to keep on attending and learn more.

HM: So you never had the support of your parents regarding education. How do you plan to break the cycle for your kids?

R2: As for me, I worked all my life. I will make sure that my kids don't do any work, but concentrate on school.

R2: Being a farmer in this area is a lot of hard work. And I can see that education is the only rescue from this life.

R5: Even though our time has passed, we're still struggling to be educated, which means that we know about education. So our responsibility is to make sure that our kids get educated.

HM: I want to hear your opinions about women education. Do women deserve to go to school?

R2: When it comes to education, it's equally needed for all people, both men and women. Just like light is needed to get rid of darkness.

HM (to R2): You told me, you have children in school. Are they all boys or girls?

R5: I have two girls and one boy in school. Education is important for all kids, regardless of their gender.

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*Pictures:*



**Picture 31: Using solar light during the night classes.**

**7.2.1.6. Semaine**

Archival No: R6

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Interviewer: HM

Translator: HM

Typist: CB

Date: 28.10.2011

Start: 19:56

End: 20:37

Duration: 31m:04s

*Respondent:*

R=Semaine

*Other people present:*

Solar Technicians (Getauw, Getauw, Bizuneh, Girma)

1 person in the backroom (didn't show up)

*Situation:*

Meseret, the SEF cook told us about her friend Semaine, who knits and sells handcrafts. Since having solar, she produces more, since she also uses the evening to work. We decided to visit her and called her whether Friday is fine. When arriving in the evening, Semaine complained to have waited for us the whole day. Still she was friendly to answer our questions. She is medium age and blind on her right eye. She was never married. Her appearance is rather slim and as we got to know, she is not healthy. In her room we saw many self made knitted traditional things. She is protestant, while most villagers are orthodox Christians or Muslims.

Semaine's birthplace is *Merhabete* town, where her parents still live. Her mother's family lives in Rema.

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*Interview:*

HM: As Meseret told you, we're here to do some study and we would like to know what effect solar light brought to your life.

R: I made all these **handcrafts** that you can see here and I was able to make them thanks to solar light. I have **lung** problems. Before the arrival of solar light, I couldn't do any **work at night**. Whatever I was doing, I had to finish it during daylight. When I was using kerosene lamps, every morning I used to spit out black smoke and I used to get sick a lot. But once the solar light came I started feeling a lot better and I was able to make all these handcrafts you see. Whenever solar light is mentioned, I get so excited that I can feel my heartbeats. The benefits are not only the handcrafts that I made, but before solar energy we used to have a huge shortage of **water**. The water pump used to break too often. But after it was replaced with the solar powered water pump, I can say that we don't have any problems...well, until recently [generator driven upper pump broke]. I can say so much about the benefits of solar, for instance because the problem with water shortage has been solved. Since then I had been able to make dry *Injera* [main dish in Ethiopia] for sale.

HM: What do you mean by *dry Injera*?

R: I sell the *Injera* without the *Wot* [sauce to be eaten with *Injera*].

HM: Can you please elaborate on the difference of your economic level before and after solar?

R: Before solar, my **income** level was low. But since I started selling *Injera*, I can say that my income has increased. And it's good. My **health** has also improved. If the **water** shortage problem hasn't been solved, I would have left this village for another, because I could not survive. I had almost left, but then the solar pump was fixed, so I stayed.

HM: Where could you have gone?

R: My mum is from *Merhabete* [town], where there is water, so I could have joined her. In this village [Rema] you need to have either a donkey or kids to help you

fetch water. A person without strength can't make it here without the help of donkey or some kind of other help. Once the solar power replaced the first generator, to pump up the water, life has been a lot better, because the solar pump doesn't break as often. Because of the **light** I've been able to do more work at night. My light did never break. I've had the same light since the beginning and I'm using it without any difficulties.

HM: Give me a list of the new type of **works** you have been doing since solar light!

R: The handcraft, the *Injera*..

HM: Do you sell your handcrafts?

R: I used to, but not any more. Instead I make it for my use. So that I can save money. Also I prepare *Shiro*, *Berber* [sauce and pepper powder] and other condiments that I sell. Because I do all these more lucrative businesses, I stopped making handcrafts for sell.

HM: Do you make the handcraft for fun then? Is it your hobby?

R: Not for fun, but for me to use them. So that I don't need to buy them. But also it makes me happy. Especially when it's displayed and shown.

HM: How did you learn it?

R: It's so easy! Everyone can learn how to make it. Most of us in the village know how to make it. I always knew how to make it, but my skills have improved since solar. Now I experiment more with coloured strings and new designs.

Before I used to have a little kiosk where I sold many things. But I closed that, because it demanded a lot efforts and time.

HM: What's your future plan?

R: From here on I only have one wish and one request from you guys [to SEF]: It's difficult to use wood for **cooking**. So I wish for a solar powered cooking stove. The smoke from the wood has been affecting my eyes since I make lots of *Injera*. I make about 80 *Injeras* per day. If I could get the stove my work will have a better result.

HM: So you plan to be richer.

R: I don't know about being rich, but my part is to work.



HM: So you told us about your health and your future plans. But tell us more about your feelings and thoughts.

R: Well, I have been to **school**...until grade 10. I had to quit school because of my eyes. But after solar, I have been able to use my brain more. My brain that had forgotten about school work is now creative... I like to write poems....so at night, I take time to write lots of poems as a way to express my feelings. I even wrote a poem about the impact of solar. Not only that I write poems about the impact of solar but also a lot more poems...spiritual poems.

HM: Do you read or share your poems with others?

R: Yes...I don't know if Samson still has it but I had already given him the poem on solar a while ago. And I had given two poems that I wrote to Karl's wife [*Menschen für Menschen* founder's wife]. And the poems on spiritual issues, I had kept for myself. I haven't shared them with anyone.

*Semaine asks me to her a question in English..*

CB: Do you have children?

R: I have a niece. My brother's child

*R recites parts of her SHS poem, dealing with the water problem (long waiting line at the well) caused by the broken water pump and solved health problems.*

R: When I used the kerosene lamp, I used to spend about 50ETB/month for kerosene but now I only pay 14ETB/month [fee for the solar system's service and maintenance, saving for the new battery]. My expense is now lower and I don't have many problems in my life.

CB: What is most important in your life?

R: Water is really important. Currently, there is a lack of water. One of the water pumps isn't working. So there is a long line at the water pump. Besides, because of my health, I can't even go fetch water. I'm getting help from a friend who fetches water for me. If the water problem isn't solved, there is no way I will be able to

stay in this village. I will have to move away. It would have been nice if I stayed in Rema because business is better here, but I can't do much without water.

If things go well for me, my dream is to work harder and be able to help my friends who are less fortunate.

I will give it one or two months from now...that's it. I am losing hope now. It's hard to live here without easy access to water.

CB: What are your wishes once your basic needs are met?

R: I was fortunate with this solar power. There are a lot of others who use up the batteries and weren't able to pay the required fee to get their batteries charged. So I wish for a system with enough power to play our **tapes** or even to power **televisions**. I am religious and I am a protestant. I like to listen to gospel music and would like to be able to worship my God with songs whenever I am not at church.

HM: So you don't listen to gospel now?

R: I do listen to gospel from the radio. And since I don't want to deplete my solar battery, I only play my gospel tapes once every two weeks.

HM: Any more wishes?

R: If all these improve, Rema is really convenient for business. If you work hard, you can make it. But other villages and towns are not so convenient. I have friends that live in places where there is abundant light and water but they are having a harder life [harder to make money with business→have less money→see administrator interview]. I have a spare land. And I wish to build a house on this land and move some of my friends here so they can start a small business and improve their life. For example, I have this very good friend that I've been trying to convince to move here. She is married but has not been successful with work. She lives in *Merhabete*. I really want her to come and try out Rema for at least a little while...maybe for 3 months. But if the water problem isn't solved, I don't think I will succeed in convincing her. She wouldn't stay without water. If water and light availability is increased, I would like, with Gods help, to create a venue where I can help others.

HM: What do you mean when you said '*Rema* is good business'?

R: In Rema, whatever your business line, things sell. But in *Merhabete*, it's harder to sell. It's easier to sell '*Tella*', '*Areke*' [self brewed alcohols] or bread in Rema. The farmers here are good consumers which is great for business.

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*Evaluation:*

In Semaines interview visible:

Differentiation b/n "Basic needs" and "Advanced needs".

Basic needs:

- Water
- Light (→work at night)

Advanced needs:

- Helping others
- Using brain, expressing herself
- Friends
- Hobby (activity which she enjoys)
- Praying

**7.2.1.7. Administrator**

Archival No: R7

Site: Village: Rema, State: Amhara

Type: **Personal Interview and Information Material**

Interviewer: HM

Translator: HM

Typist: CB

Date: 31.10.2011

Start: 10:55

End: 11:26

Duration: 31m:13s

*Interviewee:*

R=Rema's administrator

*Other people present:*

Girma

*Situation:*

We visited the village administrator of Rema in his office. He was able to speak English a little bit, so some questions were asked by me, but Hamere still translated them to make sure they were understood. The respondent was in his 30ies (guess).

He also gave us the Progress Growth Plan for Rema from the Urban planning institute, Amhara, for further information about Rema.

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*Interview:*

HM: What are the impacts on **health** from solar energy?

- R: The biggest impact on health is the reduction of lung and eye problems that used to be caused by the kerosene lamps. There used to be a lot more fire accidents caused by spilling kerosene. Especially while students are studying they would knock off the lamp and fire would start.
- HM: How often did that incident happen?
- R: At least two or three [large accidents] per year. For example there was a girl that got badly burnt. But thanks to a lot of medical attention she is a lot better now and she is studying engineering at the university.
- Another improvement in health caused by solar is that women can deliver at the health centre in Rema even at night.
- This village did experience a shortage of water and because of that they used to dig wells to extract water but so many water borne diseases prevailed. But after the installation of the solar water pump and the solar powered water treatment system, these issues have declined. You can go to the health centre and collect data on the diseases.
- CB: Did the health behaviour and fertility rate change since solar due to a change in health knowledge?
- R: Because of solar an adult school was opened up. Adult education is different from child education. Beside reading and writing, they are also taught about family planning and sexual transmitted diseases.
- HM: How is the HIV awareness here?
- R: There are lots of people that are infected. Even though official documents show that the rate has decreased, I think the opposite is true.
- HM: Are there people creating awareness about HIV?
- R: Yes there are people that come from the Woreda and the health ministry [government sponsored] and HIV positive people. Those health educators try to create awareness by playing dramas or by going from village to village and holding education meetings. [e.g. see Interview *R26 Youth group leader*]
- HM: Was there a change in the number of small scale **businesses** in the village since solar, and how about the opening times?

R: Before solar, people used to spend more money on kerosene and dry cell batteries. That has declined. In fact, if you came to this town before solar, you used to see dry cells everywhere on the ground.

