

# CATALYZING THE SOLAR MARKET

## PADER PILOT PROJECT:

### *Household Assessment and Recommendations for Action*

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## EXECUTIVE SUMMARY

This report details the results of a household assessment undertaken throughout Pader District, Uganda during January and February 2011. The Mercy Corps assessment team found the following:

- **Pader District inhabitants are comparatively asset poor** and derive the largest source of their savings from crop sale. Consequently, although respondents have high rates of cash savings, we can infer that the amount of cash savings is probably low. Accordingly, household spending is rigid; consumers have little flexibility for unplanned or nonessential purchases.
- **The prevalence of savings and credit groups in Pader District is significant** and, if tapped correctly, may help to balance out the rigidity of household spending as well as the low levels of household cash savings. Village Savings and Loan Association (VSLA) membership is high amongst Pader inhabitants. These groups amount to a series of vast networks that not only have access to the type of informal financing needed to purchase solar products, but to ancillary candidates for solar product consumption.
- **Almost all of the households interviewed (96%) use paraffin for lighting.** These households use an average of 34.58 liters of paraffin and spend an average of 106,990 UGX on paraffin each year. Often as a supplement to paraffin usage, households employ candles and torches. Very few households use electricity and even fewer use solar power. **Households almost universally purchase fuel for lighting in small increments** and do so for a clear-cut reason: they cannot afford to buy fuel in larger increments. Perhaps because they purchase small amounts of fuel throughout a week, few respondents recognize how high their annual household fuel expenditures reach.
- **The majority of Pader District households not only utilize mobile technology, but pay to recharge their mobile phones frequently** and what amounts to considerable sums over time. For the 70% of respondents who recharge their phones twice weekly, their annual mobile phone recharging expense amounts to 55,432 UGX. Pader inhabitants' surge in mobile phone use has a practical origin; it surfaced as a cheaper alternative for communication, reducing transportation and transaction costs. As the costs of using individual mobile technology have steadily declined, the number of users has increased dramatically. The expense of recharging phones, the distance required to do so and the opportunity cost of not utilizing these monetary and time resources elsewhere, likely serve as a continued barrier to even higher mobile use.
- Solar panels dot each of the main town centers in Pader District. Panels are primarily utilized by mobile recharging businesses that occasionally further utilize the panels for side barbershop businesses or home lighting. **Small, solar lanterns are neither visibly for sale nor known to be sold anywhere in Pader.** There are no overarching solar quality standards, trainings, or regulations in Pader. Yet, perhaps because solar availability and access remain minimal, market spoilage does not appear to be the major impediment to the willingness of potential customers and markets to adopt solar, as it has been elsewhere.
- **Pader inhabitants travel to their nearest town center but they rarely travel farther away from home** nor have the opportunity to do so. The infrequency with which respondents travel beyond their nearest trading center highlights the necessity of companies to bring products closer to households rather than expecting households to come to them.

**Pader District inhabitants are viable candidates for solar power consumption if targeted appropriately.** In fact, if Pader District inhabitants would reallocate their annual mobile recharging expenditures to the purchase of a solar lantern, solar companies could reasonably sell 147,201 lanterns. Moreover, if household users of paraffin, batteries, and candles would simply reallocate their annual fuel expenditures to the purchase of a solar lantern, solar companies can expect to sell 72,156 solar lanterns to paraffin users, 4,828 solar lanterns to torch users, and 4,025 solar lanterns to candle users. In order to realize these sales figures and in accordance with our findings and in support of a catalyzed affordable solar market, the Mercy Corps assessment team makes the following recommendations:

- Though consumers are asset and income poor, they do have access to some cash savings and informal lines of credit. Rather than promoting larger, household solar systems, **it is appropriate to direct solar sales efforts in support of smaller, less expensive items** that decrease household expenses more immediately.
- **Solar products that couple lighting and mobile recharging are an effective point of entry for solar market penetration in Pader.** Households adopt mobile technology because it reduces their transaction costs. In Pader, even though the costs associated with mobile phone use are high, a majority of Pader inhabitants own or utilize the technology. Moreover, Pader consumers perceive their current lighting means as adequate. As a result, consumers will be more willing to adopt solar technology as a means to cut mobile phone expenses than as a source of lighting.
- **In order to reach the Pader market, solar companies must decentralize their sales structures and go to Pader directly.** Even though solar power is offered for sale in neighboring large town centers, Pader inhabitants know almost nothing about its availability nor are they likely to travel to learn enough to incite solar product purchase. Moreover, the best potential solar customers are those that have access to cash or informal credit. Pader consumer access to cash and credit varies according to harvest season and often according to VSLA operating cycle. A company that works in neighboring districts cannot manipulate its sales strategy according to its potential customers without understanding these intricacies of the local market. And, a company that is based in a neighboring district rather than in the nearest trading center will not learn these intricacies.
- **Solar companies must adapt their payment plans to meet consumer demand.** Creating an incremental payment system or establishing a rent-to-own program, might be more appealing ways to meet current consumers' fuel for lighting expenditure structure. Pader District respondents purchase fuel for light in small amounts and use light in short segments. Though the long-term expenditures associated with their fuel use for lighting are high, households may not be cognizant of it. Pader District households perceive their current lighting means as adequate and cannot raise the necessary funds to make an upfront, lump sum solar unit purchase. One way to induce solar sales is to adopt an incremental payment plan that mirrors the way consumers currently purchase fuel.
- **Adequate time and resources must be allocated to augment consumer solar consciousness.** The majority of Pader District households are not only unaware of their high annual fuel and mobile recharging expenditures, but they are unaware of an energy source alternative that will save them money. Armed with sufficient price comparisons as well as information about product quality, consumers are more likely to adopt affordable solar power products. By partnering with viable and recommended solar companies, Mercy Corps can ensure that the first large-scale Pader consumer interaction with affordable solar products is quality controlled. Moreover, Mercy Corps can work with selected companies to provide education and awareness for consumers.

# 1. INTRODUCTION

## Mercy Corps Uganda

Mercy Corps helps people in the world's toughest places turn the crises of natural disaster, poverty, and conflict into opportunities for progress. Driven by local needs and a market-based approach, Mercy Corps exists to alleviate suffering, poverty, and oppression by helping people build secure, productive, and just communities. Our programs provide communities with the tools and support they need to transform their own lives. Our worldwide team of 3,700 professionals is improving the lives of 16.7 million people in more than 40 countries. Mercy Corps' guiding framework empowers communities to be their own agents of change and ensures lasting recovery and development impacts.

Mercy Corps has worked in East Africa for more than twenty years, implementing over 90 programs valued at nearly \$240 million in Somalia, Sudan, Uganda, Ethiopia, Eritrea, and Kenya. Responding to the needs of marginalized communities, our programs work to broaden livelihood options, secure reliable sources of nutritious food, and increase long-term savings and profit potential through formal and non-formal financial services. Our programs work closely with local government, civil society and private sector structures to develop strong social safety nets, to provide basic services to meet the needs of communities, and to lay the foundation for a productive future. In each of our East Africa programs, Mercy Corps implements with local partners and places a priority on building the capacity of local non-government organizations (NGOs), community-based organizations, and entrepreneurs. Additionally, Mercy Corps' worldwide focus on learning and innovation in Monitoring & Evaluation allows for critical assessment of our impact and subsequent efficacious forward action in the communities we serve.

Since 2005, Mercy Corps has implemented food security, water/sanitation/hygiene, youth, economic strengthening/livelihoods, and conflict programs in Uganda, reaching more than half a million beneficiaries in five districts. Through innovative, sustainable programming, Mercy Corps Uganda has proven experience in: 1) supporting youth, women, and marginalized individuals through leadership, life skills, and income generating activities; 2) strengthening local mechanisms for increasing agricultural productivity and economic growth; and 3) building the capacity of local NGOs and market actors.

