

Monitoring and Evaluation Toolkit for the Barefoot Solar Initiative
Capstone

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Introduction

In 1972, Sanjit “Bunker” founded Barefoot College in Tilonia, Rajasthan, India. The drive to set up the College was and is to find simple and sustainable solutions to water, renewable energy, education, healthcare, and livelihood. In the early 1970’s, the Barefoot team comprised of geologists, geophysicists, cartographers, economists, doctors, and social workers. However, by the early 1980’s, the urban crowd began retreating, and this changed the workers’ dynamic of Barefoot. This was the first lesson in sustainability by shifting the leadership and responsibility of Barefoot from urban specialists to local/rural leaders. This shift changed the thinking within the organization “as local people started becoming a part of the collective decision-making process. The College recognized that its dependence on urban expertise and paper credentials did damage the mindset of the rural poor, in effect preventing them from coming out of poverty on their own” (Roy & Hartigan, 2011). By handing over the leadership to the rural poor and local community made Barefoot College a success story. This community-driven approach relies on rural wisdom and finding simple local solutions to tackle community problems.

Barefoot Solar Initiative

Women’s empowerment, environmental sustainability, and stable livelihood are the main goals of the Barefoot Solar Initiative. At Barefoot, solar projects began in 1986 with a mission of electrifying remote communities, which had no access to grid or government electricity. This Solar initiative prides itself on being sustainable since the College uses democratic processes and treats the community members as partners, who manage the solar resources and technology. It started by training semi-literate and unschooled men and women from India to become Barefoot Solar Engineers (BSE). Currently, Barefoot trains only semi-literate and unschooled women from India and around the world to become BSEs. The College has ‘demystified’ this solar technology and is ‘decentralizing’ its application by making it available to poor and neglected communities. They believe that formal education / qualifications are not required to bring about a change in their community. For this reason, the solar model of training and educating completely challenges the assumptions of formal education, where semi-literate women become solar engineers.

Since 2008, around 60 semi-literate/unschooled mothers and grandmothers from India and least developed countries come to Tilonia, Rajasthan every year and immerse themselves in a 6 month solar engineering training program. The women train to create, install, repair, and maintain solar home lighting systems. Additionally, the BSEs learn to fabricate solar cookers and solar water heaters. This training takes place in a hands-on and practical environment; the women learn by hand-signals, colors, and drawings because no one speaks a common language at the training campus.

Upon returning to their village, the women solar electrify each household in their communities by installing photovoltaic systems (Solar Home Systems: a 40 Watt 12 Volt solar panel), run the Rural Electronic Workshop and receive a monthly salary for their work. The Rural Electronic Workshop is typically a permanent space that is donated by the community to carry out repairs and store solar components, spare parts and equipment. Additionally, a Village Environment Energy Committee (VEEC) is established consisting of democratically selected men and women from the community. The VEEC identifies households that are interested in acquiring solar home systems, consults with solar engineers, collects monthly solar fees from the solar beneficiaries, and opens a bank account. A percentage of the total solar contributions pay for the solar engineers' monthly stipend, and the remaining money covers the cost of spare parts and to replace solar batteries every five years (this occurs when the fixed deposit at the bank matures).

This Barefoot approach to renewable energy is replicated and adapted globally in 64 countries. Barefoot has currently trained 859 women and in turn, these women have lighted 1,081 houses around the world (Our Impact, 2013). This replication has been successful primarily because the solar electrification is local, self-reliant and self-sustaining where possible. The solar initiative focuses on the importance of building direct capacity at the village level to address rural electrification, environmental sustainability, productive employment, and women's empowerment.

Project Background

Over 1.2 billion people around the world live without access to electricity, and most of who live in the least developed countries (Energy- The Facts, 2012). In this situation, rural people seek access to these services by either migrating to the urban/ semi-urban areas or making it work with local and traditional lighting alternatives. Unfortunately, these local alternatives include kerosene, diesel, wood, candles, and dung, which are harmful to both the users and the environment. From interviews with solar beneficiaries in Rajasthan, India and Zanzibar, all interviewees used kerosene, wood, and *kibatari* (Swahili word for oil-lamp) to provide them with light, warmth, and fuel to cook. Moreover, expansion of the conventional grid system to these areas would overload the bureaucratic system, be expensive, and would dangerously increase the emission of greenhouse gases worldwide.

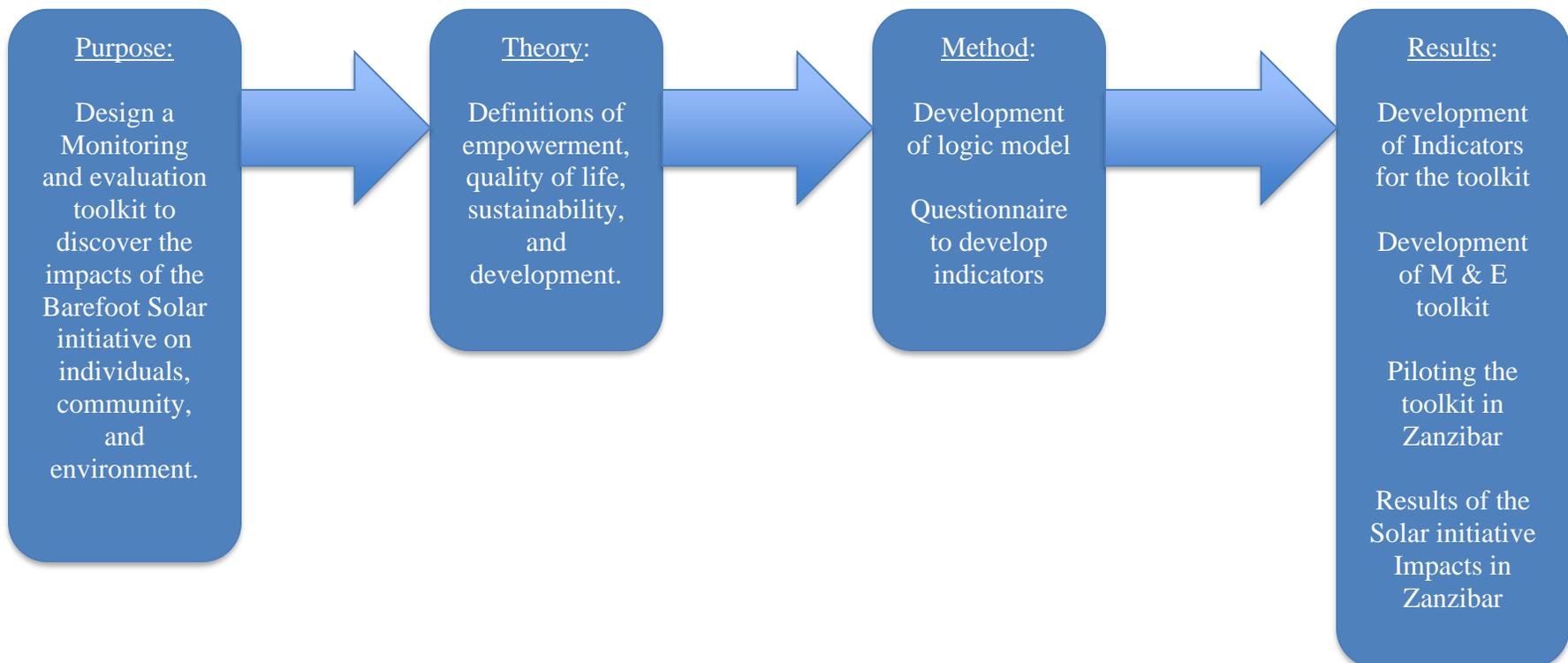
According to Keshab Das, there is direct correlation to electricity and rural development (social and economic) and that even minimum electricity for a few hours everyday would help in meeting the basic needs of the people and raising the quality of life (2012). Barefoot College found a way to answer the electrical needs of the rural poor without jeopardizing natural /non-renewable sources. They provide services to households that complement not conflict with existing social practices, behaviors, and roles. This results in empowering the rural community and contributes to development and sustainability. The Barefoot Solar initiative is designed to address these subjects of sustainability and development by interacting with the local community, utilizing indigenous resources (both human and resource capital), and the actively involving the solar beneficiaries. This access to renewable energy allows communities to move up the economic and social scale and the diffusion of solar energy may have positive impacts when initiatives are implemented and adopted successfully.

Project description

The purpose of the capstone project was to design a Monitoring and Evaluation (M& E) toolkit for the Barefoot Solar Initiative to measure impact in the following areas: women's empowerment, quality of life for individual, household and community, and environmental sustainability. This toolkit will be used in 64 countries that have implemented the Solar initiative and will be translated into multiple

languages. Currently, Barefoot does not have a formal M & E system, however, they have recently received a grant from the Barr Foundation to help the College enhance their M & E capabilities. Monitoring and Evaluation is needed at Barefoot not only from a donor's viewpoint, but also for the success of the program. There is a need for the ground partners (Barefoot teams with a local NGO in each country they work in to provide logistic support) to play a more active role in monitoring and strategic decision making, there is a need to track impacts and outcomes beyond the scope of the initiative, and finally, there is a need to develop a M & E toolkit that will adapt with changing interventions in different countries and contexts. Measuring development, empowerment, quality of life, and social change are difficult to measure since the results are often indefinable and difficult to quantify. This M & E toolkit will be an effort to evaluate the un-measurable. Below is chart that summarizes the purpose of the capstone project and the M & E toolkit design structure (Figure 1).

Figure 1: Design structure of the capstone project



Objective of the project

The objective of the project is to increase knowledge of the impacts of the Barefoot Solar initiative through field studies and literature on empowerment, development, quality of life, and sustainability. The main concern of the project work is to investigate and assess the solar implementation in rural communities to develop indicators and design the M & E toolkit to facilitate Barefoot College and other key stakeholders to improve their future evidenced-based decision-making. The deliverable will be an user-friendly and modifiable M & E toolkit to increase the capability and knowledge of Barefoot College, the 64 global ground partners, stakeholders, and funders/donors. Additionally, the deliverable will include a detailed set of indicators for the Barefoot Solar Initiative, which will present the data in a comprehensible and comprehensive form.

Approach taken

Barefoot College is a complex organization that works on different levels to achieve its goals. And since, Barefoot previously had no formal way of evaluating their solar initiatives in 64 different countries, the researcher had to start from the very beginning. Below are the steps that were taken to accomplish this goal of creating the M & E toolkit:

Step 1: Detailing in a written document the process of establishing a Barefoot community solar project

Step 2: Creation of a logic model and agreeing to outcomes and impacts

Step 3: Gathering data on indicators

Step 4: Developing key indicators to monitor outcomes and evaluate impacts

Step 5: Designing the M & E toolkit based on the indicators

Step 6: Piloting the toolkit

Establishing a Barefoot Community Solar Program

Barefoot's philosophy is that men and women who desire change need to be the architects of their own change (Innovation, 2013). Based on this philosophy, the following section details the setting up of the Barefoot's solar model in an international rural community:

Site selection – A NGO/ ground partner (anywhere in the world) invites the Barefoot Solar team to their targeted/non-electrified rural area. The ground partner completes the Baseline survey (see Appendix B) prior to the team's visit. The community in which the solar initiative is to be implemented must be remote and non-electrified and will not be covered by grid/government electricity over the next 10 years. Additionally, the minimum number of households in the selected community should not be less than 100. The Barefoot Solar team visits the site and selects the women through a democratic and transparent process with the community.

Community commitment – The community must make three commitments before the solar installation. First, the community must agree to replace the traditional lighting expenditure with an equal or slightly less monthly household contribution (solar fees) towards the maintenance and repair of the solar equipment. This contribution will go towards paying the solar engineer's monthly salary and the rest will mature to replace the solar batteries as needed. Second, the community agrees to build or provide a space for the Rural Electronic Workshop, where equipment will be stored and repairs take place. Third, the community must form the Village Environmental Energy Committee (VEEC) comprised of 3 women and two men responsible for monitoring and managing the solar program and collecting solar fees. Household contribution regularity is closely monitored and action taken for prolonged non-payment.

NGO commitment – The NGO is responsible to arrange passports, visas, medical check-ups, and other travel necessities prior to the women leaving for India. After implementation of the project, the NGO works closely with the VEEC and solar engineers in overseeing the success of the project. The NGO may also be responsible for securing funding for additional solar equipment and other solar related expenses.