HM: So what about the small businesses?

R: There is an increase.

HM: Do you have data to show the increase?

R: I don't have any, but my estimate is 20% more small businesses since solar.

HM: Has that caused an increase on tax revenues for the administration?

R: All the small business people pay business tax relative to the land area they occupy. The economy has improved, but that doesn't necessarily have to be caused by solar. There are so many other factors. Of course solar has contributed to the growth along with other factors. No one has studied the effects of each of the parameters.

HM: What's the population size?

R: 7073.

*R compared the business situation in Rema and Merhabete [a neighbour town], where he used to work before:*

*Farmers are more successful in Rema. Rema is a trading centre for surrounding villages. That's why it's easier to sell goods in Rema. In Merhabete people have enough land area, but not enough fertile land. The climate is not conducive. There are many safety net programs to help out the farmers there. Rema doesn't need this.*

CB: Are there other changes when you compare the time before and since solar?

R: Most of the changes are already mentioned. Besides, solar also brought fridges into town. Before solar this village didn't have any fridges [Information from Technicians: 6 fridges in Rema: 3 solar / 3 generator driven]. The bars and restaurants that have fridges make better business. Some bars did also buy solar TVs and that had increased their income.

CB: Do you see any changes regarding **social** interaction, community bonds,..?

R: A group of youth started a civic centre where they had set up a mini media. Solar powered megaphones are used to transmit and advocates civilised social living to

the villagers. They teach about traffic rules, judicial issues, consequences of crime, health or any messages to train the villagers how to live in a community.

When you don't have light, you don't even feel like going home. But when you have light, you like going home and do your work.

HM: So you mean, there is less socialising due to light?

R: No, it's just that they know how to better use the time. They do the community gathering and still have time to do their work at home [day is expanded].

CB: What do you think is important next for **development**?

R: More importantly we need the electricity **grid**. Even though solar is good, it can't provide enough power to run many electric appliances. For instance if we wanted to encourage the youngsters who had already been technically trained to engage in small technical businesses or industries, we are limited due to the lack of 24 hour electric power. The grid can create more work for the unemployed but skilled people. Secondly, the need for more **water** is increasing with the population increase. But also, because of the fuel price increase, the price of water has also increased. We need about 5 tanks of 200 litre each of fuel per month to power the generator [for the upper, generator driven water pump] and we were forced to set the fee for 20 litre water to 50 cents [for one jerry can. → Compare with Girmas information about water cost in *Background information*: At the well water is free, in Rema it costs due to transportation work.]

HM: You sell the water?

R: Yes, it's like the normal charge for utility services [electricity, tap water, etc.]

HM: What's the cost for a tank of fuel [200 litre]?

R: Between 3000ETB to 4000ETB.

HM: So you are hoping that water price will decrease with the arrival of the grid?

R: We are actually hoping for the second generator powered pump to be replaced with a solar powered pump. With a solar pump, we hope to reduce the fee for 20 litre water to 20 cents. We have been told that grid will reach Rema by the end of this year.

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*Information given to us by the administrator:*

**Remas progress growth plan (2004E.C.= 2011G.C.)**

Published by Amhara state, Urban planning institute

Facts about Rema:

- Location
  - Northshoa zone
  - Woreda: Mida Wearmo
    - b/n 1300 – 2656m above sea level
  - 626 km to East Bahir Dar
  - 159 km to Debre Berahn
- Income
  - 92% of population: agriculture
- Religion:
  - Orthodox Christians (88.4% for the Woreda)
  - Muslims (11.5% Muslims for the Woreda)
  - Small number of protestants
- Business

Rema= merchandise center for surrounding towns

  - 4 hotels
  - 10 restaurants
  - 10 mills
  - 33 food storage
  - 1 leather storage
  - 6 coffee shops
  - 5 boutiques
  - 45 kiosks
- Population
  - 1810 men adults



- 1955 women adults
- 3765 total adults
- 1324 0-14 year olds [? Should be around 8000..]
- 7069 estimated total population in 2040
- Natural resources
  - Sand → glass production
  - Tourist attraction
  - 3 large rivers
- Problems
  - Not enough space for housing
  - Lack of trees and forests
  - Market place is too small
  - Lack of water
  - No electricity
  - No bus connection
- Investments needed
  - Houses
  - Entertainment
  - Expansion of Market place
  - Gyms, sport centres
  - Infrastructure improvement → roads to all directions
  - Grid (24h electricity)
  - Waste) collection system
  - Skilled labour
  - Kindergartens
  - Churches, cemetery
- Strategies addressing the farmers
  - Loans
  - Irrigation
  - Introducing high milk producing cows
  - Train youth for construction, technical work, textile industry

- Encourage farmers to grow fruits and vegetables
- Urban planning

Up to now, all houses were built without planning. In the future, urban planning shall be done.

*Pictures:*



**Picture 32: In the administration office during the interview.**



**Picture 33: A collage on the office wall showing Clinton's visit to the Solar village Rema in 2008.**

**7.2.1.8. Health station**

Archival No: R8

Site: Village: Rema, State: Amhara

Type: **Personal Interview and Data**

Interviewer: HM

Translator: HM

Typist: CB

Date: 31.10.2011

Start: 10:25am

End: 10:39am

Duration:14min:26s

*Interviewee:*

R= health facility manager Mengistu

*Other people present:*

Girma

*Situation:*

In Rema's health station we met the health facility manager Mengistu, who owns this position since the past 3 years (since 2009 G.C. or 2003 E.C.). We asked him for data on diseases caused by indoor air pollution and the fertility rate (to compare before and after). He promised to copy the data so that we can collect it the next week.

The health station uses numbers of diseases classified and categorized based on the international *ICD code*\*.

Description of the health centre:

Use of wood stove to sterilize equipment. No doctors, just nurses. Solar light used also for the microscope.

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*Interview:*

HM: What was the impact of solar on health?

R: When it comes to smoke caused lung diseases, we have seen tremendous decline in the number of cases.

HM: Do you keep records that can back up that statement?

R: Yes, like I told you we take a count every month. For example, if we used to see 20 cases it means that we now see only 5 cases per month.

Solar had make an impact in reducing difficulties caused by smoke from kerosene....but what can make even a better impact is smokeless stove. Solar had also advantages. The number of lung diseases had declined in number. And we can see that data.

CB: How long have you been keeping this data?

HM: I think he had said for 3 years. Is that correct? [turning to Mengistu]

*R nods.*

HM: But since we would also like to look at the recorded data before the arrival of solar, do you think you will be able to share those data too?

R: The data exists and is available for your review, but not displayed in a chart format. I can compile these data and share them with you in a few days. We will classify the 10 prevalent diseases here. For example, the 1<sup>st</sup> one is HIV, then malaria, then TB and it goes on.

HM: Could you please include too the data of the diseases caused by smoke?

R: Lung diseases affecting Rema are diseases such as acute pneumonia. A person from SEF was here a while ago and he had shared with us some indicators. We can show you the recorded data based on these indicators.

HM: What about data related to family planning, do you have any?

R: Most of the family planning work that we do is geared towards prevention and awareness creation...and we are concentrating on that. Because of that, we haven't done any work that can already show results. However, difficulties from fertility cases have decreased by 70% [maybe e.g. death during birth=maternal mortality].

- HM: We are actually looking to know if there are any changes in the fertility rate; if the size of the population has decreased or not?
- R: Yes, because of the family planning awareness that we are creating and since we were able to reach a wide range of the people...I can say that there is a 70% decrease in fertility rate.
- We keep records for from the 8 *kebeles* in *Madi Woremo*.
- HM: But it will be sufficient if you can only share data from Rema, whatever would be easier for you.
- R: Okay I will share them.
- CB: What can improve your work on health or what are your problems?
- R: There isn't much that's preventing us from performing our work...But we don't have skilled health workers such as doctors, surgeons or specialists in town. Whenever we encounter difficult cases, we are forced to send them or refer them to clinics or health centres in a different city, which is hard on the society because cases that could be easily prevented thus resulting in death. Especially cases related to mothers giving birth [maternal mortality=death of a woman during or shortly after a pregnancy (source: Wikipedia)]. We are not equipped to prevent antenatal cases [antenatal death=fetal death prior to labor (source: Wikipedia)].
- However, we are showing lots of improvement when it comes to family planning.
- CB: So there are not enough doctors who would like to work in villages like Rema?
- R: No there are none. There are no doctors in villages but only junior nurses or health officers. Difficult cases here are referred to a clinic located 35 km away.
- CB: How do you use solar power? Is it just for lighting or do you use it any other way?
- R: It is only used for lighting.
- HM: You don't have any fridge?
- R: No we don't have a solar powered fridge. We had inquired to see if SEF can help us with one. We are waiting on that response. We do have a kerosene powered fridge.
- HM: How about a microscope in the lab?
- R: We have a manual microscope with the light that's solar powered...for stool examination.

*Pictures:*



**Picture 34: Mengistu shows Hamere the numbers of diseases from the last years.**



**Picture 35: A health officer in the laboratory.**



**Picture 36: The microscope using a solar lamp as light source.**

*Data given to us by Mengistu:*

The ten top diseases in Rema Health Centre including Pneumonia as a disease related to indoor air pollution (see 2.2.3 Health benefits):



Top ten diseases in Rema Health Centre												
	Year e.c.	Year g.c.	Intestinal parasit	Malaria	Malnutrition case	Diarrhea	Skin disease	AFI	GIT	Wound	Urinal tract infection	
<i>Total Numbers</i>												
solar energy	1999	2006-2007	763	<b>Pneumonia</b>	325	593	508	502	458	367	191	
	2000	2007-2008	601	678	323	425	411	366	423	362	173	
	2001	2008-2009	573	505	320	358	395	363	360	361	171	
	2002	2009-2010	559	509	243	321	201	341	341	325	165	
	2003	2010-2011	294	485	195	290	188	301	274	174	163	
				281								
<i>Percentages rel.</i>												
<i>To year-before</i>	Year e.c.	Year g.c.	Intestinal parasit	Malaria	Malnutrition case	Diarrhea	Skin disease	AFI	GIT	Wound	Urinal tract infection	Total
solar energy	1999	2006-2007	0	0	0	0	0	0	0	0	0	0
	2000	2007-2008	79%	84%	99%	72%	81%	73%	92%	99%	91%	84%
	2001	2008-2009	95%	48%	99%	84%	96%	99%	85%	100%	99%	91%
	2002	2009-2010	98%	129%	76%	90%	51%	94%	95%	90%	96%	91%
	2003	2010-2011	53%	58%	80%	90%	94%	88%	80%	54%	99%	80%

**7.2.1.9. Student**

Archival No: R9

Site: Village: Rema, State: Amhara

Type: **Personal Interview and Street Talk**

Interviewer: HM

Translator: HM

Typist: CB

Date: 31.10.2011

Start: 11:13am

End: 11:20am

Duration: 7min:33s

*Interviewee:*

R=Student

*Situation:*

We asked a 16 year old girl whom we saw at the school, to tell us about her daily schedule. She seemed rather shy to answer.