## Catalyzing the Solar Market: Pader Pilot Project

Mercy Corps strongly believes that solutions to poverty, conflict, and hunger in the transitional areas where we work depend upon innovation. With this in mind, we developed a pilot project that will catalyze the affordable solar market in the northern Ugandan district of Pader, stimulating local business while building linkages for an influx of innovative technology that will improve the lives of Pader inhabitants.

Currently, Pader inhabitants have extremely limited access to solar power products. Unskilled and unequipped businesses have not enticed crucial solar company investment and, as a result, successful distribution channels for a new era of affordable solar power are absent in the District. Consequently, innovative and more competitively priced items are neither circulated nor known. Pader district inhabitants are unaware of the existence, much less the affordability and the benefits, of innovative solar solutions.

With a goal to "create a replicable pilot project to catalyze affordable solar markets in the transitional areas of Uganda", the Pader Pilot Project has eight main objectives across three phases. Initial preliminary project development, the first phase, includes a review of related projects, assessments, and materials as well as a comprehensive market analysis of Pader. Included in this phase are a quantitative analysis derived from a nearly 400-household Knowledge, Attitude and Practice (KAP) survey as well as a qualitative assessment (review and analysis follow). Project implementation, the second pilot project phase, builds on initial assessment and analysis to promote linkages between private, socially responsible and respected members of Uganda's solar energy industry, Pader-based entrepreneurs, and local financial institutions and groups. This project phase advances basic marketing and sales acumen amongst entrepreneurs while disseminating crucial market data to all solar players. Further, as a facet of the second phase, the Pilot Project builds understanding and awareness of the health, savings, and livelihoods benefits of solar energy amongst Pader inhabitants while

connecting them to accessible local distribution teams. In the final phase, Mercy Corps will evaluate the Pilot Project, builds on its successes and pursues opportunities for expansion.

Throughout Pilot Project implementation, Mercy Corps is collaborating closely with key solar energy researchers, stakeholders, and entrepreneurs while partnering with local financial institutions and community-based organizations in Pader. Through collaborative action, Mercy Corps will create linkages between affordable solar power supply, area distribution channels, and local consumers, leading to a catalyzed Pader solar market.

## Pader District

Pader District is situated in Northern Uganda. In July 2010, the District was divided into Pader and Agago Districts with Pader to the west and Agago to the east. As the change is recent, it is not yet frequently reflected in reports or on maps. Pader District is flanked by Kitgum District to the north, Gulu District to the west, Lira District to the southwest, and Otuke District to the southeast. Further, Pader District consists of 11 sub-counties: Acholibur, Angagura, Atanga, Awere, Kilak, Laguti, Lapul, Latanya, Pader T/C, Pajule, and Puranga. See Appendices B, C and D for details.

For more than 15 years, the Acholi sub-region, to which Pader District belongs, bore the weight of ongoing Lord's Resistance Army (LRA) hostilities that resulted in the internal displacement of nearly 1.1 million people. In the last several years, displaced persons steadily returned home or identified new villages within which to settle. Currently, 92% of those displaced have found permanent residences outside of camps. Reintegration, though, remains an ongoing and delicate process. Those who have found new homes face continued inadequate access to basic services including water, health, and education facilities. They are also met with scarce livelihood opportunity, poor food security, and unreliable market structures. Further, insufficient law and order structures inhibit resolution of land and property disputes as well as inter-clan disagreements and rising criminal activity.<sup>1</sup>

According to projections based on the Ugandan National District Planning Unit database, the population of Pader District is 237,100, with 119,500 males and 117,600 females. Pader has an annual population growth rate of 5%; this lies above the national average of 3.3%. According to Mercy Corps survey data, Pader households' average 6.75 members; this also lies above the national average of 5. Life expectancy for Pader inhabitants is 38.5 and 43.5 years at birth for men and women respectively.<sup>2</sup>

Pader and Agago Districts have an overall literacy rate of 39.3%, with 21.6% men and 18% of women being literate. Most children drop out of school after primary seven; only 26% of boys and 17% of girls complete primary seven. Of the 223 functional schools in Pader District, 204 of them are primary schools. Yet, only 47.3% of those residing in Pader District live within a 2.5 km radius of a primary school.<sup>3</sup>

According to the 2002 Uganda Census Report, over 80% of Pader District inhabitants depend upon agriculture for their livelihood. According to Mercy Corps' assessment, 71% of those surveyed identified "farming" as their main source of household income. The majority of farmers utilizes small family plots, averaging two acres, and derives labor from family members. A variety of subsistence crops are grown in Pader, including: millet, maize, sorghum, cassava, peas, beans, groundnuts, and potatoes. Cash crops grown include: cotton, tobacco, sesame, soybeans, and sunflower. Like most Ugandan subsistence farmers, Pader farmers are plagued by low agricultural productivity that is aggravated by the high cost of inputs, the inaccessibility of modern technology, and the inadequacy of information pertaining to new techniques and market opportunities.<sup>4</sup> Generally, crops are first harvested in June and July and then harvested again in November and December. Most households have their highest influx of expendable income at the end of the harvest seasons and during the first few months following the conclusion of harvest.

<sup>1</sup> United Nations, *Uganda Humanitarian Profile 2011* (Office for the Coordination of Humanitarian Affairs (OCHA), 2011).

<sup>2</sup> District Planning Unit Database, *2002 Uganda National Household Census Overview* (DPU, 2002).

<sup>3</sup> United Nations, *Pader District: Basic Services Accessibility Atlas* (OCHA, July 2010).

<sup>4</sup> Pader District Local Government, *Three Year Rolling Development Plan (FY 2008/9-2010/11)* (Pader TC, 2008).

In February 2010, Pader District welcomed the extension of the national electrical grid, which now runs through the District from Lira Town to Kitgum Town with an extension to Pader Town Council (TC). Access to electricity remains prohibitively expensive for most of those that live along the grid line. Costs vary, but most residents pay 83,600 UGX for a connection fee, 40,000 UGX for an inspection fee, 150,000 UGX for a membership fee (includes the electric meter), the cost of poles needed to extend the grid to their residence at 400,000 UGX per pole, and the expenses associated with electrical wiring. Those that do not live along the lay of the electrical grid cannot expect access soon. In Pader TC, inhabitants purchase electricity on a pre-pay model; they purchase a set number of units in advance of usage. This system is similar to the pre-pay airtime system used by the majority of mobile phone users in Uganda. The pre-pay system is not used in other parts of Pader District where users pay retroactively for their usage at the end of each month. It is common for those that use electricity to share the cost of use across a number of residents or have the cost of electricity included in their monthly rent.

Solar power is used in Pader District. Most widely, small charging shops utilize solar panels to charge mobile phone batteries. These shops are found in all larger town centers. International institutions and non-profit organizations also readily use solar power as either their main office power source or as a back-up power source in case of electrical outages. Though a handful of health centers, shops, and households use solar power as either their main source of energy or as a backup, this is not remotely common. Neither small solar lamps nor large solar units could be found for sale within the District at the time of assessment.