Six months training in India – The women participate in the training six days a week for six months. The training utilizes visual and sign language techniques in a repetitive environment since a common language does not exist. They learn how to construct solar equipment from a blank printed circuit board to a solar panel, solar lantern, and solar cooker. Additionally, they train to set up a Rural Electronic Workshop and learn about Solar Sanitary pad production. The Government of India in partnership with ITEC (Indian Technical and Economic Cooperation) program funds the women’s travel and stay during their six months in India.

Shipping: Ideally, the solar equipment (panels, batteries, lanterns, mobile phone chargers, and spares) would arrive to the communities before the BSEs return. During the six month training, the VEEC should be formed with clear and concise instructions, the beneficiaries should be selected, and the solar fees should be determined upon based on battery replacement and the current cost of traditional light source.

Implementation: After their return, the women are responsible for the installation of solar panels in their communities. They are also responsible to share and disseminate this sophisticated technology with members of their community and train other women, thereby passing on their knowledge and sustaining the model. The transfer of the knowledge takes place when the women and NGO agree to set up Vocational Training Centers.

Monitoring and Evaluation: The NGO partner and solar engineers will be responsible to update Barefoot College about the progress, challenges and impact of the solar initiative.

The College’s approach to solar technology is designed to show the “first technically and financially self-sufficient model of solar electrified rural communities” (Roy, 2011). Private companies using a top-down process in which communities have no stake in the

initiative and the initiative knows little about the community's needs implement most solar programs in rural developing countries (2011). The distinguishing feature about this approach is that it is community-owned and managed, but uses private sector funding and investment. Communities have taken this approach and opportunity to provide electricity to not only their homes but also public spaces such as night schools, religious centers and small businesses. Most importantly, the impact of this model has been tremendous. However, to discern the impacts a thorough investigation was done to explore best practice research to M & E and key terms were defined.

Literature Review

The Barefoot Solar Initiative model augments the resources available to women, redefines their roles in a community, and expands economic empowerment, which in turn has an effect on the quality of life, women's status, education, and the natural environment. These attributes are multifaceted, contextual, and constantly changing, and are challenging to measure.

Measuring Quality of Life

The term "quality of life (QoL)" is complex and multidimensional. Traditionally, it had a material focus with the most common measure being monetary income indicators. "While [these indicators] are clearly vital and essential instruments to achieving a high quality of life, there are several reasons why quality of life measures based on [monetary] resources alone could be insufficient" (Alkire, 2005). To understand people's lives in a holistic way, concepts of subjective well-being and happiness will have to be taken into account. Alkire argues that if QoL is to be measured, the capability approach should be used. This approach postulated by Indian economist Amartya Sen contends that "that the quality of life should be conceived and measured directly in terms of functionings and capabilities instead of resources or utility" (Alkire, 2005). This approach dismisses evaluations based solely on income and resources, and that focus should be given to people's capabilities and functionings.

The advantages of this approach is that it is an “ethically individualistic theory, meaning each person will be taken into account, it looks at people’s beings and doings in the market and non-market setting, and finally, it acknowledges human diversity, such as race, age, ethnicity, gender, sexuality, and geographical location” (Robeyns, 2003). Robeyns proposes a list of capabilities that should be included while assessing the QoL: physical health, mental health, knowledge/intellectual development, labor, care, social relations, recreation, shelter, living-environment, mobility, security, respect for diversity, and political participation. This approach provided a framework when assessing and measuring QoL for the Barefoot Solar initiative. However, these capabilities were formulated for industrialized western communities and were duly noted.

Furthermore, Ruut Veenhoven provides the four-qualities-of-life framework to aid in the understanding of what QoL is and how it should be assessed. These four qualities are

1. Outer qualities life chances: denotes the meaning of good living conditions.
2. Outer qualities life results: represents the utility of life and presumes some higher value.
3. Inner qualities life chances: denotes how well a person is equipped to cope with life’s problems.
4. Inner qualities life results: represents the subjective appreciation/well-being of life.

(Veenhoven, 2000). These indicators along with Sen’s capability approach provide a richer rationale in measuring the QoL since these frameworks focuses on the complexity of people’s lives.

Sen’s Capability approach differs from other approaches that view development mainly in terms of monetary values and growth in income, which does not necessarily equate to progress or development. Therefore, instead of focusing solely on income, the M & E toolkit focuses on well-being, poverty reduction, and expanding capabilities, and the solar beneficiaries and solar engineers defined and explained what functionings they valued, which added to the existing/ assumed indicators.

Measuring Empowerment

The core concept of the Capability approach is to enable people to become agents of their own lives and communities. And apart from the human development capabilities discussed above, the capabilities approach can be expanded to agency and self-esteem of women, motivating them to scale the poverty ladder and empowering them to begin the process of change. According to Green, women's empowerment is to "redress the gender imbalances created by patriarchy and reform relations" (2008). According to Mosadale, women's empowerment is "the process by which women redefine and extend what is possible for them to be and do in situations where they have been restricted, compared to men, from being and doing. Alternatively, women's empowerment is the process by which women redefine gender roles in ways which extend their possibilities for being and doing" (2005). According to the World Bank, women's empowerment is the "expansion of freedom of choice and action" (Malhotra, Schuler, & Boender, 2002). Numerous scholars reflect different notions of empowerment and because of this, the concept of empowerment is open to wide interpretation, which presents particular challenges for evaluating the impact of the empowerment. However, a few key features are repeatedly mentioned such as: decision-making, choices, opportunity, control, and power, but they do not provide an all-inclusive view of empowerment.

Empowerment should be seen as a process and an outcome (Jupp, Ali, & Barahona, 2010). Jupp, et al argue that it is improper for an outside researcher to pre-determine women's empowerment and they propose an approach that "privileges people's own experience, their perceptions and realities, resulting in all the indicators being derived from their own analysis of change" (2010). This kind of participatory assessment can "empower and transform relationships, while at the same time generate reliable and valid statistics for what were thought to be only qualitative dimensions" (2010). Jupp et al's study deeply guided the Indicator Development process for the Barefoot Solar initiative.

Malhotra, Schuler, and Boender provide the most comprehensive framework where empowerment is measured in different stages within specific contexts. This framework recommends six areas to look at when measuring empowerment: economic, socio-cultural, familial/interpersonal, legal, political, and psychological (Malhotra, et al, 2002). The definitions and indicators from this study provided

assumptions on which the Indicator Questionnaire (Appendix C) for the Solar Initiative was built for testing the validity of the academic indicators and putting them into context.

Environmental Sustainability

Women's empowerment and the environment are inextricably linked. Environmental problems like climate change, GMO's, clean water and air, have a direct impact on women "because women in particular are vulnerable to the earth's sustainability, and their involvement with environmental efforts is crucial" (UNDP, 2013). Environmental sustainability primarily focuses on people's well-being (Molden, Janoušková, Hák, 2012). When measuring environmental sustainability, Molden et al suggest using reference targets/value, which can be used as a baseline to link them to indicators. Even vague qualitative targets such as 'reduce the use of wood/kerosene in households' can be important. The second step is to decide on the indicators, which can be classified into four groups "(1) What is happening to the environment and to humans? (2) Does it matter? (3) Are we improving? and (4) Are we on the whole better off?" (Molden, et al, 2012). Using this approach, connections were made between rural solar electrification and women's quality of life.

Indicators/ Performance Framework

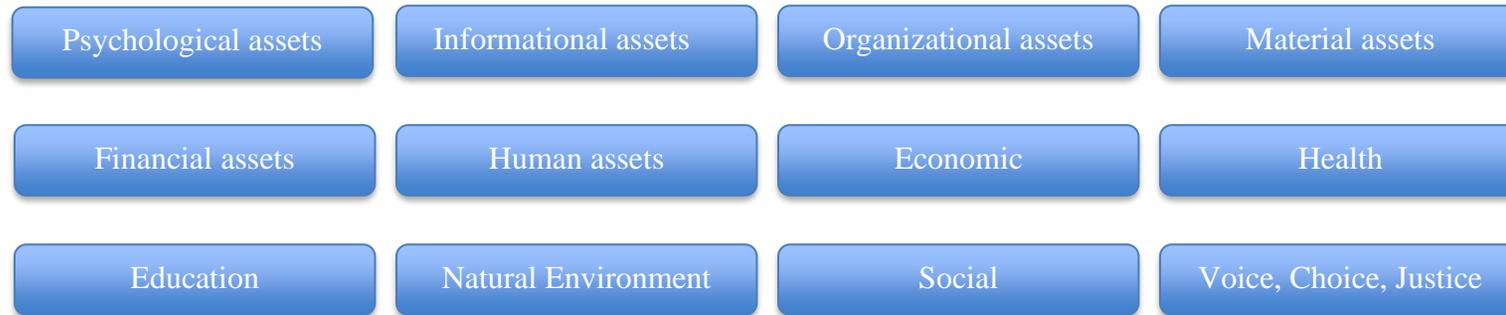
Projects, like the Barefoot Solar Initiative, that address gender and socio-economic-politic concerns are key to advancing sustainable development and natural resource management. To assess whether these concerns are met, the development of indicators or performance framework are necessary. "Indicators are inevitable approximations. They are not the same as desired change, but only an indicator of that change. They are imperfect and vary in validity and reliability (Church & Rogers, 2006). When change is tangible and measurable indicators aren't needed (2006). However, with the Solar initiative, change is subjective and more abstract, and the development of indicators would help estimate change and define progress. Selecting and determining valid indicators shows the present state of a situation and should be precise and clear. Roche suggests that indicators should be SPICED: Subjective, Participatory, Interpreted, Communicable, Empowering, and Disaggregated (1999). Indicators should also be a combination of

qualitative and quantitative measures that would help stakeholders learn about the process of change. The SPICED approach is unique and fits well with the Barefoot Solar Initiative since it uses participatory models, which recognize local contexts and include different ideas of change and what it means to different stakeholders. Judd, Ali, and Barahona believe that the “process of evaluation is in itself empowering and the approach to developing indicators should be led by insiders (project participants) (2010). They encourage using participatory approaches (or Participatory rural appraisals) to describe the impacts of the project. Since empowerment, quality of life and sustainability is a process, the project focused on the stakeholders (mainly solar engineers, solar beneficiaries, and solar trainees) to gain the true indicators of the initiative. This model also fits in with Barefoot’s philosophy of the bottom-up approach of grassroots participation. Using Judd et al’s suggestions, the statements that were transcribed from the Indicator Questionnaire were synthesized into the “language of indicators.” (2010).

Similar to Judd et al and Sen’s capability approach, Alsop and Heinsohn, provided an analytical framework that guided the design of the M & E toolkit and framing indicators. Alsop and Heinsohn specify some universal indicators that were useful to the Solar Initiative: asset endowments (indicators of agency) are psychological, informational, organizational, material, social, financial, or human; and Degrees of Empowerment’s indicators are existence of choice, use of choice, and the achievement of choice (2005). The authors support that local and context specific definitions of indicators can be generalized in degrees of empowerment in different countries. This is especially important since the Barefoot M & E toolkit will be used in 64 different countries.

Using Alsop and Heinsohn for empowerment and The Aga Khan Development Network for quality of life, the following broad range of domains were used to develop the Indicator Questionnaire and ultimately develop the key indicators for the Barefoot Solar Initiative (note: the list provided by these two sources were used as a framework and only those domains validated by the voice of the stakeholders were used) (Aga Khan Development Network, 2008). Figure 2 illustrates the 12 domains of empowerment and quality of life that can be applied to the Solar Initiative.

Figure 2: Empowerment of Quality of Life Domains



Project Methodology

The main purpose of all the questionnaires was to listen to the solar people of the rural communities. The collection of data involved observations, questionnaires, interviews, focus group discussions, and secondary data. A combination of open-ended and close-ended questions (with response categories) was used to gather both quantitative and qualitative information.

An Indicator Questionnaire was designed to collect information to develop the core set indicators for the Barefoot Solar Initiative. The stakeholders involved were solar trainees, solar trainers, solar engineers, solar beneficiaries, and field officers. The sample size was determined largely on realistic grounds taking into account of the resources available. The 12 solar communities chosen were in Rajasthan, India along with the Barefoot campus where the solar trainers and solar trainees resided. Figure 3 indicates the primary data collected.