She described her family situation to us that her mum died when she was small. Her dad married again and got children with his new wife. Then they divorced and her step mum moved away with the kids. (see *Interview*)

---

*Interview:*

HM: What's your rank in school?

R: I used to be good and ranked 1 to 5 [among 5 best students in class], but I became a bad student. Now I'm not doing well in school. So many times I've quit school. Because of that I'm lacking behind. I'm the only child at home doing **household chores**. Therefore I am left with little time for school.

- HM: Why don't you insist to concentrate on your school? Don't you want to go to university and have a better life?
- R: I want to, but it's hard to concentrate on school, because I have lots of work at home.
- HM: How comes your mum doesn't help you out?
- R: My mum died when I was small.
- CB: Do you use solar or other light sources at school?
- R: We use solar.
- CB: How is your **daily schedule**, what do you do in the evening?
- R: I go to school until 12:30. Then I go to fetch water. I cook and do house chores. I finish my house chores at 8pm. My dad comes home, I serve him dinner, finish washing the dishes by 9 and study for like half an hour. Then I'm too tired and go to bed by 9:30.
- HM: What is your opinion about solar light?
- R: It's good. Before, when we used kerosene there was the risk of **fire accidents**. Now we don't have that risk.
- HM: Do you live with any siblings?
- R: I have sisters, but they live with my step mum somewhere else. Since it's just me and my dad, I do all the work.
- HM: What would you like to become when you finish school?
- R: I have a hard time to study. My marks are not good at all, so I don't have much hope that I will enter university.

*Afterwards, we stopped some students on the street, who were on their way home from school, about their study situation at home (see Picture 38). Their estimated age was 15/16. Especially we talked with 2 or 3 girls and one boy. They said they don't have solar light, since they are from the neighbour village. So they used kerosene for studying. They would have to do housework until 9/10pm and then study for around 1h and go to bed at 11pm. Their parents would buy kerosene for study purposes (that didn't seem to be such a*

*problem), but they said it's inconvenient and even dangerous. They suffer from the exhaust gases and sometimes they may spill it and fire may rise.*

---

*Pictures:*



**Picture 37: The student.**



**Picture 38: Talking to students on the street.**

**7.2.1.10. Old woman without SHS**

Archival No: R10

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Interviewer: HM

Translator: HM

Typist: CB

Date: 31.10.2011

Start: 11:47am

End: 11:53am

Duration: 6min:04s

*Respondents:*

R1=Abayanesh

R2= Abayanesh's niece

*Other people present:*

Abayanesh's niece with her baby and a small girl (probably the niece's daughter) who came back from school.

*Situation:*

On Sunday I met an old Muslim woman on the street, coming from the fields and carrying staff on her back, who greeted me. After I asked, she told me she doesn't use solar light. I asked her, whether I could visit her another day in order to ask her about her daily schedule (as comparison to SHS users). Abayanesh told us to come on Monday to a house near the circle, close to one of the solar street lights.

---

*Interview:*

HM: Do you have solar light?

R1: I don't have a house.

HM: Whose house is this?

R1: It's my niece's house.

HM: Where do you live then?

R1: I sometimes live in a rental house. I've been applying to be placed in the solar club [house by the SEF where old people find a home who are unable to support themselves financially] and I'm waiting.

I have a kid, a son. But he is useless [doesn't support her].

CB: Where do you live from?

R1: Sometimes I go to the market and sell whatever I can, for example lemon.

HM: How is your daily schedule?

R1: I don't do anything. Most of the time I'm sitting around. I don't have anything and am not healthy either.

HM (to the niece): Do you live together?

R2: Sometimes she lives here. But when the kids bother her, she goes and rents a house. When she can't afford it, she comes back.

CB: Are there many homeless people in Rema?

R2: Yes, a few. But most of them live in the solar home. She had also applied to the Kebele [administrators] to give her a house, but without success.

HM: To get a free house?

R2: Yes.

HM: What do you do at night, do you visit other people or go out? [question targets the proximity towards street light]

R1: No.

---

*Pictures:*



**Picture 39: Abayanesh**



**Picture 40: Abayanesh and her relatives**



**7.2.1.11. Near the mill**

Archival No: R11

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Mena Hailemichael (MH)

Typist: CB

Date: 2.11.2011

Start: 14:28

End: 14:46

Duration: 18m:18s

*Respondent:*

R=Woman

*Other people present:*

Other older woman, children

*Situation:*

On this day we wanted to interview one family close to the village centre and one far away. Not far from the main road, near the mill, we met this woman in her kitchen. The kitchen was a traditional round hut near the more style living house made of clay. The woman has had a SHS, but it was removed.

---

*Interview:*

MH: What is your **work**?

R: I don't work. I have a husband who is farmer.

MH: What is your daily **schedule**?

- R: I always prepare breakfast, lunch and dinner. Sometimes I brew the local beer [T'ella] and wash the family clothes and other housework.
- MH: What do you do at night?
- R: During kerosene times, sometimes I used to produce traditional clothes, like weaving. After getting solar light, I had brighter light. I started works which need more light to see, like other handcraft [e.g. Injera tablet out of grass] and sorting the sorghum out from the chaff.
- MH: When do you go to bed?
- R: Before solar, at 9 to 10pm. With solar, I went to bed between 9 to 11pm, because sometimes I already prepared the breakfast for the next day.
- MH: Can you compare the **price** of the solar system and your old energy source?
- R: The kerosene light is more expensive than solar. I pay 4ETB/day. For solar, I paid 12ETB/month [SHS with 3 lamps]. My solar system was uninstalled 6 months ago. But I want to get it back. I have some money now, so please tell Girma [Solar Technician] to install it again.
- MH: Do you save money now?
- R: When I had a solar system, I spend money for sugar, sorghum, etc. But I did not save the money for the battery. Therefore they took away the system. Now, I have to spend much money for kerosene and there is not enough for food..
- MH: Can you compare solar light and kerosene?
- R: Solar light is like a gift of God. I just had to pay 12ETB/month, which felt like a gift. Now I have to spend so much money each day for kerosene, which is not comparable with the cost for solar.
- MH: What was the **advantage of solar**?
- R: In the wall and ceiling of the house, there was no smoke. It was **clean**. With kerosene, the wall and ceiling is dirty. Also my children have problems with their breathing system; with their eyes and noses.
- MH: How many children do you have?
- R: 4 children. They all go to school. The oldest one is 22, the second one 20, the third one 14 and the last one 13 years old.
- MH: What do you want in the **future**?

---

R: I wish that my children finish their school, find jobs and earn **money**.

MH: Are you satisfied in your life?

R: Yes, I am satisfied, because my children go to school and are healthy.

MH: Do you have hope and trust in your life?

R: I want to have more **money** and more **work**. I wish that this village develops and that the **crops** around Rema grow well, so that we can **sell and earn** much. I wish that **Ethiopia** will **develop** and is **peaceful**. Thanks God. If the country will be developed, all people will develop and have good **opportunities**, for example to go to **school**.

---

*Pictures:*



**Picture 41: The interviewed woman with children in front of her kitchen.**

**7.2.1.12. Edge of Rema**

Archival No: R12

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Mena Hailemichael (MH)

Typist: Claudia Braden (CB)

Date: 2.11.2011

Start: 15:02

End: 15:23

Duration: 22:11

*Respondent:*

Woman

*Other people present:*

Children

*Situation:*

Searching a household at the outskirts of Rema, we asked the woman (who I estimated to be around 30 years old or a bit younger) whether we could interview her. She was friendly and told us to come into her house, where she was caring for her children. Her SHS has 2 lamps, a tape and radio.

---

*Interview:*

MH: Since when do you have the solar system?

R: Since 5 years, I was among the first to get solar light in Rema.

MH: What does it include?

R: 2 lights and a tape.

MH: What changed in your life by the solar system?

R: Thanks to the Foundation, still now we use the light. Before, we used kerosene. There is a big difference now.

MH: What kind of difference?

R: Before solar, we used wood and kerosene. When I wanted to make light during the night, I couldn't find the kerosene or wood in the dark. That was a problem. But with the solar, that's not a problem any more. For example when my baby is crying, I just have to switch on the light and can see. That's a big difference.

MH: How much do you monthly pay?

R: At that time, the kerosene cost was 50cents/day for a bottle. For one day we used 2 bottles of kerosene. Therefore I spend 1ETB/day for kerosene. Now we pay 10ETB monthly for the SHS.

MH: Do you save money now? And if yes, how much?

R: I don't save money on a bank account. But I have profit, even though I don't count how much I have more per day.

### **Street light**

MH: How do you feel when you walk outside at night?

R: I'm not walking out at night, not because I'm afraid, but because I'm busy with my children at home.

### **Children**

MH: How many children do you have?

R: 5 children.

MH: Are they students?

R: Yes, 3 of them go to school. The other two are still small.

### **Work and use of light**

MH: What is your work?

R: During daytime, I care for my children, cook and do other housework. In the evening I wait for my husband coming home from the farm. Then we eat together.

MH: What is your daily schedule?

R: I wake up early at 5am, prepare Injera or other food, wash the children and their clothes. After that I cook *Wot* [sauce for Injera] for lunch and then prepare the dinner.

MH: So you use the solar light also in the morning?

R: Yes.

MH: What do you do at night?

R: My husband comes from the farm and we have dinner. After that we go to bed, because he is tired.

MH: What time do you go to bed?

R: From 9 to 10pm.

MH: And before solar light?

R: The same time, because we went to bed when my husband was tired. There is not a big difference in the time of going to bed. The benefit with solar is that we don't have to use much kerosene in the evenings any more, and save the money for that.

### **Radio**

MH: Do you listen to radio or tape by using solar?

R: I don't have time listening to the radio, but my husband does. Sometimes I listen to the tape, both to church music and cultural music. I'm happy.

### **Health**

MH: Did you have any health problems during using other energies?

R: During kerosene time, the wall and ceiling of the house were smoky and my mother had eye problems.

MH: What about now?

R: Now there is no problem, because we use the solar light.

### **Future**

MH: What do you want in the future?

R: I wish to earn more money. I want that my children go to school and become educated. I don't want more children and will use family planning, like injection or tablet, after discussing with my husband.

MH: Are you satisfied in your life?

R: I am happy with my family; my husband and children.

MH: What do you want for Rema?

R: I want to leave to go to a big city, like Addis, where I can open up a shop.

MH: Why do you want to live in a big city?

R: In a big city, there are many opportunities and everything is available. I could have a big shop and have more comfort.