## **Acknowledgments**

The Mercy Corps team would like to thank the inhabitants of Pader District who consented to participate in this exercise. In addition, we extend our appreciation to those offices, organizations and businesses that graciously contributed to this project. Further thanks are offered to the Pader survey team as well as the Kampala-based enumeration staff. Thanks are also extended to the Mercy Corps Pader Field Office staff and to the staff of the Mercy Corps National Office in Kampala whose continued support and assistance was critical to the success of this endeavor. Particular thanks are extended to Darius Radcliffe, Mercy Corps Uganda Country Director, and Timothy Sparkman, Mercy Corps Uganda Deputy Country, for their continued ongoing support and guidance. Finally, we would like to thank Dr. Jim Jarvie, Director of Climate Change, Environment and Natural Resources Management at Mercy Corps, whose generous support made this assessment possible.

## 2. METHODOLOGY

Tasked with developing and then implementing a strategy to catalyze the affordable solar market in Pader District, the Mercy Corps Pilot Project team began by examining relevant literature and related projects as well as interviewing area solar companies. The team identified the following positive correlates of both willingness and ability to purchase solar power: household income, access to informal and formal lines of credit, distance required to travel to purchase lighting and mobile phone implements, mobile phone use, perception of solar power, and access and travel to medium-sized towns. To more closely examine these correlates in Pader District, the team collected and examined data on a series of indicators using KAP surveys and key informant interviews.

Mercy Corps initiated activity on its survey by selecting and trialing questions meant to ascertain household knowledge, attitudes, and practices related to selected indicators of willingness and ability to purchase solar power. Then, the team analyzed geographic and population data from which it devised a sampling strategy. The team surveyed 1% of all households across seven Pader District sub-counties based around five larger Pader District town centers, with varying degrees of access to the electrical grid. The sample was geographically weighted according to proximity from the town center, with the number of households interviewed incrementally decreasing as the distance from the town center grew. Surveyors were instructed to begin at a set point in the center of towns, follow a plotted course and interview every 10<sup>th</sup> house until they met a certain quota for a set geographic increment. Surveyors were also instructed to interview heads of households wherever possible.

The team included nine experienced surveyors who were trained and monitored as they administered structured interviews to 392 households across eight days. All of the mostly forced-choice questionnaires were examined for accuracy and error at the end of each day. Following the completion of the survey process, two enumerators were contracted to input data in an excel format designed by the Mercy Corps team. Data entry was also monitored for accuracy and error.

As in any survey process, the Mercy Corps team dealt with bias. Unavoidable error resulting from time, monetary, geographic, and surveyor restriction did occur. As discussed earlier, the team chose a sampling strategy that utilized geographic weighting and incremental interviews. We were unable to include households that were not located along roads. Further, as we asked surveyors to make decisions, we were also unable to eliminate surveyor judgment from the process. As a result, we acknowledge that complete randomization and probability sampling did not occur and thus that a degree of bias is inherent. The team does not believe, however, that this bias invalidates the survey results. Every survey faces unpredictable and unavoidable hurdles and these are often exacerbated in remote, developing contexts. Nonetheless, the Mercy Corps team thoroughly and accurately interviewed a large sample of Pader District households. As a result, we are confident that our KAP survey yielded significant results.

In addition to the survey, the Mercy Corps team conducted a breadth of key informant interviews. The quantitative assessment highlighted areas where more in-depth qualitative research could shed further light on findings. Accordingly, the team identified those important informants and interviewed them across several weeks. The team visited the four financial institutions that operate in Pader District: Stanbic Bank, DFCU Bank, Agarú SACCO, and BRAC microfinance institution (MFI). Mercy Corps also met with local government community development sector officers from six Pader District sub-counties. Mercy Corps interviewed 11 non-profit agencies and institutions operating in the District. Across all five main town centers within Pader District, the team also interviewed 28 businesses deemed well functioning and well run by their respective communities; 18 of these businesses utilize and sell solar products in some capacity.



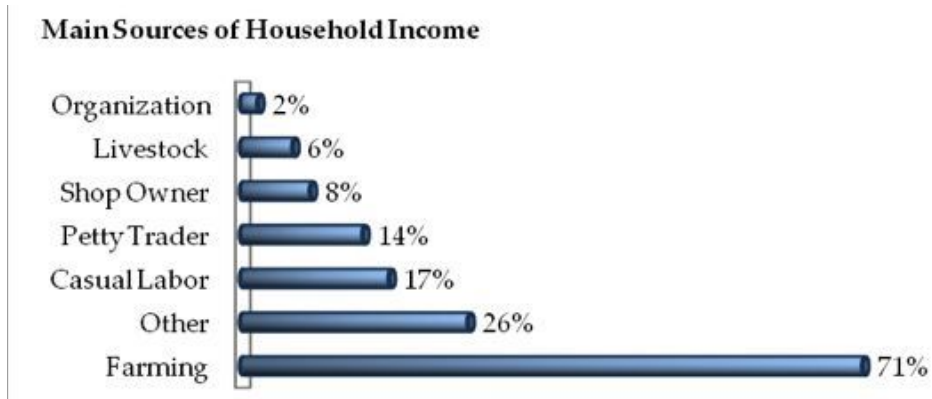
### 3. FINDINGS

The following presentation of findings is divided into six sections for ease of discussion: Household Wealth, Household Savings and Access to Credit, Lighting, Mobile Phones, Solar Power, and Market Travel.

#### Household Wealth

In this section, we examine household wealth through asset measurements and sources of income.

In Uganda, like most developing countries, a household's wealth is neither easily defined nor easily measured. For this reason, the Mercy Corps team selected a series of widely used asset indicators as contextually appropriate proxy measurements for household wealth. We then identified an asset index that better expressed comparative wealth; low household assets are determined by whether or not a household owns one or more of the following asset types: a motorcycle, a bicycle, a television, a radio, and a telephone.<sup>5</sup> Correspondingly, 57% of all respondents identified as comparatively asset poor. Of the five town centers examined, Pader TC ranked poorest with 69% of respondents defined as asset poor. Pajule ranked second poorest with 62% of all respondents similarly defined. Atanga ranked best with 44% asset poor, followed by Awere with 51% asset poor and then Lacekocot with 54% asset poor. See Appendix B for a detailed map of Pader District town centers.



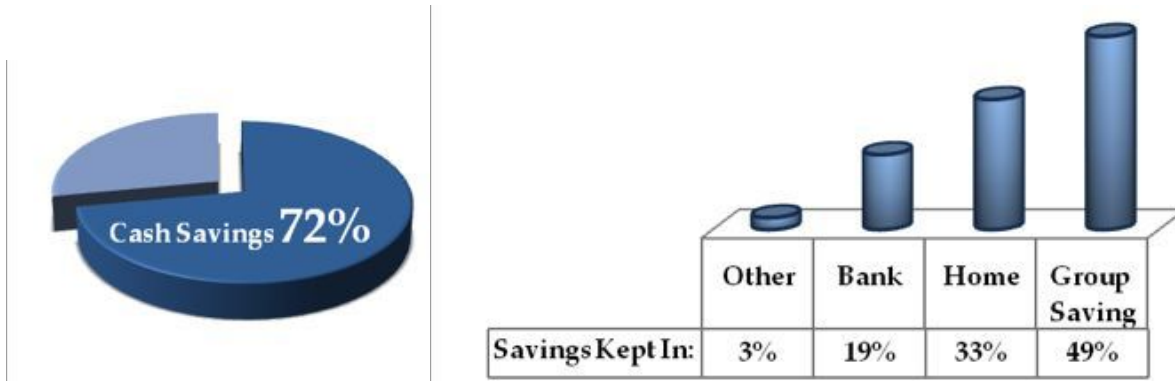
In addition to an examination of household wealth, the Mercy Corps team also assessed main sources of household income. As outlined in the chart above, nearly three-quarters of all respondents identified “farming” as a main source of household income. Second to farming, “other” was identified by almost a quarter of respondents. When those households that identified “other” were asked to more specifically delineate their source of income, most identified “home brewing.” “Casual labor”, or that which is intermittent, temporary or part-time, was identified as a main source of income by just over a quarter of respondents. Not quite a quarter of respondents identified “petty trader,” or informal hawking or market vending, as a source of household income. Further, only 8% of respondents identified “shop owner” and 6% “livestock,” or animal husbandry, as a main source of income. Lastly, 2% of respondents named “work with an organization” as a main source of income for their household. Pader District has a large local and international NGO presence; this explains the 2% of respondents that rely on income from work with an organization.