Figure 3: Stakeholders Interviewed (98 percent of the interviewed conducted were with women)

Name	Number of stakeholders interviewed	Country represented
Solar Trainees	10	India, Nepal, Comoros, and Zanzibar
Solar Trainee: 2 focus groups	21 participants total (first focus group: 14 participants; second focus group: 7)	Malawi, Djibouti, Burkina Faso, Guatemala, Colombia, Panama, Nicaragua, and Cambodia
Solar Trainers	2 (one man and one woman)	India
Solar Engineers	6	India
Solar beneficiaries	18	India
Solar beneficiaries (children from solar communities and solar night schools)	12	India

A random sampling was used in the solar communities, where lists of solar beneficiaries was obtained from field officers and solar engineers, and then randomly chose individual households by walking around the communities. The Indicator Questionnaire was designed based on the 12 broad domains and was developed in English, and then translated into Hindi and Marwari, and translated back into English. The capstone student and the field officer/solar engineers collected the data. This helped the interviewees feel comfortable to express themselves freely. Disaggregating the data collected by domains and context revealed an important range of indicators. Most of the communities chosen had solar electrification anywhere between 2-4 years and were able to compare their lives before and after solar.

The second part of the methodology was sorting the statements and developing the indicators. From the Logic Model and domains, appropriate categories were selected to sort the statements and patterns emerged. The statements were then synthesized and a number of statements were chosen that had the potential to become indicators (See Appendix D). These indicators were organized into a table for the M & E toolkit (See Appendix A). Developing the indicators was most crucial because if indicators are poorly designed, monitoring and evaluation could be challenging. Subsequently, based on these indicators and logic model, the M & E toolkit for the Barefoot Solar Initiative was designed.

The third part of the project was designing the M & E toolkit and conducting a mini evaluation in Zanzibar . The evaluation in Zanzibar was conducted to not only see the impacts of the solar initiative but to pilot the M & E toolkit. The toolkit was designed to monitor and evaluate the solar engineers, solar beneficiaries, NGO partners, and the Village Environmental Energy Committees (see Appendix A). This toolkit is to provide guidance and a reference to the monitors and evaluators in the 64 different countries in order to build a common and well-functioning M & E system. Throughout the toolkit, an effort was made to explain the purpose of M & E, define key terms, and includes instructions on how to conduct a thorough Barefoot M & E for the Solar Initiative.

In Zanzibar, the toolkit was piloted to determine primarily whether the questions measured what it was supposed to measure, whether the respondents understood the questions in the same way, calculate the length of the questionnaire, see whether it collected all the information needed, determine the difficulty in translating the questionnaires to Swahili, and consider the amount of information lost in translation.

The purpose of the mini-evaluation in Zanzibar was to provide Barefoot College, Wanawake Kupande (the NGO partner/ground partner in Zanzibar), and stakeholders with an assessment of the Solar initiative in the community of Kandwi, and report key findings. The evaluation assessed the impacts of the Solar initiative, assessed the relevance of the project to the needs of the beneficiaries, reviewed the roles and responsibilities of the initiative's key actors, and finally, assessed the sustainability of the project. Additionally, this piloted evaluation enabled the project to expand and validate the indicators. Due to time constraints in Zanzibar, one staff member of the NGO, three solar engineers, four members of the VEEC, one shopkeeper, and 10 solar beneficiaries were interviewed. Apart from interviews, observations and conversations with the village leader helped understand the social structure and activities of the community.

Limitations

Many of the limitations related to the structure of the questionnaire, as well as interpretation and translation issues. In Zanzibar, the NGO field officer, who aided in the translation and conduction of the interviews, had never conducted an interview or an evaluation. This made the interview process take a significant amount of time to carry out and the field officer had to be constantly reminded about not prompting the interviewees. Some problems arose in those questions that could not be literally translated into Swahili. However, this helped in redefining some terms and changing the structure of the questions to be specific and perfectly vague at the same time, so when the M & E is translated into different language little gets lost in translation.

A second limitation is that Barefoot College did not have any of their solar initiative processes and scope of work recorded. Additionally, the College did not have a logical framework or theory of change, making the process of designing the M & E toolkit challenging. The researcher communicated and documented the complex program goals, activities, and intended outcomes by conversing with the Barefoot Solar Team in Tilonia and observing the training program on campus.

Project Outcomes

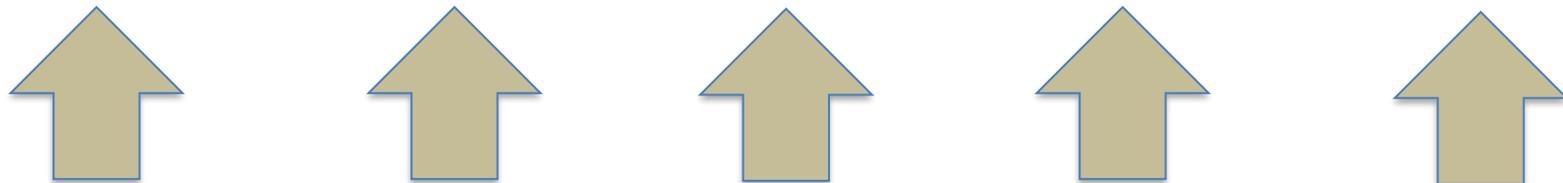
Logic Model

The development of the Logic Model for the Barefoot Solar Initiative was necessary in planning, describing, and evaluating the initiative. The graphic below (figure 4) represents the relationships between the solar activities and the intended impacts and outcomes. This Logic model can be used as reference point for all actors involved in the program. The contextual factors at the bottom of the Model are external elements beyond the program’s control that can facilitate or impede the initiative’s ability to achieve specific outcomes.

Figure 4: Logic model for Barefoot College

INPUTS		OUTPUTS	OUTCOMES (purpose)		IMPACTS (goals)		
<i>Input</i>	<i>Activities</i>	<i>Components</i>	<i>Short-term</i>	<i>Long-term</i>	<i>Economic</i>	<i>Environmental</i>	<i>Social</i>
<ul style="list-style-type: none"> - Solar team - Solar trainees - Solar trainers - Fundraising and financing scheme - Equipment(solar panels, lanterns, light 	<ul style="list-style-type: none"> - Selection - Training - Electrification - Expansion 	<ul style="list-style-type: none"> - # of women trained - # of hours of training - # of houses electrified - # of villages electrified - # of public places electrified (schools, local businesses, libraries, community 	<ul style="list-style-type: none"> - Extended work day - Longer study time - Extended business time - Savings from reduced use of kerosene, fuel wood - Better ventilation 	<ul style="list-style-type: none"> - Ease in vigilance (safety) - More leisure time - Improved convenience - Reduced time spent in collecting firewood - Improved health - Improved education/grades 	<ul style="list-style-type: none"> - Reduced poverty -Sustainable practices - Better working conditions - Improved roads/public facilities - Growth in small businesses - Increase in savings 	<ul style="list-style-type: none"> - Improved air quality - Reduce in fossil fuels/ kerosene - Reduction of deforestation - Less soil erosion 	<ul style="list-style-type: none"> -Improved health - Quality education - Safety and security - Gender empowerment - Improved quality of life - Better connectivity - Increased women participation - Increase in decision making - Improved values/traditions - Increase in personal

fixtures) -Local NGO/ground partner - Government officials - Village solar committee -solar manuals - Technical support		spaces) - # of solar committees - # of rural electrification workshops - # of solar cookers - # of POG* trainers - # of gallons of kerosene saved - # of trees saved		- Increase in household income - Better living conditions -Reduce migration to cities	- increase in the number of night schools		freedom/independence - Changes in the perception of women's roles
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Contextual Factors

- Government of India; ITEC for funding the training of women from India and other countries
- Community involvement and support from the country's government
- Competition from grid/conventional source of electricity
- External funding for solar equipment
- Socio-economic conditions: poverty in community and inability to pay solar fees
- Availability of solar equipment and shipping of solar equipment
- Donor cooperation
- Position of women in society

Indicator outcomes

From academic research, there is a lack of well-documented evaluations and field experiences from solar projects that focus mainly on rural areas, women’s empowerment, sustainable development, poverty reduction, and household impacts (Sullivan & Barnes, 2007). The studies that have been carried out focus on macro-level impacts; however, the Barefoot Solar Initiative has a unique model, and the development of indicators focus mainly on the micro-level. The table below (Figure 5) describes the domains, sub-domains, and indicators of the Barefoot Solar Initiative. These indicators and domains were formulated from the statements received from the Indicator questionnaire. The indicators are both qualitative and quantitative providing a holistic overview of the initiative. All nine domains can be directed towards the sustainability of the initiative.

Figure 5: Dimensions and Indicators of the Barefoot Solar Initiative (for a detailed version with interviewee statements, please refer to Appendix D)

Domain	Brief Description	Sub-Domain	Indicators
Household	The household/domestic domain considers the Quality of Life areas within the household that has changed or been affected by the solar initiative	<ul style="list-style-type: none"> - Comfort - Convenience - Family relationships - Time gain - Protection/security/safety - Freedom of movement - Health /hygiene 	<ul style="list-style-type: none"> - Perceptions of safety and security - Quality / hygiene of food - Use of saved time on productive/income-generating activities - Changes in health / deaths relating to traditional source of lighting versus solar lighting - Women’s perceptions in workload in the house - Control over sexual relations relating to child-bearing and contraception - Quality of light - Women’s freedom of

			movement
Profitability	This domain assesses the income-generating activities as well as business development as a result of the solar initiative	- Employment generation	- Percentage of businesses or new businesses due to solar - Perceptions of working hours of the businesses - People employed by solar (solar engineers, night school teachers)
Economic/Financial	Economic and financial sustainability analyzes the ability of solar beneficiaries to increase purchasing power, see an increase in household income, and increase income-generating opportunities through the use of solar light.	- Teacher/passing on the training - Employment generation - Savings	- Women's control over income - Women's contribution to family income - Household savings from traditional lighting - Household use of saved money - Extent to which women chose their type of employment
Environmental	Environmental sustainability looks at the extent to which the solar initiative has produced a replacement for traditional forms of lighting and any improvement in indoor air pollution. Additionally, this domain assesses any distinctive environmental benefit for the solar community.	- Fuel substitution - Air quality	- Amount kerosene/firewood saved due to solar - Perceptions of indoor quality of air and smoke - Smoke emissions from kitchen - Percentage of households that have stopped using traditional source of lighting - Reduction in CO2 emissions - Context specific environmental impact
Education	Education domain determines whether there is an effect of the	- Study/Reading - Night schools	- Commitment to educating daughters

	solar light on studying, reading, and education opportunities.		<ul style="list-style-type: none"> - Average time per day reading/studying - Parents' perception of changes in their children's education habits
Social	The social domain reports on the whether there is an increase or decrease in the realm of communication and information gathering.	<ul style="list-style-type: none"> - Connectivity - Friends 	<ul style="list-style-type: none"> - Perception of information and communication options - Change in social gatherings - Changes in the use of the electronic devices
Communal	This domain looks at the extent to which public spaces use solar light for community development or entertainment or religious or health purposes	<ul style="list-style-type: none"> - Community development - Leisure/entertainment - Safety 	<ul style="list-style-type: none"> - Percentage of increased community activities - Types of community activities and functions - Public spaces using solar electricity - Availability of street lighting - Community's involvement with solar project
Women's empowerment	Women's empowerment domain mainly focuses on the solar engineers and their status in their community after completing the training in India and returning to be "professionals." This can also be extended to the psychological changes in the women after the training and the solar implementation.	<ul style="list-style-type: none"> - Self-esteem/awareness - Leadership roles - Sense of fulfillment /accomplishment - Confidence/self-worth - Voice - Decision-making - Women's roles/status 	<ul style="list-style-type: none"> - Percentage of women who have experienced increase in confidence/self-esteem - Changes in life due to this increase - Women's participation in leadership roles - Women in decision-making positions at the household level relating to children and income - Redefining women's roles in the community

			<ul style="list-style-type: none"> - Changes in the perception of women - Capacity to visualize change - Percentage of women who take action against traditional practices
Technical	For the initiative to be technically sustainable, the solar engineers and the VEECs are responsible for reporting on the solar systems functionality and breakdowns. This domain focuses on the engineer-beneficiary relationship and management of the solar initiative. Additionally, this domain also assesses the energy use of the community and monitors the consumption patterns.	<ul style="list-style-type: none"> - System functionality - System depreciation - Stable energy source - Maintenance - Customer satisfaction - Ability to pay - Sustainability of project 	<ul style="list-style-type: none"> - Number of households electrified - Number of households with functioning systems - Number of households with inoperative systems - Uses of the solar lanterns - Brightness/ Duration of light - Timely payment of solar fees

The impacts of solar have multiple linkages with different sectors and domains that ultimately contribute to the quality of life, poverty reduction, and women’s empowerment. From these indicators poverty alleviation is not only seen in terms of monetary measures or consumption, but in terms of access to opportunity and human development. The table above provides an understanding of the connections between solar energy and solar beneficiaries, and is based on a combination of findings from various academic studies, but is mainly derived from statements that were collected in solar communities in India and Zanzibar.