---

*Pictures:*



**Picture 42: The daughters in the house of the interviewed woman.**



**Picture 43: The woman with her baby.**



**7.2.1.13. Women making handicrafts**

Archival No: R11

Site: Village: Rema, State: Amhara

Type: **Observation and field talk**

Data collector + translator: Mena Hailemichael (MH)

Typist: CB

Date: 2.11.2011

Time: around 14:00pm

Duration: around 10/15 minutes

*Situation:*

In the afternoon we met some women near the village centre on our way back home from the interviews. Three of them were producing *Injera* plates to sell on the market. Another woman made *T'ella* [local beer].

*Talk:*

We asked them whether they have solar light and how they spend their evenings. They said, they mostly do the handicrafts during daylight. The solar light in the evening they would rather use to come together with friends at home. Since they were close to the solar street light, we also asked, how they feel walking outside at night. They sometimes walk outside at night, benefiting from the street light, or sometimes carry a torch with dry cell battery.

*Pictures:*







**7.2.1.14. Three Students**

Archival No: R13

Site: Village: Rema, State: Amhara

Type: **Group Interview**

Data collector + translator: Mena Hailemichael (MH)

Typist: CB

Date: 3.11.2011

Start: 16:27

End: 16:37

Duration: 11m:20s

*Respondents:*

B = Boy

G= 2 Girls

*Other people present:*

Women and children stopping on the way.

*Situation:*

On the way from the health station to Semaine, we met 4 students (1 boy and 3 girls). One girl carried a water tank and did just stop shortly and then went on. The 3 students did not talk much and we had to encourage them by asking each of them to answer.

The students just arrived 2 months ago to join the highschool in Rema (grade 9+10). Their families live around Rema. Now the students live alone in a rented house.

---

*Interview:*

MH: Do you have a solar light at home?

R (all of them): Yes. We live in a rented house and there is solar light in the rooms.

- MH: In which class are you?
- B: Grade 10
- G: Grade 9.
- MH: How did you spend your evenings before having solar?
- B: Before solar light, I studied in the **evenings**, but not very long.
- G: Before light we studied from 8-9/10pm, now we study from 8 to 12pm.
- B: With solar, I also use to study up to 12pm.
- MH: What is the difference between kerosene and solar light?
- B: Solar light is **brighter**. I'm happy with that. Before, the kerosene was not bright and I had problems to study.
- G: The solar light is good. I can read better with it. Before, I sometimes worried that the kerosene lamp may spill and a **fire** may start. Now, I don't have to worry, because the solar lamp is safe.
- MH: How is your study **performance** now and before?
- G: I came two months ago in this year to study in Rema. The rank will be given to us after 6 months. So I can not yet compare my study rank. But up to now, the difference is that I have a longer study time at night.
- B: The light is comfortable now and I study for 2 hours more each night. But my rank didn't change.
- CB: What do you wish for the future?
- B (in English): My wish: doctor.
- G1: I want to become a teacher.
- G2: A school director.
- CB+MH: Thank you very much!
- 

*Personal impression:*

Probably we should have introduced ourselves more, so that the students knew what we do and want from them, so that they would have been freer to talk.

**7.2.1.15. Semaine 2**

Archival No: R14

Site: Village: Rema, State: Amhara

Type: **Personal Interview and test to weight the SHS benefits**

Interviewer: MH

Translator: MH

Typist: CB

Date: 3.11.2011

Start: 17:10

End: 17:37

Duration: 27:41

*Respondent:*

R=Semaine

*Other people present:*

Meseret (Semaine's friend and cook from the SEF),

Semaine's niece (young girl)

*Situation:*

In the 2<sup>nd</sup> week, Semaine invited us again for a traditional brewed beer to her house. I wanted to use the chance to ask her some of the questions from the catalogue, which we didn't ask the first time and to get to know single households better, instead of visiting more and more. Also she was the test person to see how the criteria-evaluation by the users works.

---

*Further Questions:*

**Solar system**

MH: Since when do you have the solar system?

R: Since 5 years. I was one of the first ones to get the system.

MH: What does it include?

R: 3 lamps and 1 tape.

### **Work and use of light**

MH: What is your daily schedule? What do you do at night? When do you go to bed?

R: I wake up in the morning, make Injera and get water [before the water pump broke, she collected water at the village pump] and go to the mill to mill the T'eff and sorghum [types of grains]. If I have time, I wash clothes and clean the house.

MH: What do you do in the evenings?

R: At night I sell Injera. Then I use the solar light to make handcraft. When I still have time, I do other houseworks.

MH: What about before solar?

R: Before kerosene, I did not work in the evening, due to my lung disease. I did not sell Injera or prepare handcraft.

MH: How much more income do you have by this now?

R: I don't have an exact figure. But I have a benefit now. [I guess that the additional benefit with SHS is hard to quantify.]

MH: Does it mean you have more workload nowadays? [negative...]

R: Yes, since I don't have health problems, I am able to do more work now. This is good for me. [...positive connotation]

MH: Did your social life [like meeting friends, talking with family,...] change since solar?

R: Yes, since solar I read the bible and pray with friends or have personal talks with them.

### **Street light**

MH: How do you feel when you walk outside at night?

R: Before street light, I needed hand torches when walking outside at night. Now I can go without. But I felt save all the time.

### **Future**



MH: What means *Edeget/Lemmat* [Amharic words for “Improvement” and “development”] for you?

R: Now I use to make *Injera* with wood. For me, “Improvement” would mean, changing to a stove using improved technologies. Also, using a fridge, computer, having new style dresses, all these would mean “improvement” or “development” for me.

### **Feeling**

MH: Do you feel powerful to improve your life?

R: For me, improvement means, having more money and being able to help other people with it, who are in need. Also I have a free land where I would like to build a big house if I would have more money. Since now, I wash my laundry by hand, I would like to have a washing machine.

### *Impact weighting by Semaine:*

Impacts found out from forgone interviews asking for the changes by SHS.

First experience with Criteria Evaluation, using cards with Amharic-English criteria written on it and asking the respondents whether

- They agree with the criteria
- Have something to add
- to sort them from important (left) towards less important (right)

After some time to understand the question (or maybe translation problems between Mena and me), Semaine listed the following from most to less important:

1. additional income
2. more time to work
3. more free time (new criteria), *e.g. Bible reading*
4. less money spend for lighting
5. health
6. socialising
7. entertainment

- 
8. education (*she doesn't go to school and has no children doing so, therefore this comes last*)
- 

*Pictures:*



**Picture 44: Semaine, her niece and Mena during the impact weighting by ordering the cards from more to less important.**



**Picture 45: Handcrafts produced by Semaine**



**Picture 46: Handcrafts produced by Semaine**

**7.2.1.16. Carpenter and his wife**

Archival No: R15

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Mena Hailemichael (MH)

Typist: CB

Date: 3.11.2011

Start: 18:04

End: 18:31

Duration: 27m:00s

*Respondents:*

R1 = Feleke

R2 = Feleke's wife

*Other people present:*

Children

*Situation:*

In order also to interview male respondents and being able to visit people at night when they're using the solar lamps, we waited until the evening when the farmers come home from work. Since we interviewed Semaine before, we afterwards went to her neighbour, a farmer and carpenter, to interview him. He was very polite and friendly. Just when we asked him about his children, his wife entered the house and took part in answering. She was very talkative and did not hesitate to talk the same time with the husband, who became a little bit more quite. She was younger than him (guess: she 35years, he 50years). Both were really friendly and patient and eager to answer. They seemed to be happy, thanking SEF for the solar light.

Their house was made of stone and wealthier than the others we have visited before. The living room was painted in 2 colours, had banks at the walls to sit on, a small table and stool and a mattress on the ground.

---

*Interview:*

### **Solar system**

MH: Since when do you have the solar system?

R1: Since 5 years. We were among the first to get a SHS in Rema.

MH: What does it include?

R1: 4 lamps.

MH: What changed in your life by the solar system?

R1: There is a big difference, because the kerosene lamp was not bright enough. Now, we have enough light and our children use it to study at night.

### **Economics**

MH: Can you compare the price of the solar system and your old energy source?

R1: For the SHS we pay 11ETB/month. Before, we used to pay 30ETB/month for kerosene.

MH: Do you save money now? If yes, how much?

R1: Even though we don't save but use the money, we experience an economical benefit. Now we have money to spend for our basic needs, like food and clothes.

### **Work and use of light**

MH: What is your work?

R1: I have two works: I'm a farmer and carpenter.

MH: What is your daily schedule?

R1: My schedule is different from day to day. On one day I have work as a carpenter, the next day I may go to the farm, and so on.

MH: Do you have a farm by your own, or are you employed in another farm?

R1: I own a farm together with my friends. [a group of farmers came together and put together their land and work on it together]

MH: What do you do at night? When do you go to bed?

R1: Before solar, we didn't talk much in the evening. Now we use the solar light to sit together at night and talk.

MH: When do you go to bed?

R1: Before, we went to bed at 20:30. Now we go to bed between 20:00 and 22:00.

### **Radio**

MH: Do you listen to radio or tape by using solar?

R1: We sometimes listen to a radio run with a dry cell battery.

### **Cell phone:**

MH: Do you have a cell phone?

R1: Yes.

MH: How did you charge your cell phone before and since solar?

R1: Before, we either gave it to houses with generators [e.g. the miller] or we sent it to *Alem Ketemah* [neighbour town] to be charged. Since we don't have a cell phone charger in our SHS ourselves, we now give it to neighbours who charge it.

MH: Do you save money now? If so, how much?

R1: Before we spend 3ETB for charging, and now 2ETB. Depending on how much we use the phone, it has to be charged every 3 or 4 days.

### **Street light**

MH: Do you use to walk outside during night time?

R1: Not much, but sometimes. Before I used a hand battery torch when I was going out at night. Now I don't need this any more, since it's light outside due to the street light.

### **Children**

MH: How many children do you have?

R1: 3 children.

MH: Are they students?

*Wife came in, greets and immediately joins in answering (mostly both talk at the same time).*

R1+R2: Yes they all go to school: The first one is 11 years old and goes to class 6, the second one is 7 years old and in class 2 and the third one is 6 years and in class 1.

MH: Was there a change in their study behaviour?

R1+R2: No, because 5 years ago when the SHS came, our oldest kid just started school. So we could not observe a change.

### **Health**

MH: Did you have any health problems during using other energies?

R2: We are lucky now. Before the house was dirty inside. But now it's clean.

MH: What about your health?

R2: Before, I had eye and lung problems. Now this is no problem any more.

### **Future**

MH: What do you want in the future?

R1+R2: We want to earn more money by working more.

MH: What means *Edeget* for you?

R1: Improvement means for me having businesses, like a mill, a garage or carpentry. Especially bigger businesses using new technologies.

MH: And for you?

R2: The same.

MH: You also want a carpentry?

R2: No, but a big shop or a restaurant.

MH: Do you want these businesses here in Rema?

R1+R2: Yes, anywhere.