High rates of comparative asset poverty as well as a heavy reliance on farming as a source of income indicate that respondent households possess neither the wealth nor the disposable income to support higher-priced goods. Accordingly, when targeting this market for solar, it is appropriate to direct sales efforts in support of smaller, less expensive items that decrease household expenses more immediately. With some savings and credit, a much larger percentage of the market may be able to meet these costs than those associated with larger, more complex and comprehensive solar systems.

<sup>5</sup> Sabina Akire and Emma Maria Santos, *Acute Multidimensional Poverty: A New Index for Developing Countries* (OPHI Working Paper July 2010).

## Household Savings and Access to Credit

Even though solar power is growing more and more affordable, reaching a greater percentage of the market, a household's ability to pay for solar products with ready cash remains a barrier. Formal or informal access to financial services is therefore compulsory. In the following section, we examine business and household access to financing.



As highlighted in the chart above, 72% of respondents stated that their household possesses cash savings. The percentage of households that possess cash savings does not vary greatly between town centers. Nearly half of all respondents stated that they keep their cash savings in "group savings," whereas a third of households keep their savings at home, and about a fifth of all households keep their savings in the bank. Just a little over half of the 28 business owners interviewed keep their businesses' savings in a bank account; a third of them simply reinvest their savings in stock for their business.

When respondents were asked to identify the sources of their savings, 60% identified "crop sale" and 23% identified "other". Savings sources parallel the main sources of household income discussed earlier. As farming activity and the sale of agricultural products are the principal sources of household income and savings in Pader District, matching heightened efforts to sell solar products to the harvest season when cash reserves are at their highest is paramount to the successful stimulation of the solar market. These results and analysis are supported by comparable assessments of Northern Ugandan savings and spending habits according to season.<sup>6</sup> A bi-modal seasonal calendar that delineates Pader's seasonality can be found in Appendix F.

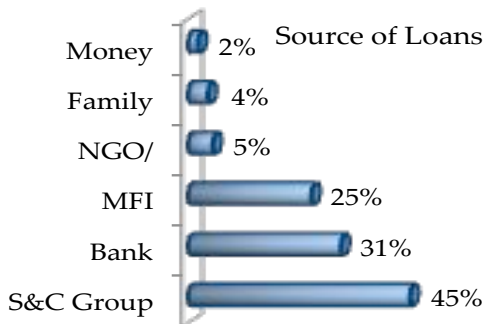
Pader District inhabitants are comparatively asset poor and derive the largest source of their savings from crop sale. Therefore, even though Mercy Corps did not ask respondents to specify the exact amount of their cash savings, we can deduce that the average amount of household cash savings is probably low. In addition to orienting sales to seasonal agricultural cash influxes, we can also make the following conclusions: First, with minimal cash savings and reserves, household spending is rigid; consumers have little flexibility for unplanned or nonessential purchases. Second, the average respondent does not belong to a household that can support high-priced, large-scale solar systems. They do belong to households, however, that would profit from the acquisition of small, affordable solar products. These households have also displayed a willingness to adopt like technological upgrading products in the past. As we will discuss later on in the assessment, income constraint has driven Pader households to adopt technology that saves time, labor, and money. When choosing which products to sell and market to Pader consumers, solar companies should not only consider less expensive products but also a payment scheme that fits with current rigid household spending habits.

The prevalence of savings and credit groups in Pader District is significant and, if tapped correctly, may help to balance out the rigidity of household spending as well as the low levels of household cash savings. Over half of all respondents (52%) stated that they belonged to a savings and credit group, and of these, 87% named "Village Savings and Loan Association" (VSLA) as their principal group of patronage. Begun in the early 1990s and adapted by a multitude of organizations throughout the world, VSLAs aim to meet basic rural and community-based financial needs. VSLAs are meant to complement microfinance organizations, serving as a place for household savings as well as a source of credit to meet life cycle needs. The large VSLA presence

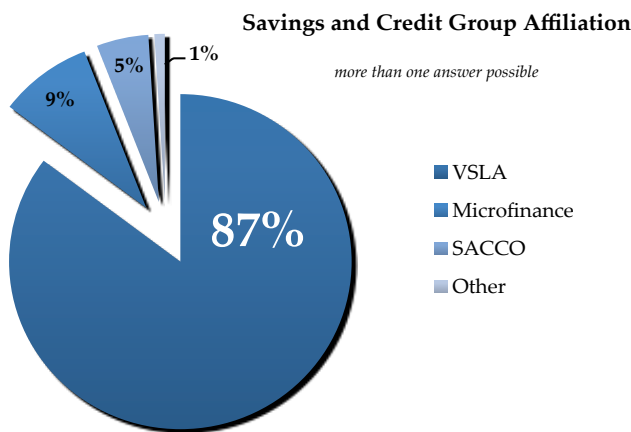
<sup>6</sup> Rich Pelrine and Olive Kabatalya, *Savings Habits, Needs and Priorities in Rural Uganda* (USAID Rural SPEED, September 2005).

throughout Pader is an outgrowth of the considerable NGO presence in the District. Of the not-for-profit organizations interviewed by Mercy Corps for this assessment, many supported VSLA creation. VSLA membership is highest amongst Awere, Lacekocot, and Pajule households with 91%, 91%, and 89% VSLA patronage respectively. In Pader TC, membership in VSLAs is just 63%, whereas MFI membership is 25% and SACCO membership is 13% of those households with savings and credit group affiliation. Across Pader District, MFI membership is 9% and SACCO membership is 5%. Notably, BRAC is the only MFI with a base of operations in the District; the Agaru SACCO is the only SACCO that operates in the District.

The presence of high household use of informal financial structures is advantageous for affordable solar market penetration. Only about 14% of all households surveyed have ever received a loan, with 45% of those loans coming from a savings and credit group, 31% from a bank, 25% from a microfinance institution, and 4% from a family member. Of the 28 business owners interviewed, only two had taken loans and only one of those did so from a formal bank. Not surprisingly, Stanbic Bank and DFCU, the only two formal banking institutions present in Pader District, have high collateral expectations for loan recipients. Contrarily, BRAC and Agaru SACCO have a more lenient loan structure. When asked where their household would acquire the money needed to purchase something that was not imminently affordable, respondents identified family members and then VSLAs most often.



Pader inhabitants' comfort with and access to informal financial structures, particularly one that offers credit to members for life cycle needs, bodes well for less expensive solar product diffusion throughout the District. Moreover, VSLAs amount to a vast network of financially supported individuals and communities that have extensive NGO assistance and widespread community backing. This network not only has access to the type of financing needed to purchase solar products, but also to ancillary candidates for solar product consumption.



In order to take advantage of this market, however, it is important to understand general and individual VSLA payment structure and life cycle. The cycle of VSLA savings and lending is time bound. Members save through a share-purchase system that requires regular savings. Members can also receive short-term, time-bound loans that must be repaid in regular increments and prior to the conclusion of the operating cycle. All loans are accompanied by a service charge.