Impacts of the Solar Initiative in Kandwi, Zanzibar

A mini-evaluation was conducted in the solar community of Kandwi, Zanzibar to assess the impacts brought by solar lighting, the sustainability of the solar initiative, and to learn whether solar energy alleviates poverty and promotes human development in the community. Kandwi is relatively big community situated in the north region of Zanzibar. It consists of four hamlets and 480 households, out of which 90 houses are solar electrified. Since 2011, 3 solar engineers have been trained (Fatima, Patima and Mwashamba) and solar installation took place in 2012. The community has a Rural Electronic Workshop and a Village Environmental Energy Committee consisting of 3 women and 3 men. The solar beneficiaries pay 6,000 shillings (\$4 approximately) per month to the VEEC for one solar panel, three wall fixtures, a charge controller, a battery, and a mobile phone charger. If the household pays a little extra, they receive a solar lantern. The NGO partner Wanawake Kupande (Women Empowerment Project) helps with the implementation of the solar initiatives in the various communities around Zanzibar.

The economy of Zanzibar is based on agriculture, fishing, and seaweed farming. Most of the community members on the island are Muslim and the rest Christian. An elected local leader (the *sheha*) governs at the village level and is recognized by the Government of Zanzibar. This *sheha* is responsible for the development of the community and presides over any conflicts within the community.

The status of women is fairly low in terms of decision-making regarding family size and income. The main occupation of these women is mainly seaweed farming because of the close proximity to the ocean and the massive commercialization of the product over the last few years. Women spend approximately one month to seed and harvest their weed, which they sell for only 400 shilling (25 cents) per kilogram. The income received does not indicate the amount of work these women put in. The seaweed farming provides a supplemental income for the family and in some cases the only income. Women also work on subsistence crops mainly used for family consumption. The people of Kandwi live a life of survival, however, they are relatively happy and have a vibrant culture of dancing and soccer.

All these activities and work were previously and currently (for most of the population of the community) done with traditional source of kerosene lighting called *kibatari*. The *kibatris* are easily portable but are expensive (the average household spends around 10,000 shillings per month on kerosene). Apart from this source, candles and flashlights were / are used. For some families, when money is scarce, the household lives in darkness. Therefore, the responses from the solar beneficiaries were unanimous in regards to making their life “easier” in a variety of ways. Figure 6 describes the analysis of the collected data on mainly women solar beneficiaries and solar engineers. Included in the table are details about the indicators with citations from interviews.

Figure 6: Impacts of the Barefoot Solar Initiative on the community of Kandwi, Zanzibar

Indicator	Description	Interview Citation
Change in the perception of women Women’s participation in leadership roles Percentage of women who take action against traditional practices	Two out of the three solar engineers expressed that the training in India transformed their lives and changed the way the community perceives women. The leadership roles as engineers have definitely challenged and/ or redefined the patriarchal norms in the community. The third solar engineer is currently waiting for the rest of the solar equipment to come in, so she can start working. However, she is confident that the new role will change her life and her status. Since this initiative is fairly new to the village, the impact on the roles of women is small but significant, and shows the multiple and complex roles that women can play (raising a family and working).	“Now, the community calls me an expert, now they call me in a respectful way not like before.” “Yes, the training increased my status in my community, especially in my house from my husband. My husband was amazed that I could build a solar lantern. The community respects me now, because now they come to me and ask me for advice.”

<p>Self-confidence / self -esteem</p>	<p>Solar engineers also experienced a boost in self-confidence and self-esteem in their new life and participation in their community. The women also talked about their future-orientated actions indicating a sense of self and agency. Utilizing the resources (the training and work) not for their own interests can bring about a sense of empowerment and this was observed in the BSEs.</p>	<p>“I like to build solar lanterns, it makes me feel good and is what I do best and what I like best.” “I feel good, proud, and honored to be a solar engineer.” “I enjoy everything about my solar engineering job. The people who talk bad about me are ignorant.” “When I get enough of money from solar, I will build a toilet for my children.” “In the future, I want to be a solar teacher and help the future children.”</p>
<p>Women in decision-making positions at the household level relating to children and income.</p> <p>Percentage of women who take action against traditional practices</p>	<p>Only the solar engineers recorded a change in the decision-making sphere regarding finances, thereby, improving her status in the household. However, the solar beneficiaries stated that decision-making was restricted and women did not participate in household decision-making regarding income or children. Making choices and having control over the resources and challenging the status quo were only seen in the solar engineers’ households. This shift can be assumed to be her international training and contribution of money to the household. However, the decision-making only focused on finances and allocation, and not on children/child-bearing matters.</p>	<p>“I sit together with my husband and decide what to do with the money” – BSE “We make the decision together. Only cooking and carrying water decisions, I make by myself.” –BSE “Only the man makes decisions regarding how many children to have.” – Solar beneficiary “Everything I do is the decision of my husband. My life is run by the husband.”</p>
<p>Perceptions of safety and security</p>	<p>The most significant impact to solar</p>	<p>“Solar is safe. kibatari doesn’t produce</p>

<p>Quality / hygiene of food</p> <p>Changes in health / deaths relating to traditional source of lighting versus solar lighting</p>	<p>beneficiaries' lives from solar lighting were safety and improved health. Two respondents reported severe accidents from fire, which broke out due to a disturbance in the <i>kibatari</i> lamps. Beneficiaries claimed that the quality of light was better and solar provided more light than the traditional sources. This helped them to guard for snakes, scorpions, and other bugs that came into their homes or in their food.</p>	<p>enough of light, but the lamps provide enough of light even to see small bugs and insects in my house and food.”</p> <p>“Once, before solar, my mosquito net caught fire when my children were near. My house is safer now especially for my children. I don’t have to worry about them when they play alone.”</p> <p>“The <i>kibatari</i> flame was dangerous especially for small children.”</p> <p>“My child is more safe because before in the mornings I would find <i>kibatari</i> smoke in their noses.”</p> <p>“I feel safe walking outside, because I fixed solar lamp outside my house. It’s like a city now.”</p>
<p>Perceptions of indoor quality of air and smoke</p> <p>Smoke emissions from kitchen</p> <p>Percentage of households that have stopped using traditional source of lighting</p>	<p>Another frequent and important impact mentioned was the improvement in the air quality in the household. All solar beneficiaries recorded reductions in indoor air pollution due to a decrease in smoke and increased visibility in the house.</p> <p>However, 80 percent of beneficiaries explained that <i>kibatari</i> was still used in the kitchen, which was located outside the home and did not have a place for a solar lamp. Therefore, the smoke emission from the kitchen area is unchanged.</p>	<p>“I don’t use candle or <i>kibatari</i> anymore. Except I use <i>kibatari</i> in the kitchen. I wake up early in the morning before sunrise to make food, so I have to use <i>kibatari</i>.”</p> <p>“Yes, air quality better. By using <i>kibatari</i> and candles, there was lots of smoke in the house, but now there is a change.”</p> <p>“I no longer use <i>kibatari</i> or candles. I don’t even know how much kerosene costs anymore. I cook early and then I have time to do other things in the house that has light.”</p> <p>“My house and curtains smell better.”</p> <p>“The air quality changed. In the morning she could fumes and smoke everywhere.”</p>

<p>Amount kerosene/firewood saved due to solar</p>	<p>For the most part, solar has replaced candles, kerosene, and flashlights. According to the NGO partner, a family spent a large portion of their income on kerosene. Even though some beneficiaries still used a small quantity of kerosene in the kitchen, there was still a decrease by almost 70 percent after solar lighting. It was recorded that 5- 6 liters of kerosene per month and per solar family was saved in the community of Kandwi.</p>	
<p>Household savings from traditional lighting</p> <p>Household use of saved money</p>	<p>The results from the solar beneficiaries highlighted that monthly expenditure on traditional lighting reduced substantially allowing for savings and spending. Ninety percent of the solar beneficiaries could not quantify their savings, since most spent it directly on clothing or basic needs for the household. Savings represents an economical plus for the households, however, only two households reported saving a portion of their money for their children’s future education.</p>	<p>“Yes, I save money. I keep the money to buy dresses for school and other things.”</p> <p>“I don’t save any money because I have to buy food for my house.”</p> <p>“I save a lot of money because I don’t buy batteries anymore for my shop. Because of solar I can keep my shop open longer, which is good for me and the people who work late.” – Solar shop owner</p> <p>“I used to spend 300 shillings per day to light three rooms in my house. Now, I only have to light the kitchen for very little time. The money I save I buy food and clothes for my children.”</p> <p>“I save some money incase my children need medicine or need to go to hospital.”</p>
<p>Use of saved time on productive/income-generating activities</p>	<p>It was reported that solar light enabled women and men to do productive work in the evening hours thereby increasing their</p>	<p>“After I eat dinner, I can still work on my mats and baskets.”</p> <p>“My income has increased a little because</p>

<p>Women’s perceptions in workload in the house</p> <p>Change in social gatherings</p>	<p>family income (80 percent of the respondents used this prolonged time productively). Women mostly did activities such as making and selling doughnuts, weaving baskets and mats, and producing other handicrafts. Some women and solar engineers use their solar lamps and lanterns for creative income-generation such as loaning out the lanterns or collecting a fee for mobile charging. Women who seaweed farmed valued the increased light time they gained. They reported during chores at night instead of waking up early, giving them flexibility of time to determine their daily schedule. However, sometimes this flexibility could burden them with additional work. Some women viewed this increased workload positively (in regards to increasing income) and for others negatively (it was reported that some husbands pressurized their wives to do more household chores).</p> <p>When not considering the prolonged light time from an economic perspective, solar beneficiaries (women and children) reported spending more time with family and neighbors in the nighttime, thereby expanding their leisure time.</p>	<p>I take money to charge my neighbor’s mobile phone.”</p> <p>“I have more time to cook doughnuts and cookies to sell in the nights.”</p> <p>“My work in the household increased because my husband makes me do more work in the nights and not in the mornings.”</p> <p>“I do not have business, so I spend more time doing house work.”</p> <p>“Sometimes our neighbors come over to talk in the night because we have light.”</p> <p>“More children come to my house in the night to play.”</p> <p>“My children can play longer in the night.”</p> <p>“The children went to sleep early before, now they have more time to play in the night.”</p>
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<p>Average time per day reading/ studying</p> <p>Parents' perception of changes in their children's education habits</p>	<p>It was reported that there was a direct impact between solar and education. All the mothers explained that their children did spend an average of 2-3 more hours studying in the night. The parents expressed that this benefited their children tremendously since they did not have to worry about them getting injured because of the <i>kibatari</i>.</p> <p>From some of the statements recorded, it was assumed that the quality of light was higher, which made it easier for children to read and revise their studies.</p>	<p>“Now I can see very well, I revise my exercise book. Before <i>kibatari</i> was low light and I could not see my books and my eyes would hurt. Now there is enough of light, so it benefits us.” – Solar beneficiary child</p> <p>“My children keep learning in the night sometime at 11 pm and 12 am and this is very good for them.”</p> <p>“The children use light for revising their exercises for school.”</p>
<p>Quality of light</p>	<p>85 percent of the solar beneficiaries reported an improved brightness of light and felt that the solar light was reliable and convenient. Additionally, the duration of the solar light as compared to <i>kibatari</i> was longer, provided there was sufficient sunlight.</p>	<p>“Now I have to only switch on a button and I have light even if I don't have money.”</p> <p>“<i>Kibatari</i> doesn't produce enough of light, but the lamp produces more light.”</p> <p>“I used to put the <i>kibatari</i> on a stool and there was not enough of light. But now, it is better.”</p> <p>“<i>Kibatari</i> only lights a small part but now solar lights the whole living area and some of the outside for a longer time.”</p> <p>“If I charge my lantern regularly, I get about 12 hours of light” – Solar shop owner</p>
<p>Number of households electrified</p> <p>Number of households with functioning</p>	<p>Currently, 90 out of the 480 households in the village of Kandwi is solar electrified. According to the VEEC, 100 additional</p>	