MH: What do you wish for Rema?



---

R2: That it develops, that more and more businesses grow, and the life becomes better for children and old people.

*Afterwards we still sat a bit inside and waited that the rain stops. Faleka said that before it used to be very dark at that time already at home and he could not even recognize his wife at the other side of the room. Moreover he compared his experience from visits in a neighbour village which is already connected to the grid. Even though they have grid electricity, there are often power cuts, which showed him that solar is more reliable. This is why he wouldn't want to have grid-power, even in case Rema gets connected to the grid.*

---

*Pictures:*



**Picture 47: Feleke and his wife.**

*Personal Impression:*

They seemed to be happy, thanking SEF for the solar light. This may have influenced their answers, trying to mention many positive things about solar.

**7.2.1.17. Children on the field**

Archival No: R16

Site: Village: Rema, State: Amhara

Type: **Group Interview**

Data collector + translator: Mena Hailemichael (MH)

Typist: CB

Date: 4.11.2011

Start: 14:01

End: 14:11

Duration: 10m:35s

*Respondents (age):*

B = Antenayhahu Belaye (10)

G1 = Senetalem (8)

G2 = Beletu (10)

G3 = Webite (9)

*Other people present:*

During the interview, 1 other young boy came and at the end also an older boy.

*Situation:*

We went to the farm below the SEF guesthouse, where children are working on the field with their animals every day. We met 4 children from different families in Rema.

---

*Interview:*

**SHS**

MH: Since when do you have solar light?

B: Since 3 years.

---

*The girls also use solar, but do not know since when.*

### **Work and use of light**

MH: What do you do during the day?

B: In the morning I go to school. In the afternoon, I do my homework for school and help my parents. In the evening, I study and talk to my parents. Then I go to bed.

G1+G3: In the morning, we go to school. Then we go to fetch water. At night, we study and then go to sleep.

G2: I go to school in the morning. Then I do my homework for school and afterwards help my parents at home and on the farm.

MH: How did you spend your evenings before solar?

R: We studied as well at night, but less than now.

MH: When did you go to bed?

G: At 9pm. And now between 10 and 11pm.

MH: Do you just use the additional time in the evening for study, or also help your parents?

G: Yes, we do both more now: Homework for school and housework for our parents.

MH (to G1): The same with you?

G1: I study two hours longer per day. [true?]

MH: What was your rank in class before and now?

B: Before I was 30 [class has maybe 50 kids], now I'm at rank 20.

G2+G3: We're grade 2.

### **Future**

HM: What do you want in the future? What do you want to become?

B: A doctor.

G2: Nurse.

G3: Teacher.

G1: I don't know yet.

---

*Pictures:*



**Picture 48: The interview location: The field with the stone circle on the hill.**



**Picture 49: Mena and the interviewed children during the interview.**



**Picture 50: The children during the talk with Mena.**



**Picture 51: The children during the talk with Mena.**



**Picture 52: The children during the talk with Mena.**



**7.2.1.18. T'eff farmer**

Archival No:R17

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Mena Hailemichael (MH)

Typist: CB

Date: 4.11.2011

Start: 14:28

End: 14:40

Duration: 12m:18s

*Respondents:*

R1+R2=2 Farmer

*Other people present:*

SEF guard

*Situation:*

On our way back to the SEF compound, we met two farmers (of around 30 years, estimated) coming from their fields. We asked them whether we can ask them some questions and we sit together in the shadow at the compound. They told us, they are from Rema and own their own farms. Right now they are harvesting T'eff. Since they seemed to be a bit in a hurry, we didn't ask many questions.

---

*Interview:*

**Solar system**

MH: Since when do you have the solar system?

R: Since 5 years.



MH: What does it include?

R: 2 lamps.

MH: Which energy source did you use before?

R: We used kerosene.

MH: Can you tell us the difference between solar energy and the energy source before solar?

R: Before, we had to buy kerosene daily. Now we don't have to spend daily money for lighting any more.

### **Economics**

MH: Do you save money now?

R: We have more money now, which we spend for food.

MH: How much do you pay now and before?

R: Now we pay 7ETB/month. Before we paid 30ETB/months on kerosene. Sometimes we also collected wood.

### **Health**

MH: Did you have any health problems during using other energies? And what about now?

R: During kerosene, we had health problems in the nose and eyes. Now we don't have problems any more.

### **Children**

MH: Do you have children?

R1: Yes, one 2 year old son.

R2: No, I don't have children.

### **Work and use of light**

MH: How does your day look like?

R1: I wake up in the morning, go to the farm, cut the grass for the cattle, come back to our house and help my wife with the cattle.

MH: How do you spend the evening?

R1: At night, I have dinner with my wife, we talk and go to bed.

R2: I don't have a wife, but also have dinner at night and go to bed afterwards.

R: We just use the light at night.

MH: What did you do during kerosene time?

R: We used kerosene in the evening, but tried to save the amount of kerosene by also using wood.

### **Cell phone:**

MH: Do you have a cell phone?

R: No.

### **Future**

MH: What do you wish for the future?

R1: I want to own a mill.

R2: I would like to have a big shop.

MH: Here in Rema?

R: Yes.

MH: What means *Edeget* for you?

R: Improvement means for us to become more money.

---

*Pictures:*



**Picture 53: The farmers**

**7.2.1.19. Mama Trengo**

Archival No: R18

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Mena Hailemichael (MH)

Typist: CB

Date: 6.11.2011

Start: 16:15

End: 16:35

Duration: 20m:21s

*Respondent:*

R = Mama Trengo

*Situation:*

Mama Trengo is a wealthy woman in Rema, renting 8 houses, including solar lights. She is around 45-50 years old (estimated), Muslim and widow. The room in her house where we did the interview included 2 beds, some furniture and many Islamic sayings at the wall. It was the most comfortable and furnished room I saw in Rema.

She was very happy seeing and talking to Mena again. Also to me she was very open and friendly during the informal talk, also she was very hostile, offering beer, bread and popcorn. Anyway, during the interview, she did not seem too comfortable answering all the questions, especially the financial ones.

---

*Interview:*

**Future**

MH: Are you satisfied in your life?

- R: I was not as much satisfied before I got the solar light. But now, I am satisfied in my life.
- MH: Besides the light, what contributes to your **satisfaction**? What are the positive things in your life?
- R: I'm happy in my life. I have 3 children, my husband passed away 7 years ago. I'm still a little bit sad, because I lost him. But besides that, I'm really happy for life.
- CB: I'm sorry for that!
- MH: Which **problems** do you have in your life?
- R: My only income comes from renting the houses. But right now, just half of them are rented. This is my problem right now.
- MH: What do you **wish** for the future?
- R: I wish to have a TV, a sofa and other furniture for my house. I want to have nice houses and being able to watch TV during break times.
- MH: What means *Edeget* [improvement] for you?
- R: I don't want to work any more in the future, because I'm already old. But I wish that my children have better houses than me. This would mean "Improvement" for me!
- MH: Which changes did the SHS bring to you?
- R: First, the solar light is brighter than a kerosene lamp. Working at night was not possible before. Now it's a bright light, that's very good! Another change is the expense from kerosene.

### **Work**

- MH: You say, you can work at night now. How did your evening schedule change due to solar? When did you go to bed?
- R: With kerosene, I used to go to bed at 8pm. Now we sleep at 9.
- MH: What do you do at night, when you use the light?
- R: I don't work at night, because I finish cooking and make *Injera* before the evening. So there is no work left at night. But I spend the evening talking with my children.
- MH: So you use the night time for your family?
- R: Yes, every day.

**Children**

MH: How many children do you have?

R: 4 girls and 2 boys.

MH: Are they students?

R: No, all of them already finished school. 3 are employed in my guesthouse, and the other 3 live in other countries.

**Economics**

MH: You also mentioned, having less expenses now from buying kerosene.

R: I don't save money.

MH: How much did you spend before and after?

R: Before I spend 50cent to 1ETB/day. Now it's 7-10ETB/months for one rented house. I have different SHS in the houses I rent, therefore the range. All of the 8 houses I rent have solar light.

**Radio**

MH: Do you have radio or tape?

R: No, because the customer used to listen too much to the radio/tape, so that the battery voltage was low. Then I disconnected the radio/tape.

**Income**

MH: Do you earn more money from renting the rooms now?

R: Now I just rent 4 of the 8 houses, so there is no increase in income.

**Street light**

MH: Do you use walking out at night?

R: No, I don't go out after 6pm.

**Health**

MH: Did your health situation change?

R: Yes, I had lung problems before, which are solved now.

MH: Are there any other changes from solar?

R: I benefit much from solar.

---

*Pictures:*



**Picture 54: Mama Trengo's house.**



**Picture 55: Mama Trengo's house**

*Remarks:*

This day, I tried out starting with the 2 topics “Future” and “Changes by solar” in the beginning as open questions, asking further to make the people talk more about it and then adding missing topics from the checklist. But I noticed, that starting with the ‘hardest’ questions about future/wishes and problems is a bad idea, because even though respondents are not focusing on SHS, the trust and comfort in talking is not there in the beginning. So it’s better starting with questions about SHS, family or work and then go deeper!



**7.2.1.20. Farmer in Rema Dire**

Archival No: R19

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Mena Hailemichael (MH)

Typist: CB

Date: 6.11.2011

Start: 16:08

End: 16:23

Duration: 14m:56s

*Respondents:*

R1 = Farmer and owner of the round hut, where we did the interview

R2 = neighbour who joined in

R3 = Daughter of the house owner

*Other people present:*

2 boys and the daughter of the house owner

*Situation:*

In the afternoon we went to Rema Dire, a small village 15 minutes away from Rema. Some people in Rema Dire have SHS, but not all. We wanted to interview farmers without SHS. We found one small traditional *Gojo* (round hut) which did not have a SHS and asked the house owner, a farmer who was sawing wood in the “garden”, whether we can interview him.

The interview atmosphere was not very free and the respondent seemed a bit mistrustful against us and displeased to answer much (see *Remarks* at the end).

---

*Interview:*

MH: Do you have a satisfied life?

R1: Yes, I'm satisfied.

### Work

MH: What is your job?

R1: I'm a farmer.

MH: What do you grow?

R1: *T'eff* and sorghum [types of grains].

MH: What's your schedule?

R1: Sometimes I sleep in the farming place, because my farm is 2.5 hours far away.

When I come back home at night, I've to start walking home at 1pm.

### Children

MH (looking to the girl who stands in the house): Is this your daughter?

R1: Yes.

MH: How many kids do you have?

R1: 3.

MH: Are they students?

R1: No, because two are small, and she [the daughter] does not want to go to school.

MH: Why doesn't she want?

R1: She started going to school, but then she didn't like going any more.

### Light

MH: Do you use the kerosene for lighting?

R1: Yes.

MH: What is your schedule at night?