At the end of an operating cycle, all shares and dividends earned from loan service charges are paid out to members in a lump sum proportional to the number of shares the member owns. At the conclusion of an operating cycle, as in the end of a

harvest, members have an influx of cash. Targeting VSLA members for affordable solar power product purchase, then, should happen towards the end of their groups' savings and loan cycle. Unfortunately, the length of a group's operating cycle depends entirely on a period of their choosing; it varies in time as well as dates of commencement and conclusion with each group. Generally, groups schedule their VSLA cycle of operation to receive payouts around larger events like, school fee due dates, seasonal agricultural input purchases, and Christmas. Local retailers and distributors, unlike their parent companies, can more readily access and track specific VSLA cycle information. Likewise, a localized sales structure can help solar businesses to develop relationships with NGO VSLA facilitators and individual VSLA leaders for even more localized solar awareness and sales.

## Lighting

In the following section, we examine patterns surrounding current household light use.

Roughly 1% of rural Ugandan households benefit from grid access. Even those households that are reached by grid lines find that the electricity supply is intermittent and unreliable.<sup>7</sup> This is reflective of Pader District where the supply of electricity not only remains erratic but where very few inhabitants can even afford the expense of access. Further, of the five town centers serving as the bases of households surveyed, only two have access to the grid: Pader TC and Pajule. In line with these barriers, few respondents identified electricity as a source of light. We received 13 positive responses to electrical use; this amounts to 6% of households surveyed from an area where access to electricity was even possible.

Electricity use, moreover, was also challenging to quantify. Some respondents purchase electricity in units in advance of usage, others pay for usage retroactively, others include electrical usage fees in rent payments, other respondents divide costs amongst a series of households sharing one meter, and still others simply steal electricity. Consequently, when asked about electric usage, respondents offered a range of answers that could not be accurately quantified across all respondents. Of note, inhabitants or landlords based in Pader TC must purchase electricity on a pre-pay system similarly to how the majority of Ugandans purchase mobile phone airtime; they purchase cards for set amounts in advance of usage. With this said, residents often share lighting and its associated expense across a series of connected households or even through a singular shared outdoor light. Respondents in Pajule did not identify a purchasing scheme similar to Pader TC respondents.

The most accurate measurement associated with electrical use is the number of hours in a day that respondents use electricity for lighting. On average, respondents that use electricity stipulated that their household uses eight hours and 20 minutes of light each day. Most respondents that utilize electricity do so for almost 2.5 times as long as candles (three hours, 21 minutes) as well as paraffin/kerosene (three hours, 26 minutes). Respondents utilizing electricity also employ light from electricity for nearly five times longer than those respondents that employ light from batteries (one hour, 45 minutes).

Solar use, like electrical use, was challenging to quantify accurately across all respondents. We specifically asked respondents to identify units of fuel, cost per unit of fuel, and units used a week; these measurements have little bearing on solar users. We did learn that panels vary dramatically in cost from 300,000 UGX to 750,000 UGX; no respondents identified solar energy as a source of light. All of the 18 businesses interviewed that utilize solar power initially purchased panels for the purpose of charging mobile phones as an income generating activity. As an offset of their initial business, some solar businesses now use their systems to light their shops and homes at night as well as to power televisions, radios, and barbershop equipment.

Again, like electricity, the most accurate measurement associated with solar power use is the number of hours in a day that respondents use solar for lighting. On average, respondents that utilize solar power stipulated that their household uses two hours and 30 minutes of light each day from a solar source. Of note, the respondents that identified solar as a lighting source almost exclusively use it either as a supplement to electricity or when its power is not being utilized by their mobile recharge businesses.

- **96% of all respondents use paraffin**
- **Paraffin users purchase an average of 34.58 liters of paraffin annually**
- **Paraffin users spend an average of 106,990 UGX (\$45.15) on paraffin annually**

Paraffin, or kerosene, is a source of lighting for 96% of all household respondents. On average, households purchase just 266 ml of paraffin at once but do so 2.5 times a week. This amounts to an average use of 665 ml of paraffin weekly and 34.58 liters annually. On average, 266 ml of paraffin costs 823 UGX. At this rate, users spend 2,058 UGX weekly and 106,990 UGX yearly. At a conversion rate of 2.3697 UGX to \$1 US, households average \$45.15 in annual paraffin expenses.

<sup>7</sup> Edwin Adkins, Sandy Eapen, Flor Kaluwile, Gautam Nair and Vijay Modi, "Off-Grid Energy Services for the Poor: Introducing LED Lighting in the Millennium Villages Project in Malawi," *Energy Policy* 38 (2010): 1087-97.

Survey respondents stipulated that their households use three hours and 24 minutes of light from paraffin on average each day. The median household paraffin purchase is 150 ml. Perhaps because households purchase paraffin for lighting in such small increments and only use paraffin for about three and a half hours a day, they often do not recognize how much money they spend on paraffin over time.

Paraffin use and expense do not vary significantly across town centers. Pader TC respondents, however, do purchase paraffin in larger increments and more often than other respondents. Their median household paraffin light use is also four hours, slightly higher than respondents based around other town centers.

- **16% of all respondents use torches (batteries)**
- **Torch users purchase an average of 57.2 batteries annually**
- **Torch users spend an average of 42,957 UGX (\$18.13) annually**

Next to paraffin, 16% of household respondents identified torches (batteries) as a source of light. On average, households purchase 1.1 batteries weekly with one battery costing 751 UGX. Mean household battery expenses amount to 826 UGX weekly and 42,957 UGX annually. At a conversion rate of 2.3697 UGX to \$1 US, households average \$18.13 in annual battery expenses.

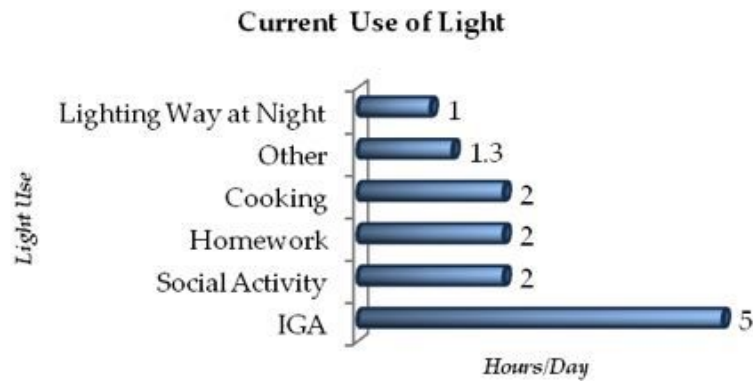
Survey respondents stated that their households use torches an average of one hour and 45 minutes a day. Again, torch (battery) use and expense do not vary significantly across town centers. Further, as with paraffin, users purchase batteries incrementally. As a consequence, users are not likely cognizant of how much money they spend on batteries over time.

- **10% of respondents use candles**
- **Candle users purchase an average of 280.8 candles annually**
- **Candle users spend an average of 57,283 UGX (\$24.17) annually**

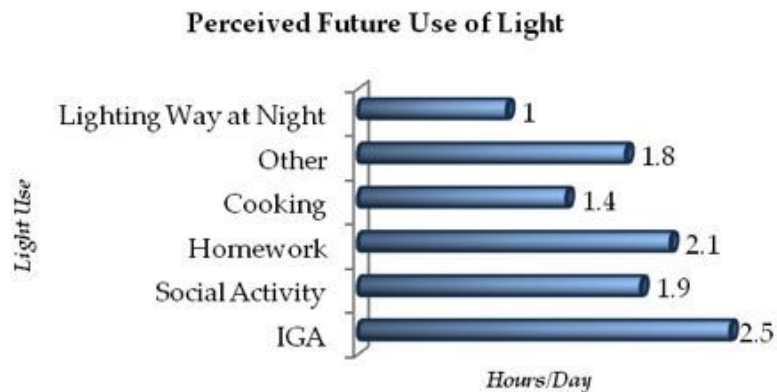
On average, 10% of household respondents identified candles as a source of light. Households purchase 5.4 candles weekly with one candle costing 204 UGX. On average, households spend 1,102 UGX weekly and 57,283 UGX annually on candles. At a conversion rate of 2.3697 UGX to \$1 US, households average \$24.17 in annual candle expenses.