<p>systems</p> <p>Number of households with inoperative systems</p>	<p>households have signed up for solar and they are presently waiting for the shipment of new equipment to arrive.</p> <p>VEEC reported that Kandwi is divided into North and South, where the South side pays regularly and the North side defaults on payments often. The committee gives these households two months to pay (provided there is no dire financial constraints) otherwise the solar equipment is removed from the house and installed in another. The installation and removal of the equipment is done with prior permission from the <i>sheha</i>.</p> <p>VEECs have different structures and management systems depending on the location and culture of the community. In Kandwi, the <i>sheha</i> made final decisions and the VEEC committee members received a small stipend for their work (10,000 shillings per month).</p> <p>The concerning aspects reported by the VEEC was that no bank account was opened in a year and half and money was kept in a committee member's home. Secondly, the VEEC was not aware that the solar batteries needed replacement in the next five-six years.</p>	
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There are a number of influencing factors on the solar beneficiaries' experiences, and the impacts of the solar initiative will vary in different locations and cultures. Therefore, not all indicators will pertain to every solar initiative. It was definitely interesting to see that the impacts of the initiative in the Indian context (see indicators) were fairly similar to the impacts from the Zanzibar beneficiaries. The most cited impact with the solar beneficiaries was increased opportunities for income generation and greater study/reading time for their children. For the BSEs, the solar initiative has created for them a new space in the realm of women's empowerment: elevated their status in society, redefined the traditional "domestic/mother" role, increased role in decision-making, and an increase in self-esteem and confidence levels. The data collected concludes that there are more positive impacts than negative and the satisfaction of the solar initiative depends on the quality of solar energy provided, the understanding of the system and its maintenance, and the ability to pay for the services.

Recommendations

- Educating solar beneficiaries: to ensure the sustainability of the project, solar beneficiaries will need to be educated on understanding how solar works and the correct maintenance of the solar equipment. Providing a small amount of upkeep training will benefit the technical sustainability of the project. Most beneficiaries were unsure / unaware about the cleaning of the solar panels and one beneficiary damaged the system by replacing distilled water for rain water in the solar batteries. The responsibilities of the beneficiaries should be made clear and BSEs should be in charge of inspecting the systems and managing the solar community. For this reason, an additional short customer satisfaction survey was included in the M & E toolkit to gauge the positive and negative response of the solar initiative from a customer's point of view. Additionally, this will enable BSEs to implement different delivery models based on their customers' needs.
- Solar in the kitchen: It was noted that women continued to use kerosene for light and biomass/firewood for cooking in the kitchen areas. Women and children usually spend a considerable amount of time in this area and the combination of kerosene

smoke and firewood/biomass smoke creates a “cocktail of hundreds of pollutants such as carbon monoxide, nitrogen oxide, butadiene, and other harmful chemicals” (World Health Organization, 2006). Apart from the smoke effects, other negative effects of this traditional set up are time spent gathering firewood, safety concerns, quality of cooking, and environmental degradation. Most women interviewed reported waking early to cook (if they worked in the seaweed fields) or late at night (after farming), thereby making solar in the kitchens a necessity. If kitchens are located outside the home (a kitchen location question was added to the Baseline Questionnaire after this finding), an extra solar lamp should be included in the solar home system package. BSEs train to fabricate and design solar cookers in Tilonia and should be provided with the materials and panels to replicate that model in their communities. This would reduce indoor air pollution, reduce carbon emissions, conserve forests, and increase household savings. Disadvantage: the Barefoot solar cookers are massive in size and is mainly used for community cooking. This model needs to be communicated with the community before adopting this method. Secondly, solar cookers cannot be used during the rainy season, however, it can be used for the majority of the year.

- Education: the solar initiative should capitalize on education (most cited impact of the program). Providing facilities for solar in schools and other education facilities should be accounted for when shipping solar equipment. The current solar systems maximize the reading opportunities at home, and providing solar to other educational centers will increase the literacy and learning opportunities for the community. Barefoot could replicate their Night School model (provided a feasibility study is done) for children who cannot attend school during the day or where there is a lack of teachers (the Night Schools uses village elders as teachers) (Barefoot College, 2013).
- Promoting income-generating activities: From the interviews, it was reported that beneficiaries did use the solar light to aid in income generating activities. Based on the results from the customer satisfaction survey, if a household needs additional solar energy to enable income-generating activities, the amount of solar fees could be negotiated and determined between the household and the VEEC.

- Equitable distribution: Only 5 percent of the households in Kandwi were solar electrified and this could be due to a number of factors such as community needs, Barefoot capacity, and ability to pay. However, distribution of solar should ideally reach all households (100 households have been waiting for the shipment of solar equipment from India for over 9 months). To speed up this process, Barefoot should conduct a solar provider market research. Currently, Barefoot gets its supply of solar equipment from Indian suppliers and ships the equipment to its global solar communities. By sourcing two to three solar providers per region, Barefoot would reduce their shipping costs and speed up the delivery to solar communities within that region.
- Systematic monitoring and evaluation: A continuous monitoring and annual evaluation should be conducted. The indicators and /or metrics suggested in this paper can be used as a basis for evaluation and for further discussion. Additionally, the indicator list is flexible and will be receptive to refinement and amendment when data and inputs from different solar communities are presented.

Conclusion

This paper discussed in detail the Barefoot Solar Initiative and the development of indicators in order to design a Monitoring and Evaluation Toolkit for the initiative to measure women's empowerment, quality of life for individual, household and community, and environmental sustainability. The toolkit was designed by including the perceptions and insights of solar beneficiaries about what empowerment, quality of life, and other impacts mean to them. The development of the indicators and the toolkit using this participatory approach helped the project better understand the solar communities and how change is defined at the community level. This toolkit will be sent to 64 different countries worldwide and will be translated into multiple languages. Moreover, it will be interesting to see the odyssey of the toolkit and the additional indicators it might bring.

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Appendix A: Monitoring and Evaluation Toolkit for The Barefoot Solar International Initiative

Monitoring and Evaluation Toolkit for the Barefoot Solar Initiative

This toolkit is designed to help your organization in conducting an effective Monitoring and Evaluation for the Barefoot International Solar Initiative. It explains what monitoring and evaluation are, planning process on how to conduct them, and what to do with the data collected. Monitoring and Evaluation will help you examine the quality and impact of the project, identify problems, and make necessary changes to increase the effectiveness of the solar initiative.

IMPORTANT: Monitoring and Evaluation are two separate processes that are related but are different.

Please read this document carefully and thoroughly. If you have any questions or need help understanding the toolkit, the process, or have recommendations to improve the toolkit/questionnaire, please feel free to contact me at laurenremedios@gmail.com

Contents

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When to monitor and evaluate diagram

Solar Initiative Indicators

Monitoring

- What is monitoring?
- Who conducts the monitoring?
- Why is monitoring important?
- When should you monitor?
- How should you conduct monitoring?
- What do you do with the data collected?
- How to write a monitoring report

Monitoring questions for the Barefoot Solar Initiative

Evaluation

- What is evaluation?
- Who conducts the evaluation?
- Why is evaluation important?
- When should you evaluate?
- How should you conduct evaluation?
- What do you do with the data collected?
- How to write an evaluation report

Evaluation Questionnaire for the Barefoot Solar Initiative

- For the NGO/ground partner
- For the Solar Committee
- For the Solar Beneficiaries and Solar Engineers
- For the Solar Engineers ONLY

Success story

If time permits, possible Customer satisfaction survey for Solar beneficiaries

Do's and Don'ts for interviewing

Key terms

Data: information or facts collected during the interview process

Evaluation: This is a process that is carried out one year (and every year thereafter) after the installation of solar lighting in a community. It is an on-going process to see what impact or what effect solar has on a particular community or individual. The information collected will be used to inform the Barefoot staff and your organization about the efficiency and opportunities to improve the effectiveness of the solar program.

Impact: The positive and negative long-term effects of the solar initiative on the community. The impacts can be economic, social, cultural, financial, and environmental.

Indicators: Measures of the solar initiative performance that is used to show change and results.

Interviewer: The person conducting the interview (The person who asks the interview questions).

Interviewee: The person who is being interviewed (The person who answers the interview questions).

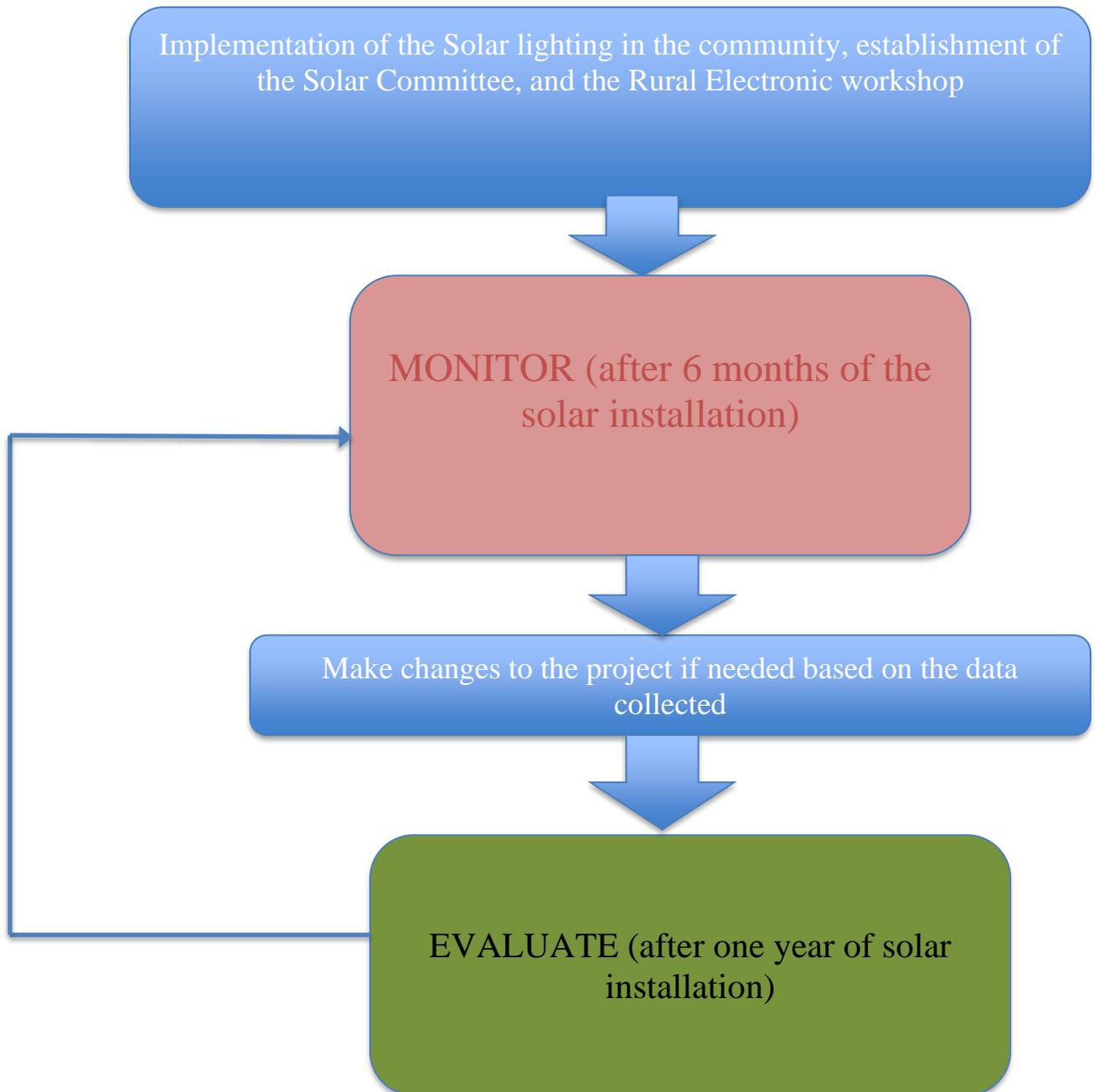
Monitoring: This is a continuous process (conducted every 4-5 months) after the installation of solar lighting in a community. It provides your organization with regular feedback at an early stage about the performance of the solar project. This will help in recommending corrective opportunities.