R1: After dinner we go to bed.

### Cell phone

MH: Do you have a phone?

R1: No.

### Future

MH: What do you wish for the future?

R1 (first didn't know what to answer, just after more explanation of the question and thinking a bit): I wish to harvest more *T'eff* and sorghum products. I want to build a bigger house with a stabile roof. Then I want more furniture and other things for the building.

MH: What are problems in your life?

R1: A problem is that I have little harvests right now.

MH: Is it because of the rain?

R1: Yes: 3 months ago, we needed rain so that the crops grow. But there was little rain. Now we don't want rain, because it damages the yield, but it rains much.

MH: Is that the normal whether condition here?

R1: No, it's not. It just was like that this year and the year before as well.

MH: What means *Edeget* [improvement] for you?

R1: To harvest a bigger yield.

MH (to R2): And for you?

R2: To have more money, for example by selling more and good farming products and earning more from that.

MH (to both): And what do you wish for your family and for Rema Dire for the future?

R2: I want that the children get educated, that the parents earn more money and can give their children a better life, e.g. education.

R1: Me too.

MH: Do you want to stay in Rema?

R1: If we get a land in another place, we would go there. But we don't have another place, so we stay here.

MH: And what would you like to improve here, so that you would like it better here?

R2: If you don't have money, it's a hard life here in Rema Dire, as my mother used to

have it. But if you have money, which I understand under development, you can have a good life here. Then I like it here.

MH: Thank you very much!

MH (to the daughter): Can we also ask you some questions?

R3: No, I don't like.

MH: Okay.

---

*Pictures:*



**Picture 56: Farmers coming back from their fields before the sun sets.**



**Picture 57: Traditional round huts (*Gojos*), like that of the interviewed farmer (even though those on the picture have SHSs).**

*Remarks:*

This day, I tried out starting with the 2 topics “Future” and “Changes by solar” in the beginning as open questions, asking further to make the people talk more about it and then adding missing topics from the checklist. But I noticed, that starting with the ‘hardest’ questions about future/wishes and problems is a bad idea, because even though respondents are not focusing on SHS, the trust and comfort in talking is not there in the beginning. So it’s better starting with questions about SHS, family or work and then go deeper!

Either due to starting with such complicated questions, or because of other reasons (e.g. no trust, not willing to give such private information, no time, other people around listening, not proud about his life,...) he was not talkative during the whole interview. He became a little bit more free during the farming-questions (maybe he knows well about this topic). When we included another farmer, who came during the interview and was more talkative, I first had the impression, the houseowner also didn’t like that. At the end, we asked his daughter whether we could also talk to her, but she disagreed (my guess: because her father was around).

**7.2.1.21. Shop 1**

Archival No: R20

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Tsega Meseret (TM)

Typist: CB

Date: 1.12.2011

Start: 9:16am

End: 9:21am

Duration: 5:47

*Interviewee:*

R = Shop owner Yusuf Ahmed

*Other people present:*

Girma and villagers

*Situation:*

Interview was conducted on the village square, where the shop is located. The shop owner had at least one helper in his shop.

---

*Interview:*

TM: In which year did you open your shop?

R: In 1997 E.C. [2004 G.C.].

TM: When did you get the SHS?

R: In 1999 E.C. [2006 G.C.]. Before I used candles and kerosene.

TM: Are there differences in income and opening times since having SHS?

---

R: Before, I worked up to 7pm, now I open until 9pm. Before I was afraid of fires from the candles or kerosene. Now, beside light, I also gained a mobile charger. Moreover I had a smaller shop before. Then the demand increased and I was able to expand: I build a new shop beside the old one, which is double the size.  
[unclear which impacts are due to SHS]

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*Pictures:*



**Picture 58: From l to r: Interview situation with Tsega, Yusuf (in the shadow), Girma.**





**Picture 59: Yusuf (wearing the scarf) in front of his shop. Customers in the background, the SHS to the left on the roof.**



**Picture 60: Yusuf's old shop, close to the new one (size doubled) on the village square.**

**7.2.1.22. Shop 2**

Archival No: R22

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Tsega Meseret (TM)

Typist: CB

Date: 1.12.2011

Start: 9:32am

End: 9:39am

Duration: 7:06

*Interviewee:*

R = Shop owner Mesetawet Geletaw

*Other people present:*

Girma

Villagers passing by on the street (shop open to main road)

Young daughter of Mesetawet

---

*Interview:*

TM: In which year did you open your shop?

R: In 1996 E.C. [2003 G.C.].

TM: When did you get the SHS?

R: In 1999 E.C. [2006 G.C.]. Before I used candles and kerosene.

TM: Are there differences in income and opening times since having SHS?

R: Yes! Since there is a good market, I was able to expand my shop. Moreover, with solar I am free to open as long as I want.

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*Pictures:*



**Picture 61: Mesetawet and Tsega Meseret during the interview.**

**7.2.1.23. Shop 3**

Archival No: R23

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Tsega Meseret (TM)

Typist: CB

Date: 1.12.2011

Start: 9:39am

End: 9:44am

Duration: 5:25

*Interviewee:*

R = Shop owner Fatuma Ali

*Other people present:*

Girma

Sometimes customers coming in (shop in a room with a door to the street)

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*Interview:*

TM: In which year did you open your shop?

R: In 1997 E.C. [2004 G.C.].

TM: When did you get the SHS?

R: 1999 E.C. [2006 G.C.]. Before I used candles and kerosene.

TM: Are there differences in income since having SHS?

R: Yes, I got an economic benefit: Instead of 2ETB/day I just spend 11ETB total per month for lighting.

Before I employed a worker in my shop, but now I do the work myself.

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*Pictures:*



**Picture 62: Fatuma (I) in her shop.**

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**7.2.1.24. Shop 4**

Archival No: R24

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Tsega Meseret (TM)

Typist: CB

Date: 1.12.2011

Start: 9:52am

End: 10:01am

Duration: 9:13

*Interviewee:*

R = Shop owner Asrebebe Breku

*Other people present:*

Girma

Villagers passing by on the street (shop at the street)

---

*Interview:*

TM: In which year did you open your shop?

R: In 1996 E.C. [2003 G.C.]. 1999 E.C. [2007 G.C.] I got my SHS, which includes 4 lamps, a charger and radio.

TM: Are there differences in opening times and income since having SHS?

R: Yes: Before having solar, I used kerosene and candles for lighting and batteries for the radio. I had to spend 60ETB/month. Now I have to pay 14ETB/month for the SHS.

I have an additional income from the cell phone charger now: I charge approximately 11 phones per day and take 3ETB/phone.

---

The opening times didn't change. I closed at 8pm in the evening before and after solar.

Another change I noticed in my health: before I used to have eye problems, which are solved now.

TM: Thank you very much.

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*Pictures:*



**Picture 63: The shop owner in her shop.**



**7.2.1.25. Pharmacy**

Archival No: R25

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Tsega Meseret (TM)

Typist: CB

Date: 1.12.2011

Start: 10:17

End: 10:30

Duration: 13:13

*Interviewee:*

R = Pharmacist Shewangezaw Gebresilase

*Other people present:*

Girma,

Young man [maybe working in the pharmacy or a son of the owner]

*Description:*

He started his pharmacy 2000 E.C. [2007 G.C.]. He rented the house for the pharmacy inclusive SHS, since light is important in a pharmacy. To become a pharmacist, he studied 'Health assistance' for 3 years in Addis and afterwards already worked for 36 years. Nowadays he only uses solar for lighting, but wishes to also have a laboratory with a **solar-microscope**.

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*Pictures:*



**Picture 64: Pharmacist in his pharmacy**



**Picture 65: Children observing us during the interview**

**7.2.1.26. Youth group leader**

Archival No: R26

Site: Village: Rema, State: Amhara

Type: **Personal Interview**

Data collector + translator: Tsega Meseret (TM)

Typist: CB

Date: 1.12.2011

Start: 16:58

End: 17:06

Duration: 8:35

*Interviewee:*

R = Youth group leader Hassen Yemer

*Other people present:*

Administrator (A)

*Situation:*

The village administrator had told us about the youth group *Kalkidan* (promise) which uses solar energy to spread social education in the village. In the evening we met their leader together with the administrator for an interview at the SEF compound.

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*Interview:*

TM: Since when are you in the youth group?

R: I joined *Kalkidan* ["promise"] 3 years ago [2008 G.C.] and became their leader.

TM: When was *Kalkidan* founded?

R: In 1997 E.C. [2004 G.C.]

TM: What kind of work do you do?

- R: Our mission is to educate the community through mini media [transmitting the news via loudspeaker from their office] and drama on social issues like the gender issue; including circumcision, forced marriage, kidnapping and health issues; mainly on HIV.
- TM: Are there women group members?
- R: Yes, there are women who educate about the gender issues. About rape, kidnapping,.. All these issues are taught by women.
- TM: How many women are there?
- R: 8 women out of 16 group members. When we started working, there were 24 members, but 8 of them left for work or live in other places now.
- TM: What is the aim of your work?
- R: We want to educate the society and achieve a change in their attitude, for example raising awareness and tolerance about HIV. Many of our members, including me, live with the virus. We want to tell them that a life with HIV is possible.
- TM: How are your experiences to live as HIV positive in a village like Rema?
- R: Previously it was a big problem for me to tell the people about it. But the government and organisations like *Menschen für Menschen* and *Habco* [?] supported me. With the time, people start being aware and to understand. The stigma was that people with HIV can't work and live a normal life. Now, since they see and know me, they get an idea about how life with HIV really is. I tell them about my life, for example I explain that I regularly have to attend clinic checkups, but also that I am able to have a 'normal' life with the virus.
- We want to encourage people to check their status and if they are positive to attend the checkups and get medical care. At first 6 positive people joined my association *Fana* ["lighting"]. Now we have more than 100 members. *Fana* members are taught about HIV and get medicine and treatment from different organisations.
- TM: Do you have to pay for the medicine?
- R: No. Organisations in *Merania* [town] provide it to us for free.
- TM: How does solar energy help you in your work?
- R: In and around Rema we transmit the news with the mini media using solar. Before solar we used batteries for the microphone, which cost 34ETB per week [using 8

batteries/day for 5 days]. Now we just pay 19ETB/month for the solar system. But in remote areas we still use a portable mic using batteries and we play drama.

TM: The mini media you use for spreading the news from your office is run by solar. How did you work before solar came to Rema from 1997 E.C. [2004 G.C.], when your group started, until 1999 E.C. [2006 G.C.], when SEF came?

A: They were just teaching by going to the community personally.

TM: What is your wish for the future?

R: We want to be able to use solar also for the portable microphone.