Survey respondents stated that their households use an average of three hours and 20 minutes of light from a candle every day. As with paraffin and torches, candle use and expense is largely stagnant across town centers. Awere, though, uses an average of just 1.5 hours of candle light a day and purchases an average of just four candles a week. Awere candle use figures are slightly below those from other town centers. Again, candle purchase and use are incremental; it is doubtful that respondents are aware of how much money they spend to light with candles in the long term.

Respondents also outlined their daily household light use according to the number of hours of light used on specific activities each day. The average daily light use amongst respondents is 3.5 hours. However, respondents that use light to illuminate their way home at night average one hour of light use. Those households that use light for cooking, school homework, and social activities use light for two hours a night for each. Finally, respondents that use light for income generating activities (IGA) use light for an average of five hours each night. The following chart highlights this use:



Having defined their current light use, respondents were then asked to perceive what their household might do with additional light if neither the cost nor the availability of fuel for lighting were barriers. The mean perceived hours of additional daily household light use are defined in the following chart:

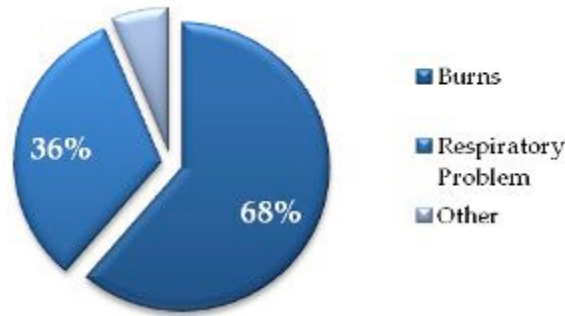


Households found it both difficult to perceive what they might do with additional hours of light as well as how their current use of light might change if the cost and the availability of fuel were not barriers. For example, a number of surveyors expressed that respondents often told them that their households had no need for additional light. Additional light use or varying uses of light, then, may not serve as successful entry points for solar power promotion. Households that adopted solar power in other studies note similar findings. Some changes in household light use do happen, but they are not envisioned ahead of solar product purchase.<sup>8</sup> Likewise, advocating additional use or changes in use patterns will not likely sell solar products amongst residents of Pader District.

Though directing solar marketing towards possible changes in household light use may not be an effective strategy, targeting marketing towards perceived health implications of current light use might be. Respondents were asked to identify whether or not they believe that a member of their household suffers health consequences as a result of their current means of lighting. As 96% of all households use paraffin/kerosene and 10% of all households use candles as chosen lighting means, it is not surprising that 57% of respondents answered in the affirmative. As highlighted in the below chart, 68% of these respondents believe that at least one member of their household has suffered burns as a result of their current light source, while 36% believe that at least one member of their household has suffered respiratory problems.

<sup>8</sup> Jennifer Tracy, Peter Alstone, Arne Jacobson and Evan Mills, *Technical Report #6: Market Trial: Selling Off-Grid Lighting Products in Rural Kenya* (The Lumina Project, June 2010).

**Perceived Health Consequences of Current Lighting Means**



A closer examination of current Pader District household light use, perception, and expenditure offers great insight into the market. Respondents almost universally purchase fuel for lighting in small increments and use the light in short segments. As a result, few respondents recognize how high their annual household fuel expenditures reach. The Mercy Corps team seldom interviewed a business that kept records of their activities; if businesses do not accurately identify sales and expenditures, it is highly improbable that households do so. Consequently, it is imperative that the Mercy Corps Pilot Project as well as the companies that endeavor to sell their products in Pader District takes the time to increase awareness of current household lighting expenditures. Once residents are able to recognize their current fuel costs and conceptualize their potential fuel savings with the use of solar power, their willingness to adopt solar will grow.

It is also vital to recognize that Pader residents spend money on fuel in small increments for a clear-cut reason: they cannot afford to buy fuel in larger increments. Though Pader respondents have some savings and access to credit, it is not enough to finance larger solar system purchases nor even to finance solar lantern purchases in a single, upfront payment. Households are willing to spend only enough to meet bare essentials; because they perceive their current light use as adequate, these households will not dramatically change their purchasing behavior to buy a product that is deemed superfluous. As respondent households both perceive their current light use as adequate and cannot afford to make large payments, the burden falls to the solar companies to concoct a payment scheme that follows a comparable incremental payment pattern to current household lighting purchases. For solar companies to prompt successful solar product sales, then, they must devise an incremental payment scheme that only asks households to reallocate their current lighting expenditures away from paraffin and toward solar.

### Mobile Phones

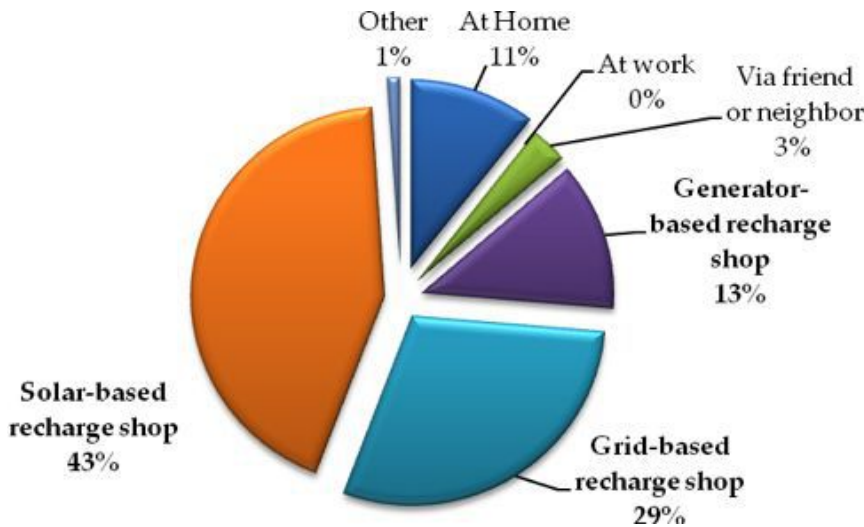
The following section examines mobile phone use, adoption, and associated expenditures amongst Pader District survey respondents.

Access to mobile phone technology has grown exponentially in recent years. Even in some of the most remote and impoverished regions of Uganda, inhabitants readily use mobile phones. This too is true of Pader District where mobile phone use is broad. Among those surveyed, 38% stated that they personally own a mobile phone while 47% stated that another member of their household owns a mobile phone. In addition, of the 153 respondents (39%) that neither own a mobile phone personally nor belong to a household in which another one of its members owns a mobile phone, 69% still use mobile phones. Hence, 88% of all respondents use mobile phones.

- **88% of all respondents use mobile phones**
- **85% of respondents that charge a mobile phone pay a shop to do so**

Of the respondents that charge a mobile phone, 85% pay a solar, generator, or grid-based shop in order to do so. Note, though, that this number does not include casual mobile phone users that may or may not pay to recharge and/or use mobile phones informally. Consequently, this number likely underestimates the actual percentage of the population of Pader District that pays to recharge mobile phones. As highlighted in the

chart below, 43% of all mobile recharges are done at a solar-based recharge shop, 29% are done at a grid-based recharge shop, and 13% are done at a generator-based recharge shop. Only 11% of mobile recharging is actually done in the home.