Stakeholders: People or groups who have an interest in the solar program. These include Barefoot Solar team in India, your organization's field staff, solar community, government officials (if applicable), and donors.

Transcribing: After the interviews have been recorded, the process of typing or writing out the interviews so they can be easily analyzed.

When to Monitor and Evaluate Diagram

The diagram below shows that your organization will monitor and make changes several times before you are ready to evaluate.



Solar Initiative Indicators

Domestic	Productive	Economic and/or Financial	Environmental	Education	Social	Public	Women's empowerment	Technical
*Time saved on collecting fuel wood *Safety and security *Incidence of health issues relating to smoke *Decision making in the household *Comfort and convenience	*Women's working time *Employment due to solar electrification	*Income generating activities: household and/or outside like agriculture *Use of money gained from savings and/or income generating activities *Energy expenditures	*Emissions from burning fuel (wood and kerosene) *Use of fuel wood *Use of kerosene	*Studying / reading hours of school children *Use of information from communication facilities *Number of solar engineers trained	*Information and communication facilities *Social /leisure activities in the household	*Number of schools electrified *Number of clinics electrified *Number of public spaces electrified *Conditions for communal activities *Safety and security	*Self confidence/ self awareness experience *Perception of women's roles *Satisfaction/ happiness in life and job	*Number of solar electrified houses *Functioning of the systems

MONITORING

What is monitoring?

Monitoring is a continuous process and helps you keep track of the progress of the solar initiative.

Who conducts the monitoring?

Typically you (the Barefoot NGO partner) should conduct the monitoring.

Why is monitoring important?

It notifies your organization to problems / issues / successes and provides a opportunities for correction measures.

When should you monitor?

Ideally, your organization should conduct monitoring **every six months (that is once a year)** from the start of the implementation of the solar lighting.

How should you conduct monitoring?

Using the Monitoring questionnaire below, your organization should conduct interviews with the solar engineers and with solar program staff/field officers. This is a short questionnaire designed to assess the short-term impact of the solar project.

Time and resources needed: the monitoring process should take no more than 2-4 days to conduct interviews and observations. You would need at least 2 interviewers (one to ask questions and one to take notes/ record). The interviews should not take more than 30-40 minutes per interview.

While conducting the interviews (please see last page for a more detailed do's and don'ts for conducting interviews), please remember that:

- The interviews should be conducted in a comfortable and safe environment / space.
- General observations should be carried out in the solar community. Look around, take pictures, and write down the condition of the solar community.
- Explain to the interviewees the purpose of the interview and explain to them that no action will be taken for answers that are negative. Having the interviewees express positive and negative feedback will be useful and empowering.
- The interviewees have the choice not to answer any question or participate in the interview process.
- And finally and most importantly, do not prompt the interviewee. You may explain the question but do not give out any leading information.

It is advisable to invest in a voice recorder. If this is not possible, have a person who will be able to take detailed notes of the interviews.

What do you with the data collected? (analysis, reporting, recommendations, and taking action)

- All the interviews should be transcribed. This means that all the answers from all the interviews should be typed out. Remember not to change any answers from the interviewees.
- All the data should be kept securely.

How to write a monitoring report

Data analysis: After all the interviews have been transcribed in an organized format, you will have to make sense of the information.

- What did you observe?
- What did you find?
- What conclusions can you draw from the information?
- What recommendations can you give? Identify solutions to the concerns that came up during the interview process.

Write a small report of your findings and conclusions and send to the Barefoot Solar Team. This report should be 2-3 pages

Your report should include the following:

A. Introduction

- Short background of the community (name of community, total number of house households, number of solar households, number of solar engineers, REWs, and Village Solar Committees)
- When did the solar initiative begin?
- The NGO's name and mission

B. Findings

- What did you learn from the interviews? What information did you find?
- Describe what you found both the successes and the challenges (remember the monitoring part will help you and your solar team continuously improve the solar initiative)
- Please be honest

C. Reflection and Recommendation (this section should be discussed with solar engineers and the NGO team)

- What were the major challenges and how will the solar team (NGO partner and solar engineers) remedy the challenges.
- Give suggestions/advice/ and recommendations on how the solar project can improve. (The Barefoot Team can always help with this section just let us know).

Monitoring questions for the Barefoot Solar Initiative (for NGO partner and Solar Engineers ONLY)

Name of Organization:

Name of Solar community:

How long has the solar community been electrified?:

Name of Monitor(s):

1. How many households have been electrified so far?

2. How many schools have been electrified?

3. How many public areas have been electrified?

4. How many women have the solar engineers trained?

5. How many houses are in need of solar?

6. How are the houses selected?

based on need and willingness to pay

based on first-come first-served basis

Other _____

7. Do beneficiaries in the community still use kerosene, chimneys, candles for light in your house?

Yes

No

8. How many liters of kerosene not used (was avoided) within the last four months in the community? (This can be an approximate figure)

9. How many kilos of firewood was not used (was not cut down) within the last four months?

10. Is the solar light brighter than the [insert traditional light source]?

Yes

No

11. Is the community safer?

Yes

No

If yes, from what? _____

12. List three changes you have seen in the community after solar?

- (i) _____
- (ii) _____
- (iii) _____

13. List three challenges that the solar project faces

- (i) _____
- (ii) _____
- (iii) _____

14. Do you (NGO partner) raise money for the solar equipment?

Yes

No

If yes, how much have you raised? _____

If yes, how do you raise these funds? _____

General Observation notes:

EVALUATION

What is evaluation?

Evaluation is an in-depth analysis of the solar initiative. It shows what impact the solar initiative has on women's empowerment, quality of life, and environmental sustainability, in addition to other impacts.

Who conducts the evaluation?

Often (but not always) external evaluators conduct the evaluation. However, if resources don't permit, your organization can conduct the evaluation.

Why is evaluation important?

The evaluation will let Barefoot College know the effectiveness of the solar initiative. It will be used to generate knowledge about best practices for you, Barefoot College, and potential/ existing donors.

When should evaluation be conducting?

Typically, evaluations should be conducted a year after the solar project has been implemented and every year thereafter.

How should you conduct evaluation?

Using the Evaluation questionnaires below, your organization should conduct interviews with the solar engineers, solar beneficiaries, the village solar committee and with solar program staff/field officers.

What is included in the evaluation:

- 1) There are three questionnaires to the evaluation
 - One for the ground partner/ NGO partner
 - One for the solar beneficiaries and solar engineers (IMPORTANT: the solar engineers will be asked the solar beneficiaries' questions AS WELL AS solar engineer's questions)
 - And, one for the solar village committee
- 2) Writing a success story
- 3) An optional solar customer satisfaction survey
- 4) Making general observations of the solar community.

Time and resources needed: the evaluation process should take no more than a week to conduct interviews and observations. You would need at least 2 interviewers (one to ask questions and one to take notes/ record). The interviews should not take more than 30-60 minutes per interview.

Note: The NGO has to interview all program staff/field officers that are engaged with the solar initiative, all the solar engineers, and all the Solar Committee members. The NGO can select and decide on how many solar beneficiaries / households they would like to interview. For example, if the total population of the solar households is 100, then a good sample size would be 40-50 households. While conducting the interviews (please see last page for a more detailed do's and don'ts for conducting interviews), please remember that:

- The interviews should be conducted in a comfortable and safe environment / space.
- General observations should be carried out in the solar community. Look around, take pictures, and write down the condition of the solar community.
- Explain to the interviewees the purpose of the interview and explain to them that no action will be taken for answers that are negative. Having the interviewees express positive and negative feedback will be useful and empowering.
- The interviewees have the choice not to answer any question or participate in the interview process.
- And finally and most importantly, do not prompt the interviewee. You may explain the question but do not give out any leading information.

It is advisable to invest in a voice recorder. If this is not possible, have a person who will be able to take detailed notes of the interviews.

What should you do with the data collected? (analysis, reporting, recommendations, and taking action)

- All the interviews should be transcribed. This means that all the answers from all the interviews should be typed out. Remember not to change any answers from the interviewees.
- All the data should be kept securely.

How to write an evaluation report

Data analysis: After all the interviews have been transcribed in an organized format, you will have to make sense of the information.

- What did you observe?
- What did you find?
- What conclusions can you draw from the information?
- What recommendations can you give? Identify solutions to the concerns that came up during the interview process.

Write a detailed report of your findings and conclusions and send to the Barefoot Solar Team. This report should be written in a simple language that is understood by all and should not be more than 4-5 pages.

Your report should include the following:

- **Introduction**
- Short background of the community (name of community, total number of house households, number of solar households, number of solar engineers, REWs, and Village Solar Committees)
- When did the solar initiative begin?
- The NGO's name and mission
- **Methodology**
- How did you conduct the evaluation? (interviews?)
- How many people did you interview? (Number of NGO staff members, number of solar engineers, number of solar committee members, number of solar households)
- **Findings**
- Reading through the transcriptions and the indicators (given in the toolkit), you will begin to examine your data.
- The findings should be presented in a way that is honest and complete. Both negative and positive information should be shared. (Remember this report is to help you and the community improve the solar program)
- At this stage, do not write down your reasons for why things are successful or challenging, just tell us what you found.
- **Reflection and Recommendations (this section should be done in collaboration with solar engineers and/ or NGO staff members)**
- In this section, you will begin to “make sense” of your data.
- Tell us what made the project successful
- Tell us what did not make the project successful (what were the challenges)
- Give reasons why the project faces these challenges (be detailed here)
- **Finally**, give suggestions/ recommendations/ advice on how to improve the solar initiative in your community (The Barefoot Team can always help you with this section, just let us know).

Evaluation Questionnaire for the Barefoot Solar Initiative

Name of Organization:

Name of Solar community:

How long has the solar community been electrified?:

Name of Evaluator(s):

For the NGO/ GROUND PARTNER

1. Is the Rural Electronic Workshop used for anything beyond the repair / maintenance and storage of solar equipment?

No

Yes

If yes, please explain _____

2. What kind of condition is the Village Workshop?

Good

Fair

Not in use

Needs improvement

3. Does the solar committee report their progress and accounts to you?

No

Yes

How often? _____

4. How much of money is currently being maintained by the Village Solar Committee?

5. Do you provide the Solar Committee with assistance or additional capacity training?
 No
 Yes
What kind of assistance /training? _____

6. How many months has the committee been collecting contributions?
_____ months

7. Do you face any challenges with the
Solar Committee Yes No
Workshop Yes No
Overall solar project Yes No

If yes, how do you overcome these challenges?

8. Have you been successful in raising funds for the solar project?
 Yes
 No
If yes, how much have you raised? _____
If yes, please list three ways you raise funds
(i) _____
(ii) _____
(iii) _____

For the SOLAR COMMITTEE

1. How many households have signed the agreement to install solar and pay the solar fees per month?

2. How many systems were installed in the community?

3. How are the fees collected per month?
 Door to door
Other _____

4. How many solar beneficiaries pay regularly?

5. What are three reasons beneficiaries don't pay?
(i) _____
(ii) _____
(iii) _____

6. What actions does the committee take if a household does not pay the fees after 3 months (when hardship is not the cause)?

7. How does the Committee make the accounts transparent (how do you share the accounts information with the ground partner or stakeholders)?