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*Pictures:*



**Picture 66: Hassen**



**Picture 67: During the interview. From l to r: CB, TM, the village administrator and the youth group leader.**

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**7.2.1.27. Women group**

Archival No: R27

Site: Village: Rema, State: Amhara

Type: **Group discussion**

Data collector + translator:

During discussion: Alem Tsegaye (AT), Samson Tsehaye (ST)

Translation in Oldenburg: Firealem Wosene (FW)

Typist: CB

Date: 6.12.2011

Start: 9:30am

End: 11:30

Duration: 2h:00min

*Respondents:*

11 women from Rema using SHS (W)

*Other people present:*

Girma (camera man)

SEF housekeeping staff (bringing coffee and water)

*Situation:*

At the end of the interview period I did a group discussion with SHS users in order to verify the results. There were two group discussions, the first one planned from 9-10am with 10 female users, the second planned from 10-11am with 10 male users. Girma and the village administrator invited the guests. They choose them according to the criteria: SHS user, little problems with the system, rather long time of use. Moreover the people must be free in the morning, which is possible for most women, but for the male just for farmers who already finished the harvest.

I got to know about those criteria shortly before the discussion and did expect them to choose guests randomly. Girma explained as a reason for choosing successful SHS users,



that they may give hints for other users how to prevent mistakes with using the system and may talk about interesting and positive experiences with the system.

The people arrived later than 9, so finally the first discussion started around 10am. The women discussion was lead by Alem Tsegaye as a female chair and the men discussion by Samson Tsehaye as a male chair.

The aim of the discussions was to verify the results from the preliminary interview interpretation. Therefore the results (development indicators, changes by SHS) were presented to the guests. Then they were asked to comment on them (add, agree/disagree). Finally they should order the indicators/changes according to their importance.

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*Interview:*

ST: Claudia visited some houses and got replies. This is her last day now and we would like to know whether the answers she got during the interviews are correct, and you can add comments on it. Alem Tsehaye will also ask questions to you. We want to get on hand evidence on the changes by electricity.

AT: Claudia wants to know what changed in your life by getting light. I heart the road was bad in former times, maybe now it's improved due to electricity, since many people are coming here?

ST: We want to be neutral and let the people talk..

AT: And maybe your children help you with your work at the daytime and can study at night.

W: Yes, there is no more kerosene smoke.

AT: The smoke of the kerosene lamps created eye problems, which are now reduced. Kerosene lamps were spilled and people burned.

W: Our children don't quit the school early, they attend it for more years [FW: People may mix different factors and not clearly differentiate changes from SHS and other changes.]. Now they can study at night. The whole daytime is occupied with farm work, fetching water and so on.

When we bought kerosene for 2ETB, that didn't last long. So we're even helped economically. Our health also improved. We're really happy about the electricity. Now since this issue is solved, it would be good if you would also deal with the water problem [the broken water pump].

Adult people who are working during daytime now can go to school during night.

AT (Starting to present the answer sheets to *Changes by SHS*, starting with *Education*):

Now with radio, TV and tape you can see what is happening in Addis Abeba.

W (agree to point 1 (*Improved child education due to studies at night*) and 2 (*Adult education in the night class*) but not with 3 (*Information by TV/tape/radio*)):

We have radio, but don't normally listen to it. We are too old for that.

AT (Presenting answer *Health: Health improvements by smokeless light*)

W: We had black mucus coming out of our throat in the morning and black slime in our eyes as well. No this is solved.

AT: Who mainly benefitted from SHS health improvements?

W: All of us. Also our husbands benefit. Before, they had to leave early without breakfast because it was too dark to prepare food. After the sun rose, we prepared their breakfast and carried it to the fields. Now we can use the light early in the morning and make them breakfast which they take along to their fields.

AT (explaining the point *Quality of Light* (meaning *Safe light (no danger of fire accidents), Bright light, Cleaner house due to smokeless light, Easy to use (just switch on/off)*), but by mistake talking about *Quality of Life* instead):

Now your life quality is improved because your house is clean. You have much time to do things at night. Now there is no more hurry.

W: Yes, yes!

W: Before we had to finish all the work at daytime. But now we can take a nap during the hot noon and finish work at night. There is no hurry any more, we have enough time.

AT (explaining the point *Social Life* (*Spending more time with the family at night, Meeting friends in the evening, Stronger community bonds due to more social interaction, Time to follow personal interests (reading, praying, writing, etc)*):

It is our culture to visit neighbours during happy or sad occasions [e.g. marriage, burial ceremony] and also to go to church in the morning. When you go to church in the morning, you have to leave some work. How does having light in the night influence your daily, cultural activity?

ST: Previously you directly had to go to bed after coming home in the evening. Now you have the opportunity to discuss with family members. As an example, I knew a man who had a very messy house before getting a SHS, because he hadn't got the time to clean it up in the eve and also he didn't spend much time at home, just for dinner and breakfast. When he got solar, he took time to put everything in order and now his house is clean. What do you do in your family? What is the added value to your life, other than getting light with that your children can study at night. We believe that you get time to discuss with your family at night. What do you say about this?

W: We are really enjoying doing activities at night. Previously we were not able doing that. You already know that [addressing AT].

*Laughter.*

During burial ceremonies, we stay at our neighbour's place until midnight. We even collapsed with other people on the street because we couldn't see them in the dark. Now there isn't this problem any more, since we have solar street light. Even now the number of thieves is reduced. Because there is light, we can recognize and catch them. The **security** is increased.

*CB writes "Security" as a new point on a card.*

AT (talking again about *Entertainment*): We already had the point of entertainment, and you said you don't really listen to the radio.

ST: Do you own and listen to radio?

W1: I don't have a radio.

W2: I have but don't listen to it, because I am busy.

W3: My husband is listening to it. He really follows it much, until midnight.

*ST explains to me: People are not so much used to using the radio, since they don't see who's talking. This is strange for many people in the villages.*

ST: Does your husband forbid you to listen to the radio?

W: No, no! But we prefer working instead.

*AT asks the men (ST and Girma) to leave the room.*

AT: Now I told the men to leave the room, because I we have our own secrets to talk about [meaning women issues].

Previously, we went to the bed early, because there was no light and then the men wanted to have sex. Then we would give birth. That is a burden for us. If we want to improve our life, we have to control our birth rate. The burden of a woman who has 2 children or 3 children is not the same.

W: Yes, yes!

AT: If you want to live your own life, you have to control it. It seems we are just created to serve for them like a slave. Therefore we have to control the birth rate. Now having this light in your home, you don't go to bed early. And the men don't come back home early, they will stay outside [meeting other men, drinking, etc.]. In the night you are working nowadays, you have some activities. Therefore the man will not ask you to come to bed. Instead he will just come and sleep. The opportunity of giving birth will be reduced. Have you observed that in this village? Feel free to speak!

W: In order to improve women's lives, much work should be done on the water issue [reducing the distance the women have to carry the water home] and on controlling the birth rate. Previously I would work on home activities and I couldn't find it [birth control pill], because it was dark. I would bring the pills from the clinic, put it somewhere and not find it when I would need it at night. Now I can find it easily [and take it before having sex]. There is a big change in our life.

AT: So now the men stay outside longer and drink. What is their behavioural change? Are they drunk when they come home and disturb you?

W: No, there is no problem.

There is a big change. I can wash today's night what I want to wear tomorrow. And also the duty man in the clinic will be available at night. Before, nobody was assigned because there was no light.

AT (explaining the point *Opportunities (New opportunities in life which lead to start of new initiatives)*): Having light you benefit from the mentioned things. What is the missing one?

You have light, so can you use it for further purposes? For example getting education at night; on health issues, about family planning, agriculture, and so on..? [Meaning especially education for women, f.e. about the following issues:] Many women can share their works so that one cares for all children while the others work. Women should take care on their health more than men. They need more medical care than men. The gap between two babies should be a bit long. How to grow up her children. Using different kind of grains for feeding babies beside breast feeding [for older babies], that's a good nutrition for babies. This will make your babies healthy and save costs for health treatment. There are things which you could get but so far don't have.

W: That's water. We tried both cattle types, habesha and ferenji, but without water we can do nothing. We want to have more cattles, our village is really good to keep cattles. But without water that's not possible, therefore we give our feedstock to relatives who live in other places. We know how to handle and look for the animals, but without water we're not able to treat them right. The government should introduce a policy plan for giving us education and so on. But nobody is motivating us to learn. The Woreda administration always just talks about crimes and so on, but they don't care about education and other social problems. Even when the solar project started, the Woreda did not support it. They don't care about us, don't listen to us, respond no answers to our problems. The water pump is not repaired. If it was for them, they would immediately repair it.

...

"So what?" the government says.

In Addis they really get education. Even at the old age they can still learn. We want to learn! We try to organise ourselves to educate our children [maybe meaning Kindergarten]. For example by collecting some money and so on, we want to educate our children. We are the ones to do that. There is no good support from the government and at Woreda level.

AT: We are the ones voting for the government. They are elected by us...

W1: We are together with other villages in our Woreda. But we want to be independent from them. Also because we are economically stronger than them. Let us be alone! Our income is good, we are economically strong...

W2: Yes we are economically strong!

W1: ...our only problem is the water.

AT (explaining the point *Economics (Less expenses for lighting, More income due to new/increased business times)*): With solar you do handcrafts at night, like producing Mesob [Injera plate], knotting/spinning Gabi [traditional clothes], preparing K'ollo [snack from wheat] and bred, so you have increased income. On the other hand you reduce the cost of light when shifting to solar.

*Agreement from the women.*

AT: Is there something else to add?

W: Before, our life was dark. Now it is bright and even our mind can think and we can speak.

*Starting with the ordering now.*

W: We believe that now there is a big improvement to our health, because we have 24h service, unlike before. Especially before giving birth, it's a big help to have 24h service.

*→Most important improvement from SHS: Health*

W: Generally we really benefit from solar [Can not prioritize further.].

AT: Do you think the order is right?

W: Yes.

AT: Entertainment goes with quality of life? If there is TV and entertainment, there will be a good life quality?

W: No it will not, because we have a water problem.

When we run out of water from the source, we have to use the water from floods. We will be ill from that. What will make us sick is that water.

The water from the source near Rema is really clean. It's everywhere tested and proved to be clean.

AT: How do you care for the system, so that it functions well?

- W1: If there is a 3 lamp system, with 1 lamp switched on we won't use the other 2. We always try to save energy.
- W2: So far I didn't have any maintenance problem, since I have the system since 5a.
- W3: In the neighbour village using SHS, they always have problems with their systems and ask for maintenance. We are surprised and ask them what they do with the system. They say they turn it on continuously during the day, listening to music and so on. Also at night they always have the light on. When they cut some trees, they destroyed the system. They are farmers, villagers...
- AT: Since the transmission line is already built up to Rema, would you be interested in getting electricity from hydropower by the grid?
- W (all): NONONO, we don't want to throw our solar!
- AT: Why don't you want grid?
- W: Some of our friends even enjoy watching TV with solar. Even me I had a solar TV but couldn't afford it at the end. Also Rema has lack of water, so how could we produce hydropower with that? Hydropower is human made technology, not natural like solar. We don't believe that hydropower will work. Moreover, SHS is our own property.
- 

*Pictures:*



**Picture 68:** The discussions were conducted in the SEF classroom on the compound. The yellow cards hanging on the rope show the results from the interviews, written in Amharic. The board gives the heading of the talk (first “development”, secondly “changes from SHS”) in the middle and the order “most important” in the left and “least important” in the right.