- 70% recharge twice weekly
- 27% recharge once weekly

Such a large percentage of Pader District households not only utilize mobile technology and pay to do so, but they pay to recharge frequently and what amounts to considerable sums over time. As the chart above states, 70% of respondents that pay to recharge a mobile phone do so an average of twice weekly; 27% of respondents that pay to recharge a mobile phone do so an average of just once weekly. The mean cost of a single phone recharge in Pader District is 533 UGX; the median expense is 500 UGX. So, for the 70% of those respondents who recharge twice weekly, their annual mobile phone recharging expense amounts to 55,432 UGX. At a conversion rate of 2.3697 UGX to \$1 US, Pader households average \$23.39 in annual mobile phone recharging expenditures. Notably, the monetary expense of simply recharging a mobile phone at a solar, grid-based, or generator recharge shop is not the only cost of recharging. Households that recharge a mobile phone often travel to a neighboring town to do so. Of the solar recharge shops the Mercy Corps assessment team visited throughout Pader District, all were based in larger town centers. None of these recharge shops identified additional solar recharge shops that were not located in town centers. The cost of mobile recharging not only includes weekly expenditures to power-up phone batteries, then, but also the monetary cost of traveling to town centers from rural homes. Further, the time households expend to travel to town centers is time taken away from something else.

- **Annual mean cost of recharging a mobile phone: 55,432 UGX (\$23.39)**

The rural Ugandan surge in mobile phone use has a very practical origin; it surfaced as a cheaper alternative for communication, reducing transportation and transaction costs.<sup>9</sup> Simply put, mobile phones save their users money. As the costs of using individual mobile technology have steadily declined, the number of users has increased dramatically. The expense of recharging phones, the distance required to do so, and the opportunity cost of not utilizing these monetary and time resources elsewhere, likely serve as a continued barrier to higher mobile use. Do the costs associated with recharging deter those who may otherwise purchase a mobile? Do the costs depress current mobile usage? Mercy Corps did not examine these questions directly in our assessment, but the data we collected indirectly and anecdotally points to "yes." Recent innovations in affordable solar power products couple mobile recharging with a light source. These dual lighting and recharging solar systems could offer rural inhabitants a means to circumvent the barriers associated with the costs of mobile recharging. Therefore, these products may also present companies with the biggest opportunity to penetrate the rural solar market.

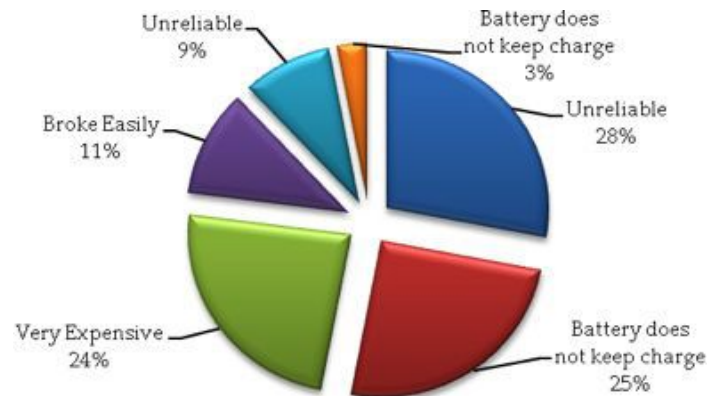
<sup>9</sup> Dr. Jenna Burrell and Julius Matovu, *Livelihoods and the Mobile Phone in Rural Uganda* (Grameen Foundation. January 2008).



## Solar Power

We more closely examine solar power and potential solar market spoilage in the following section.

Solar panels dot the main streets in each of the five town centers that served as an epicenter for the Mercy Corps assessment. It is not surprising then that 90% of respondents stated that they have some kind of experience, understanding, or perception of solar. Unfortunately, 52% of respondents identified their experience, understanding, or perception of solar as negative. The following chart more specifically delineates respondents' negative experience, understanding, or perception of solar:

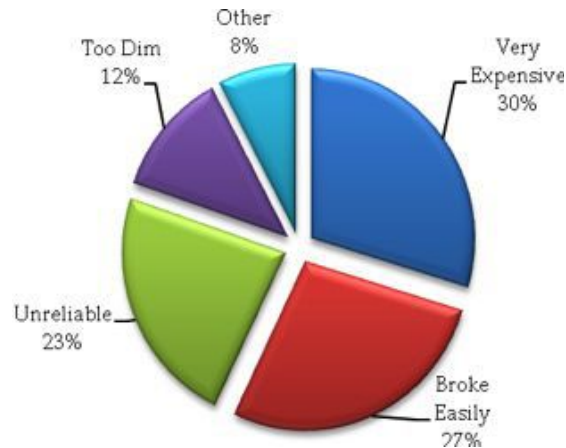


Market spoilage is a major impediment to the willingness of potential customers and markets to adopt solar power and is documented in a number of project reports. The solar industry is poorly regulated in Uganda, like most developing countries. Consequently, businesses sell poor quality products and offer minimal technical training to users, resellers, and solar-based businesses. As result, systems may break easily, corrupt batteries, damage equipment, or the like. Solar becomes a wasted investment for those that took the leap; a poor reputation prevents other would-be customers from purchasing.<sup>10</sup>

In Pader District, neither respondents nor the businesses that utilize solar systems for recharging seem to differentiate a good product from a bad product. Every one of the 18 businesses interviewed that owns a solar system discussed how they personally ensure quality when using the system on behalf of customers by limiting the number of phones charging at once or keeping the system clean, for example. None of the businesses identified any over-arching quality standard for the solar equipment itself. Further, none of the solar businesses have attended any formal training; all either learned from the solar dealer that sold them their equipment or from a friend. Without quality standards and adequate training, it is difficult to prevent the sale of bad solar products or misguided solar panel usage that result in damaged mobile phones and wasted solar system investments and ultimately cause solar market spoilage.

Problems with market spoilage in a range of solar projects are not just limited to solar systems or panels, but also encompass light-emitting diode (LED) bulbs, commonly called “energy savers” in Uganda. Accordingly, the Mercy Corps assessment team asked respondents to stipulate whether or not they had some kind of experience, understanding, or perception of LED lights and what that was. Surveyors found that most respondents were unable to identify what an LED bulb was without some explanation. It was explained first as an energy saver light bulb and second through comparison to “yellow light”. After the explanation, 40% of respondents identified that they either experienced or perceived the following problems with LED lights:

<sup>10</sup> Marek Harsdorff and Patricia Bamanyaki., *Impact Assessment of the Solar Electrification of Microenterprises, Households and the Development of the Rural Solar Market* (GTZ (PREEP), September 2009).



Solar power availability and customer experience in Pader District is still in its infancy. This is particularly true of small, affordable solar products. One positive corollary of poor solar market penetration is that perception of solar power can still be molded and thus substantial solar market spoilage prevented. By supporting reliable, experienced companies that offer quality products to enter the Pader market, Mercy Corps can help to create brand dependability. As we begin to connect local businesses with Kampala-based companies and affordable solar product availability skyrockets, however, it is also likely that competitors offering poorly manufactured and unreliable products will enter the market as well. In order to prevent such market spoilage, consumer awareness must be a focal point of any project to catalyze the solar market.

## Market Travel

In the following section, we examine respondent travel to area market centers.