8. Does the committee make any expenditures apart from the solar engineers' salaries?
 No
 Yes
If yes, what expenditures? _____

9. Do you have any systems that have not been installed?

No

Yes

10. How many families are in need of solar systems?

11. How often does the Solar Committee meet?

Once a month

Twice a month

Other _____

12. How often does the Committee meet with the NGO partner?

Once a month

Once in six months

Other _____

13. Has the Committee opened a bank account?

Yes

No

If no, why? _____

14. How much does the Committee pay the Solar engineers per month as salary?

15. How much does the bank account hold currently?

For the SOLAR BENEFICIARIES and SOLAR ENGINEERS

1. What are three things that are easier in your household after solar lighting?
 - (i) _____
 - (ii) _____
 - (iii) _____

2. Who in your household decides how income is spent?
 - Husband
 - Wife
 - Joint (husband and wife)
 - Elder members (male)
 - Elder members (male and female)

3. Has your involvement with decision making regarding family planning increased?
 - Yes
 - No
 - Nothing has changed

4. Since solar, do neighbours and friends come over more often?
 - Yes
 - No
 - Nothing has changed

5. Do you have a cell phone?
 - Yes
 - No

6. What do you use your cell phone for?

7. Do you still use kerosene, chimneys, candles, or any traditional lighting?

- Yes
- No

8. Do you believe the air quality in your house has improved?

- Yes
- No

9. Is your house safer?

- Yes
- No change

If yes, from what? _____

10. Do you have more time to increase your income (for example work on your business at night)?

- Yes
- Nothing has changed

If yes, how has solar helped you? _____

11. After solar, have you had more or less household work?

- More
- Less

12. How has solar benefitted your children?

13. Do your children spend more time reading/studying/ playing after sunset?

- Yes

Nothing has changed
If yes, how much more time? _____

14. Overall, has your family saved money due to solar lighting?

- Yes
- Nothing has changed

15. If you saved money, what do you do with the money now?

- Save it
- Other _____

16. Tell us two things you hope for the future?

- (i) _____
- (ii) _____

17. Overall, has solar lighting benefitted you and the village?

- Yes
- No
- Nothing has changed

For SOLAR ENGINEERS ONLY (Make sure you have also asked the solar engineers the Solar beneficiary's questions in addition to these questions)

1. How many solar systems have you installed in your community?

2. Has the training raised your status in your community?

Yes

No

Nothing has changed

If yes, how? _____

3. Are you seen as a “professional” in your village now?

Yes

No

Nothing has changed

4. How do you feel after you became a solar engineer?

Confident

Hopeful

Satisfied

Other _____

5. What do you like most about being a solar engineer?

6. What kind of information do you explain to the solar beneficiaries?

7. How many times a month do you visit the solar households?
_____ per month
8. What is your biggest challenge being a solar engineer?

9. Do you feel your life has changed after you became a solar engineer?
 Yes
 No
 Nothing has changed
IF yes, how? _____
10. Has your relationship with your husband changed after you came home from India?
 Yes
 No
 Nothing has changed
11. Do you believe your husband respects or listens to you more?
 Yes
 No
 Nothing has changed
12. Currently, how many solar panels are in need of repair?

13. What is the Rural Electrification Workshop used for?

14. Is the Rural Electronic Workshop being used for anything beyond the repair maintenance and storage of solar equipment?

- Yes
- No

15. Is there a TV installed for the community in the workshop?

- Yes
- No

16. Apart from households, what other public spaces have been electrified?

- Schools
- Public meeting places
- Clinics
- Shops/local businesses

17. List three changes you have seen in the village after solar

- (i) _____
- (ii) _____
- (iii) _____

18. List three things people use the solar lanterns for in your community

- (i) _____
- (ii) _____
- (iii) _____

19. What is the solar lighting system used for?

- Charge mobile phone
- Radio
- Fan
- Other _____

General Observation notes:

Success story

A descriptive of how the program impacted a family/person. This is not a regular overview of the program, but a complementary element to the evaluation template.

- One story from a solar engineer and one from a solar beneficiary.
- The story should be not more than 500 words accompanied by pictures, if possible.
- Provide background information about the person/ family (mainly demographic information)
- In the person's own words describe how the solar initiative impacted them
- Provide multiple quotes

IF time permits, possible Customer satisfaction survey for Solar beneficiaries

1. How often does the solar engineer come to your house?

2. What kind of instructions did the solar engineer give you to maintain the solar equipment?

3. Are you happy/satisfied with the service?
 Yes
 No
If no, please explain why _____

4. How are the solar fees collected every month?

5. Are you happy with the solar equipment?
 Yes
 No; If no, please explain why _____

6. Do you need more solar energy?
 Yes
 No
If yes, for what purposes?
 Business
 Fan
 TV
 Refrigerator
 Other _____

7. Would you be willing to pay extra for more solar energy? Yes No

Do's and Don'ts for interviewing

Things to keep in mind when conducting interviews (do's and don'ts when conducting interviews)

DO test the interview questions to make sure questions are understood and makes sense, especially if you are translating into another language.

DO explain very clearly what the purpose of the interview is to the interviewees.

DO tell the interviewee that what he/ she says will be treated in confidence and that no repercussions will take place depending on their answers.

DO ask the interviewee for permission if you take notes, pictures or tape record the interview.

DO record the exact words of the interviewee as far as possible.

DO watch for answers that are unclear and ask for more information, but do not force them to answer.

DO be flexible and note down everything interesting that is said, even if it isn't in the questionnaire.

DON'T offend the interviewee in any way.

[[[DON'T interrupt in mid-sentence.

[[[DON'T put words into the interviewees' mouth.

DON'T prompt the interviewee when he/she cannot answer the question, just move on to the next question.



DON'T push the interviewee to answer any question. Move on to the next question immediately.

Appendix B: Baseline Questionnaire for Solar Electrification Project

Country:

Name of village:

Surveyor name:

Date:

Demographic

1. Does the village have a community meeting place? Yes No

2. If yes, what do you use this place for?

a) _____

b) _____

c) _____

d) _____

3. Does the village have a library? Yes No

4. What kind of public facilities are available to the community?

a) _____

b) _____

c) _____

d) _____

5. What kinds of transportation are available to the community?

- a) _____
- b) _____
- c) _____
- d) _____

6. What is status of the roads?

- Fair Good Poor
- Easily accessible Not easily accessible Not easily accessible during the rainy season
- Mud road Paved road
- Rocky terrain Lots of potholes

Other _____

Education

- 7. Where is the nearest school? _____
- 8. Do your children go to school? Yes No
- 9. How do they go to school? Walk Bus Bicycle Other _____
- 10. How many hours per day do your children spend studying/reading? 1 hour 2-3 hours more than 3 hours
- 11. What time of day do your children do school work? Morning Afternoon Evening

12. Did you attend school? Yes No

13. How many years did you attend school?

Finished high school
Number of years attended _____

Livelihood

14. How many hours a day do you spend working outside your home? _____

15. How many hours a day do you spend on household activities? _____

16. Do other family members help you with work outside the home? Yes No

17. If you had light, what kind of activities could you do after sunset?

- a) _____
- b) _____
- c) _____
- d) _____

18. Do you or any family member migrate from your village to work? Yes No

19. What kind of work do you/family members migrate for? _____

20. How long are they gone for? _____

Income

21. How much do you spend on

- a) Food _____
- b) Transportation _____

c) Medical _____

22. If you need additional money, do you borrow or receive loans?

Yes No I'm not allowed to borrow/receive loans

23. If yes, where do you borrow? _____

24. What are the interest rates? _____

25. How much do you normally save per month? _____

26. Are you allowed to spend money without permission from your husband/family member? Yes No

27. What kinds of handicrafts/artisans are present in your village?

a) _____

b) _____

c) _____

28. Do you/ family member sell items (handicrafts/food) outside your village? Yes No

29. Do you own Land House Bicycle Livestock Other _____

30. What kind of assets do you personally own? _____

Health

31. How many meals do you have everyday? _____

32. When you or family members are sick, where do you go to get medical help?

Hospital Local medical center Other _____

33. What kinds of diseases are present in your community? (Malaria, dengue, etc.)

a) _____

b) _____

c) _____

34. Where do you go to deliver babies?

Hospital Local medical center Home with midwife Other _____

35. What kind of prenatal care is available to you? _____

36. How old were you when you got married? _____

37. How old were you when you had your first child? _____

Political

38. What kind of village meetings/events/organizations do you participate in? _____

39. What kind of meetings/events/organizations are you not allowed to participate in? _____

40. Are there any local political organizations or local self-governments? Yes No

41. Are women a part of these organizations? Yes No

42. What kind of decisions do these organizations make?

a) _____

b) _____

Social/Women's rights

43. Are there discriminations against a certain group of people? Yes No

If yes, whom? _____

44. Is divorce common? Yes No

45. If there is a divorce, to whom do the children go to? Mother Father

46. What rights does a divorced women have in your community?

47. Do widows Live alone Live with husband's family Return to live with her family

48. At what age do girls get married? Average age _____

49. Is there a dowry system? Yes No

50. If yes, please explain _____

51. Are women allowed to own land? Yes No

52. Who makes decisions regarding household income expenditures?

Husband Wife The oldest household member Joint decision-making

Other _____

53. Who makes decisions regarding children (education, marriage, etc.)

Husband Wife The oldest household member Joint decision-making

Other _____

54. In your opinion, are there problems of

- Drugs Yes No

- Alcohol Yes No
- Rape/sexual abuse Yes No
- Domestic violence Yes No

55. Do you go out alone? Yes No

56. If yes, where do you go? _____

57. Do you need your husband's/family members' permission to go out? Yes No

Natural environment

58. What are your sources of water?

- Well River/sea/lake Water pump Rainwater collection Other -

59. How far is this source? _____ kilometers _____ miles _____ minutes/hours

60. How does water get from source to your house? _____

61. If you collect water, how many hours per day do you spend fetching water? _____

62. What is the size of cultivable land (if applicable)? _____

63. What crops do you grow?

- a) _____
- b) _____
- c) _____

64. How is the land watered? Rain-fed River-fed Other _____

65. Do you sell the crops? Yes No

66. If yes, who sells them? _____

67. What percentage is sold
within the village _____ %
outside the village _____ %

68. Are there problems of erosion? Yes No

69. Are there problems of deforestation? Yes No

70. Do you cook with Firewood Kerosene/Propane Charcoal Dung Peat
Other _____

Communication

71. Do you listen to the radio? Yes No

72. Do you have a mobile phone? Yes No

73. Where do you charge your phone? _____

74. List three functions you use your mobile phone for

- a) _____
- b) _____
- c) _____

Solar (after explaining the project)

75. Where is your kitchen located?

- Inside the house
- Outside the house
- Community kitchen

Other _____

76. Would your community be willing to have solar energy as a source of electricity? Yes No

77. Is there a community space that could be used for the Electronic Rural Workshop? Yes No

If yes, where? _____

78. Is the community willing to select women through a democratic process? Yes No

79. Is the community willing to pay the solar fees every month? Yes No

80. What are three immediate concerns or questions that the community might have with the solar initiative?

a) _____

b) _____

c) _____

81. How would the solar beneficiaries be selected?

First come first served

Selection by Village Solar Committee

Other _____

Appendix C: Indicator Questionnaire

Solar trainer questionnaire

1. When did you get trained?
2. What do you do here?
3. Describe your daily work activities?
4. Why do you think it is important to train women?
5. Apart from training about circuits/resistance, what else do you teach the women?
6. What is the biggest challenge in your work, apart from language?
7. What are you most proud of, in your job?
8. What changed in your life, after you became a solar trainer?
9. How was your life before you became a solar trainer?

Solar trainee questionnaire

1. How many households in your village?
2. Did you go to school? For how many years?
3. Do your children go to school?
4. Do you think getting an education is important? Why?
5. What is your occupation?
6. What work do you do at home?
7. Do you own any land?
8. Do you go out alone? Do you need your husband's permission to go out?
9. What decisions do you make at home regarding money and children?
10. Are you a member of any group?
11. What are the 5 most important areas in your life?
12. When were you the happiest?
13. Why did you come here to train?
14. What do you want to do with the training?
15. How will things change in your house when you go back?

16. How will things change in your village when you go back?
17. How will things change for you when you go back?
18. What is the biggest challenge facing your village?
19. Describe your village without electricity

Solar village questionnaire

Name of village:

Gendder

Age

Religion/caste:

No. of solar households:

No. of solar engineers:

** only for solar trainers*

1. How many women have you trained? *
2. From when do you have solar in your home?
3. How many of your children go to school?
4. How has solar benefitted your children?
5. Did you children's grades change after solar?
6. How many hours a day do they study/read for, now?
7. Where do you work?
8. How much time do you spend working outside the house?
9. What do you do at home?
10. What time did you go to bed before solar and after solar?
11. What do you do now in the evenings/night?
12. How much do you pay per month?
13. How much did you pay for traditional source of lighting?
14. Do you have a solar cooker?
15. Are there changes in your health after the solar cooker?
16. Is the air in your house better?