**Picture 69:** Alem Tsehaye opening the discussion for the women.





**Picture 70: Women telling their experiences.**

**7.2.1.28. Men group**

Archival No: R28

Site: Village: Rema, State: Amhara

Type: **Group discussion**

Data collector + translator:

During discussion: Alem Tsehaye (AT), Samson Tsegaye (ST)

Translation in Oldenburg: Firealem Wosene

Typist: CB

Date: 6.12.2011

Start: 11:30pm

End: 13:00pm

Duration: 1h:30 min

*Respondents:*

10 men from Rema using SHS (M)

*Other people present:*

Girma (camera man)

SEF housekeeping staff (bringing coffee and water)

*Situation:*

At the end of the interview period I did a group discussion with SHS users in order to verify the results. There were two group discussions, the first one planned from 9-10am with 10 female users, the second planned from 10-11am with 10 male users. Girma and the village administrator invited the guests. They choose them according to the criteria: SHS user, little problems with the system, rather long time of use. Moreover the people must be free in the morning, which is possible for most women, but for the male just for farmers who already finished the harvest.

I got to know about those criteria shortly before the discussion and did expect them to choose guests randomly. Girma explained as a reason for choosing successful SHS users,

that they may give hints for other users how to prevent mistakes with using the system and may talk about interesting and positive experiences with the system.

The people arrived later than 9, so finally the first discussion started around 10am. The women discussion was lead by Alem Tsegaye as a female chair and the men discussion by Samson Tsehay as a male chair.

The aim of the discussions was to verify the results from the preliminary interview interpretation. Therefore the results (development indicators, changes by SHS) were presented to the guests. Then they were asked to comment on them (add, agree/disagree). Finally they should order the indicators/changes according to their importance.

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*Interview:*

ST: We installed 2500 SHS. Now we want to know the change in your life. You have to answer correctly, because your answer is important for the study.

[Presenting the cards:] These are the answers from people during the interviews. Most of you can read [still reading it out to them and explaining everything]. Do you really believe you are getting those services from the solar technology? If you don't agree, you can just take off the card or if you have further ideas, you can add them.

M1: Previously we were afraid that a fire will break out from the kerosene lamp, which is now not scaring us any more. We were scared for the children and old people. Some people died from these **accidents**.

M2: The **crime** rate is reduced in places with streetlight. But in dark places of the village still crimes happen. Now the batteries for radios etc are getting expensive, and we are freed of these **expenses** by using solar. We reduced the amount of firewood which we were using for lighting outside in front of the houses for gathering and staying outside. Now we have light inside the house and **meet** there. People who were not able to buy kerosene, would have to use wood. Other people would have used kerosene and met inside the house. There was **smoke** from burning the wood.

Some people who don't save the solar, would light the solar light at night in order to make **thieves** think they are awake, so the thieves wouldn't dare to come inside.

I don't have words to explain what we get from solar. It really helped us a lot. Even **economically** we saved a lot of money. Some people are regretting that they don't have the SHS [Maybe they had it and it was taken away when they didn't pay the monthly rates.], because they see how much we are benefitting from the system.

I can not list out all the benefits we have, it's so much.

M7: I wanted to use a **fridge**, but hesitated to order it. Then the price increased even more and now it's so expensive. I'm regretting I didn't buy it before, because other people benefit much from it.

The **quality** of the light should be improved though. That would be nice, because it's not bright enough.

The people from neighbour villages **admire** our technology when they pass through Rema.

M1: We are really lucky and proud to be the first user of solar technology in this area. Especially when comparing solar to other technologies, like hydropower, which has interruptions for maybe 1 month for maintenance. We really benefit from this technology economically. We are the ones to give the witness, because we are the ones who know how much we benefit from it. We have seen some villages which have **hydropower**, but there are long interruptions in their electricity. We pay 2ETB/months. That is nothing for us, compared to what we are benefitting. You could even say that we use it for free when you compare the benefits to **the costs**. It's like a gift! Even if **Hydropower** is coming, I would not throw the SHS. I know, this is not enough, if we aimed to use large appliances. But we don't have to use such large technologies. For **our purpose**, just using light so that our children can study and so on, this one is really enough. Our children get more time to **study**. They are performing better now in school. We wish long live for this company. I hope you will continue, also introducing **other technologies** to us. We have really benefitted. How can I explain all of these benefits?

M6: The **crime** rate really reduced. I'm not exaggerating when I say that, it's true. In the beginning, when solar came to our village, there were some trained people from

other places in Ethiopia for maintenance. Now we know how to handle the system on our own, since they gave us a training. Then also local people were trained and are working as technical helpers here now, therefore **jobs** were created. If you ask anybody in the village, everyone would tell you positive things from the solar and thank the company.

Starting from June there is no **water**. They [*Menschen für Menschen*] promised to repair it up to September, but up to now, it didn't happen. The people really suffer from that: Just young and fit people can go there to fetch water, but it's difficult for the old people. And not all people can afford to buy the water [which is brought to the village and sold there], so **old and poor people** really have a big problem.

Nobody complains about you [*Solar Energy Foundation*]. Not only we who are here [in the discussion] are satisfied, but everyone in the village. It just would be nice if you would also deal with the water problem.

M3: So many people come here to buy the power boxes. They acknowledge our village and thank those who brought the technology to Rema.

The **teachers** are not afraid working at night nowadays. After they finish the lecture at night, they are safe walking home with light.

If you double this one [maybe the capacity?], we don't need electricity from other technology, e.g. **hydropower**.

Nobody complains about the technology. Even our neighbour villages appreciate it. Everything is mentioned already by the others, I don't have something new, so I just stop my explanation.

ST: Thank you.

M1: There is one thing left to add: We now keep in touch with the outside world by **communicating** with cell phone technology. If there is no charger, we can not use mobiles at all. Therefore SHS is a really big improvement to keep in touch with our relatives who are far. Now every farmer buys a cell phone to communicate with others.

*CB adds the card communication*

ST: Previously you directly went to bed at night. But now the families have the opportunity to discuss at night. Others can go to night school or work at night. So there are different options. What is your opinion, what do you do at night?

M3: Previously, to save wood or kerosene, everything was dark and we would [just shortly] discuss in the dark, or we would sleep. Now we can **discuss** with light and stay a bit longer. We are also shifting some of the **workload** from the day towards the night.

We really thank you, Samson! Your approach is friendly. You know very well what our problem is. [Tells a story about someone some time ago, who wanted to support them. He sent some goods with a driver to the village. On the way the car was stopped by robbers, who cut his hand.] How can people do that to someone who has good intention and who wants to help?

You are really close to us! Now we are satisfied with the solar, many changes happened. Just what is left is the **water**. Please solve the problem with the water, the second pump leading the water to the village and the filter. Then everything would be finished [all problems would be solved].

M1: **Women** can work at night. They produce Gabi, weave and knit. If somebody is **sick** at night, it is easy to treat him. You can easily give him water and so on. Even the light gives him some relief.

[Translation from ST:

M: Before, **women** were busy with important works all day. But now they have additional time to do handcrafts at night. They can use the additional time for productive works.

CB: Do you like and support when your wife has income?

M: Life is like a stretcher. You can't carry it just on one side. You need support. It's helpful if they make money for the family. It helps to increase our family economy.]

M2: **Old people** who have no one any more who helps them are getting care in the solar club. It's great of you to support them. Otherwise no one would do that.

When the bus comes late at night with travellers, we can prepare food and **sell** it to them, because there is light.

You can not finish listing all the services we are getting and benefitting. These are the main points. What is left is **water**, and this is urgent.

M: The **crime** rate is reduced, not only by the street light, also because of light inside the houses, which scares thieves from breaking inside. Moreover the hyenas don't come.

[He is an owner of a grocery] My customer want to listen to music. Therefore I have to play tape. It would be expensive to buy batteries for it. Therefore the SHS really helps me **economically**. I never had technical problems during the 5 years and no technician had to visit my home.

Now I pay 14ETB/month for solar. But the tape would need 6 batteries/day, 1 battery costing 12ETB [very high estimation!]. I use solar for light and to run the tape. I saw improvement in my business.

[Translation from ST: Bar owner didn't have any maintenance problems since the past 5 years with his SHS including tape recorder and light. He used to spend 36ETB/day for only the tape recorder. Now he totally pays 14ETB/month. These benefits really improved his business.

Before, with kerosene, no one had the appetite to stay long in the bar. But now, people forget what time it is, because they enjoy getting of the cold there.]

M: Previously when we sold meat, the smoke covered the meat, which is unhealthy. Now we sell clean meat and also alcohol. Therefore our service is improved.

Previously we just opened the shop for a short period of time: until 8pm. It was not profitable using wood and kerosene for lighting the business at night. Now it's profitable to work over night.

[Translation from ST: If we had to stay with light for doing work at night, before with kerosene the time was money. But now with solar we don't have to pay for that. So this minimizes our cost. ]

M: I am sewing clothes. If 3 people order for tomorrow, I can finish the work at night. Previously it was not possible.

M: What the solar technique benefitted to our life is a lot. It really changed our life.

[Translation from ST:

- Now I'm in this meeting and can't do my work. But I have time tonight. So when I go home, even at night I can work.
- It's ready to use. Before, when women came home late, they had to look for a match and for kerosene. But the solar light has just to be switched on.
- Suggestion for the future: If you solve the water problem and supply a solar water pump using also the solar filter, we would have 100% clean water and could **sell** that for making business. [business idea]
- Technical question for a small battery which fits in the pocket is raised.]

*Starting to **order** the cards:*

M: *Entertainment* is on the interest or future need, but is not a basic need now.  
The other things are all on the important side.

ST: How do you care for the SHS in order to avoid problems?

M: Mainly the systems work perfectly, even in the bar. Some have **problems** with the battery, mostly when they use tape recorder. Some batteries didn't work even after they were exchanged. Guesthouse owners who rent rooms with solar light complain that the people who rent it may use the light for the whole night, because they don't care because they don't own it.

We care for the system, because we have an ownership feeling for them.

ST: Would you exchange solar for **hydropower** if the grid comes?

M: If you take the SHS again, we would have our special war on them. We would pay every sacrifice to stay with them.

*Laughter.*

M: The meeting here was sweet before, now we come to the bitter part [using insulting words]. We want to keep the SHS!

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*Pictures:*





**Picture 71: Samson and the SHS users during the men group discussion.**