17. Do you still use kerosene or fuel wood?
18. Do you feel your house is safer after solar?
19. Do you feel your community is safer after solar?
20. After solar, do you use any other electronic devices?
21. Which community functions do you take part in?
22. What do you do there?
23. Do you go out at night?
24. When did you go to sleep before and since solar?
25. If you go to bed later, what do you do now?
26. DO you take the solar lantern?
27. How do you feel going out at night?
28. Do you have to ask your husband's permission to go out?
29. What decisions do you make at home? (regarding purchases, savings, loans, children, etc.)
30. Do you get to spend the money you earn from solar on your own? *
31. Do you have a cell phone?
32. Where do you charge your battery now and before?
33. What changed in your life after solar?
34. What changed in your village after solar?
35. How do you feel about having a job and getting some money? *
36. Do you feel that you can make change in your community and life? *
37. Are you happy? With what?
38. What are the five most important areas in your life?
39. What challenges does your household face or community face?

Appendix D: Development of Indicators for the Barefoot Solar Initiative

SOLAR TRAINEES

Question	Statement	Category- code- Patterns- domain	Indicator
How many houses in your village	60-70; 250; 120; 200; 130; 1300	<ul style="list-style-type: none"> • System functionality • (Technical) 	<ul style="list-style-type: none"> • Number of households electrified • Functioning of systems • Depreciation of system • How much of usage
Why did you come here to Tilonia?	Life better; study; learn; improve my life; become a solar teacher; solve my community problems; to become a teacher; because I have no light in my village; to help my children; because my village does not have the resources to attain electrification; people back home depend on us and this course in India	<ul style="list-style-type: none"> • Self-esteem/awareness (Women's empowerment) • Leadership roles (women's empowerment) • 	<ul style="list-style-type: none"> • Percentage of women who have experience an increase in self-confidence • What changes have they made with that increase in self confidence • Number of people who have taken up leadership roles in their community
What are you going	I am going to be a teacher; I want to train women; to become	<ul style="list-style-type: none"> • Teacher/giver 	<ul style="list-style-type: none"> • People employed by the solar

to do with solar training when you go back?	a solar engineer; to show men that women can do this too; I can work, get money and not worry about food; help my community; I want to become a teacher; I want to teach others; I will put solar lighting my village; we will put in to practice what we learned here; we will install in very house and every home a solar panel that will provide light for every family; we will share our knowledge; instruct other women; we are the carriers of knowledge and have lots of responsibility ;	<p>(economic / social)</p> <ul style="list-style-type: none"> • Women’s status/roles (empowerment/ quality of life) • Employment generation (economic) • Financial stability (Economic) 	<p>electrification (solar engineers/ night school teachers)</p> <ul style="list-style-type: none"> • Percentage of women using solar electricity for income generation purposes • Changes in the perception of roles of women • Capacity to visualize change • Household expenditure • Food expenditure
Where do you work?	Homemaker; sea-weed farmer; homemaker; farmer; farmer; farmer; homemaker	<ul style="list-style-type: none"> • Characteristics of population 	<ul style="list-style-type: none"> • Employment history
Do you think education is important?	To improve lives; help you move forward in life; I wanted to go to school; I had to leave school to work; if you go to school all your problems will go away; it opens your eyes; you see the world with different eyes	<ul style="list-style-type: none"> • Educational system 	<ul style="list-style-type: none"> • Literacy level
What will change when you	I will make money (6); I will be able to charge my mobile phone; I will no longer have to	<ul style="list-style-type: none"> • Connectivity (Domestic) 	<ul style="list-style-type: none"> • Number of night schools using solar electricity

<p>go home?</p>	<p>do sea-weed farming; children will be able to study; I will not only be in the house all day; help the villagers not cut down trees; we can put a fan when it is hot; children will be able to study and read better; We won't have to use kerosene (4); the men folk will be happy because the women are earning so they can work less; I will change my life, my life has already changed; I would like to spend the money I earn as I wish; improve not only our lives but other people's lives and that's a good thought;</p>	<ul style="list-style-type: none"> • Financial situation (Economic) • Personal freedom (Women's empowerment) • Fuel substitution (Environment) • Comfort (Domestic) • Community development (Public) 	<ul style="list-style-type: none"> • Public spaces using solar electricity • Percentage of households that have stopped using kerosene or wood •
<p>What are the 5 most important areas in your life?</p>	<p>Strength, health, work, school, clean environment, children, husband, family, studies; work with hand, good family, prayers</p>		<ul style="list-style-type: none"> • Health status
<p>What is your decision-making capacities regarding income/money/spending?</p>	<p>Yes, I am consulted; no; no;no; no; no; no; no;</p>		

ng?			
What did you do at night when the sun sets and there is no electricity?	Go to sleep after sunset; go to sleep early and wake up very early; cook with the kerosene chimney		<ul style="list-style-type: none"> The work load of women (increased or decreased)
What difficulties do you face in your community ?	No light; Divorced; no place to charge phone; not enough of drinking water; no work in village; oil is expensive; oil smells bad; not being able to speak the language (training); no light in our village		

SOLAR ENGINEER/TRAINER

Question	Statement	Category- code- Patterns	Indicator
How many years did you go to school?	Three years; 8 years; no school; 2 years; no school	Characteristics of population	
Why is education important?	It is good to move forward; for the future; to learn about things;	Characteristics of population	
What do you like about being a solar engineer?	It makes me happy, I had a lot of objections about becoming a solar engineer, but I liked it; I like having a life outside the home; I feel happy that I can give to people especially children; I feel confident and happy when I go fix the lights in the village; I get to meet big people; it has given me some purpose in life; I love to out of the house, I do not like sitting at home	<ul style="list-style-type: none"> • Family relationships (Domestic) • Sense of fulfillment / accomplishment (Women's empowerment) • Confidence/self-worth (Women's empowerment) 	<ul style="list-style-type: none"> • Levels of self-confidence • Extent to which women chose their type of employment
What has changed after you became a solar engineer?	My life changed, I never really met and chatted with friends after marriage; What has changed is that I am doing much better; I don't have to work in the fields anymore; I am a solar engineer	<ul style="list-style-type: none"> • Friends (Public/social) • Personal freedom (Women's 	<ul style="list-style-type: none"> • Percentage of women who takes action against traditional practices

	<p>that's what has changed; I got the courage that I can do anything; I also got the courage to tell my husband I want a daughter after having two sons; I keep some money aside and don't give it to my husband, this is for my children's education; I can take the lanterns into the fields and work 3-4 hours extra and finish the work in a month, otherwise it used to take me more than a month;</p>	<p>empowerment)</p> <ul style="list-style-type: none"> • Financial security (Economic) • Voice (women's empowerment) • Self- worth (women's empowerment) • Savings (Economic) • Time gain (domestic) 	
<p>What are the five most important areas in your life?</p>	<p>Studies, work, health, children, family, education, land, family, children, work,</p>		
<p>What has changed in your house after you got solar?</p>	<p>I can now see the snakes and insects in the night; I don't feel anxious about the snakes, I can do my housework with ease; I can take the lanterns into the fields and work; my children can study at home</p>	<ul style="list-style-type: none"> • Health/hygiene (domestic) • Comfort (domestic) • Convenience (domestic) • Education 	

		(social)	
What is your decision-making capacities regarding income/money/spending?	I can't spend the money as I wish, I have to ask for permission, but I can buy vegetables, this is wrong, but what to do; I have to ask my husband and in-laws for money; The money I earn is for my household not only for me.	<ul style="list-style-type: none"> Decision making (women's empowerment) 	<ul style="list-style-type: none"> Ratio of women and women who control the cash inflow in the house
What difficulties do you face?	I am out of the house for a long time and that's makes it difficult for me finish my work at home; there is no school close by for my smallest children; I don't get a regular income from solar, only when something is broken they will call me and pay me; my small children have to stay at home and raise the goats.		

SOLAR BENEFICIARIES (WOMEN, MEN, and CHILDREN)

Question	Statement	Category- code- Patterns	Indicator
How many years have you had solar light in your home?	In Years: 2, 3, 2, 1, 2, 5, 1.5	Characteristics of population	
Do your children go to school?	My small children don't go to school because it is too far and they can't walk very far; these grandchildren here don't go to school now because it is harvest time and no child goes to school then because they have to work in the fields; yes all my children go to school; my girl child even goes to school; sometimes, my children have lots of problems in school because we are of a lower caste, my children don't want to go to school	Characteristics of population	<ul style="list-style-type: none"> Freedom of movement
Occupation	Livestock farmer; homemaker; farmer; farmer; farmer; take care of animals; salt farm; house maker; salt fields, work in the fields and with goats; sheep farmer; stay at home; house maker	Characteristics of population	<ul style="list-style-type: none"> Women's economic worth

<p>What kind of solar units you have at home?</p>	<p>All said only light fixtures; there was no lanterns or solar cookers</p>	<ul style="list-style-type: none"> • System description 	
<p>What do you do in the evenings/nights now after solar?</p>	<p>I can cook and not have to sleep early; my children can play and study; now, I can sit outside; I can play in the night; children study in the night; I can study early in the morning before the sun comes up; I can stitch my clothes in the night</p>	<ul style="list-style-type: none"> • Comfort (domestic) • Convenience (domestic) • Education (social) • Productivity (domestic) 	<ul style="list-style-type: none"> • Improved brightness/duration of light • Increase in available time for other activities • Increase in leisure activities
<p>What has changed in your life/house after solar lighting?</p>	<p>I don't have to worry about worms in our food and snakes in our house, I can see now; It doesn't take me a long time to cook in the evenings now; I can play in the nights now; I used to be very afraid of the dark and not leave my grandmother alone; Before the time of day used to tell us what to do, now with this we can work when we want to; I save about 300 rupees per month now; Before it took me 45 minutes to cut vegetables, now it takes me 15; I am not scared to be alone at</p>	<ul style="list-style-type: none"> • Protection/security (domestic) • Health / hygiene (domestic) • Comfort (domestic) • Convenience (domestic) • Leisure/entertainment (public) • Savings (productive) 	<ul style="list-style-type: none"> • Improved air quality in the house • Improved safety and security in the house • Increase use of other electronic devices • Decrease in monthly expenditure on kerosene/other

	<p>home now when my mother comes back late from the fields; I can return late from the fields now and finish the harvest sooner; The most important thing is that I can go pee in the nights now, I used to be really scared and hold my pee in; I don't have to wake up early to do work now; Before I had to send my children to other home to study; we have a night school here for the children who can't go to day school; I charge my phone at home now, which makes it easier for me to talk to my family; my wife can now stitch at night; I can take the lantern on the tractor and go into the jungle; I can use the lantern to go to the bathroom at night; At nights I can now see what animals come into the house because we don't have a door; I like it a lot especially since I don't have to walk to my friend's house and use their electricity; at the night school I can learn new things; Before in the nights my husband just wanted to sleep with me, now we can do other things.</p>	<ul style="list-style-type: none"> • Communication/ connectivity (domestic) • Voice/representation (women's empowerment) • Productive uses (domestic) • Study/reading time (social) 	<p>fuels</p> <ul style="list-style-type: none"> • Increase in time spent reading / studying • Increase in access to and control over income • Increase in decision making sphere • Increase in self-confidence/self worth, agency • Increase in reproductive decision-making • Satisfaction and happiness in life and job
Do you use	I don't use kerosene anymore and	<ul style="list-style-type: none"> • Air quality 	<ul style="list-style-type: none"> • Percentage of

kerosene in the house after solar?	the air/wind is better in the house; we still use kerosene sometimes because the light isn't very bright; we use kerosene also, even though the light is not very bright, it gives us some sort of convenience;	(environmental) System functionality • (technical)	households that have stopped using kerosene
What would you like in the future?	I would like a school to be closer to my house; I would like a cellphone; more; light, fan, tv; I would like good roads; clean water; clean water; night schools; like to learn about how the sun makes light; water		
What are some of the difficulties you face?	I feel bad when my children don't go to school; The roads are really bad near my house and to get to my house; The water is full of salt; I don't know how to fix my solar light;		