Solar products are virtually unavailable for sale in Pader District. Some Kampala-based companies stated that their distributors and resellers work within the District, but none of the interviewees or respondents had any knowledge of sales. Of all the 18 businesses interviewed within Pader that owned and operated solar equipment, none of them offered it for sale. Each business owner stated that they traveled to another, larger town, most neighboring Pader District, to purchase their equipment. When asked whether or not there are local solar distributors in town, one business owner stated, “We normally go to them.” Accordingly, not only are small, more affordably-priced solar systems or lanterns unavailable for consumption, but the majority of Pader inhabitants have no idea that such systems even exist.

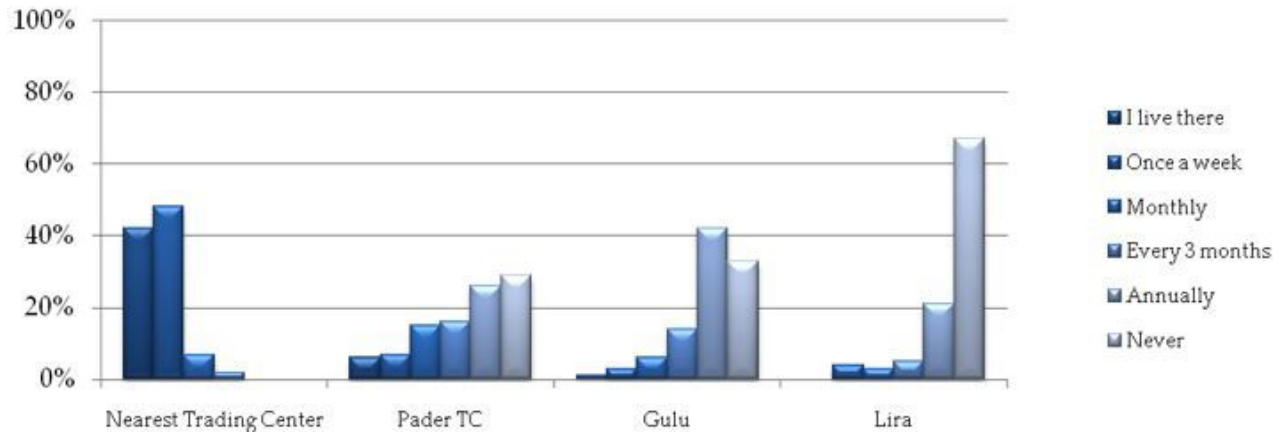
Proximity and travel to medium-sized market centers are two of the strongest correlates of household expenditure in Uganda.<sup>11</sup> Predictably, smaller town centers do not offer a diverse selection of commodities for consumption and do not prompt as much expenditure as medium-sized towns. Medium-sized towns not only offer a greater selection of commodities that prompt greater expenditure, but they are also home to wealthier inhabitants. Pader District, however, is home to no medium-sized market centers. Pader TC is the largest of all trading centers in the District with just 13,500 inhabitants. Gulu and Lira towns are the next closest medium-sized market centers. Both towns are also home to a number of solar power wholesalers, distributors, and resellers.

The Mercy Corps assessment team examined the frequency with which Pader households travel to trading centers. Respondent households seem to perceive the nearest trading center as the closest town center, not the nearest larger town. Pader inhabitants do not travel to larger towns or cities; they stay close to home. Further, District infrastructure does not support ease of travel: roads are dilapidated and difficult to traverse; buses and minibuses seldom operate. In short, Pader inhabitants travel to their nearest town center but they rarely travel farther away from home nor have the opportunity to do so.

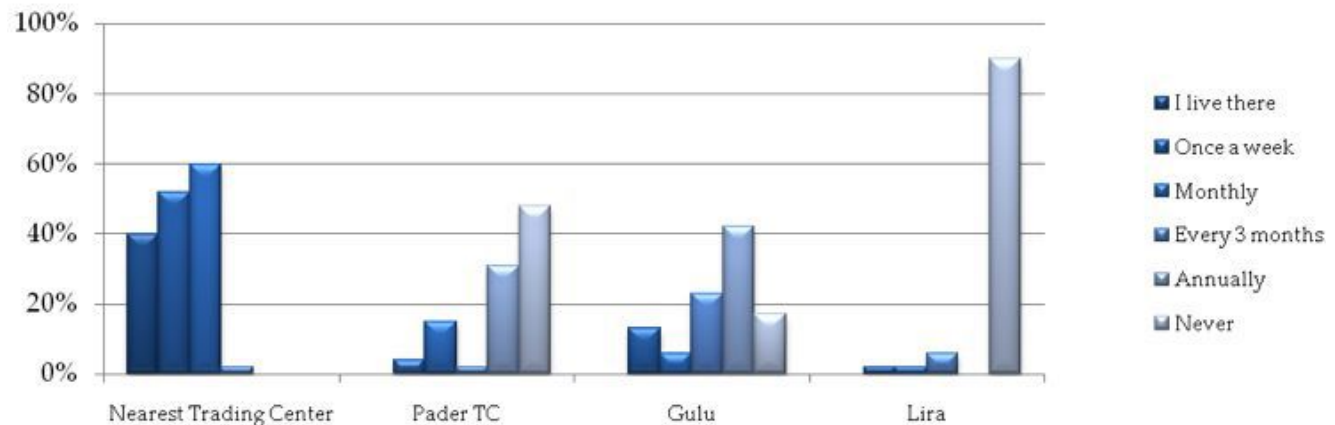
<sup>11</sup> Francesca Pozzi, Tim Robinson and Andrew Nelson, *Accessibility Mapping and Rural Poverty in the Horn of Africa* (IGAD Livestock Policy Initiative Working Paper, January 2010).

The following charts highlight respondents' frequency of travel to the nearest trading center, Pader TC, Gulu, and Lira. The charts are organized by all respondents, and then by respondents from each of the five town center focal points.

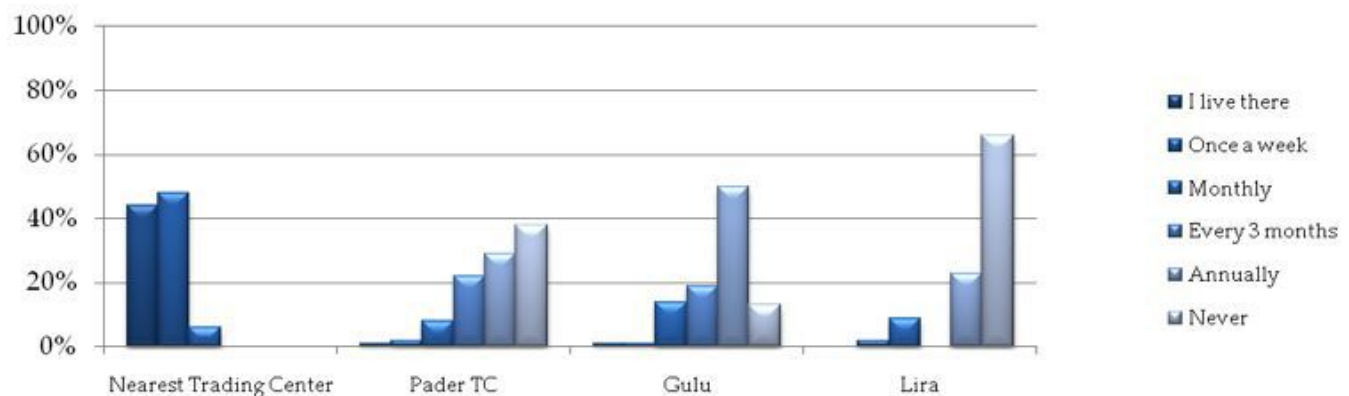
**Across All Respondents:**

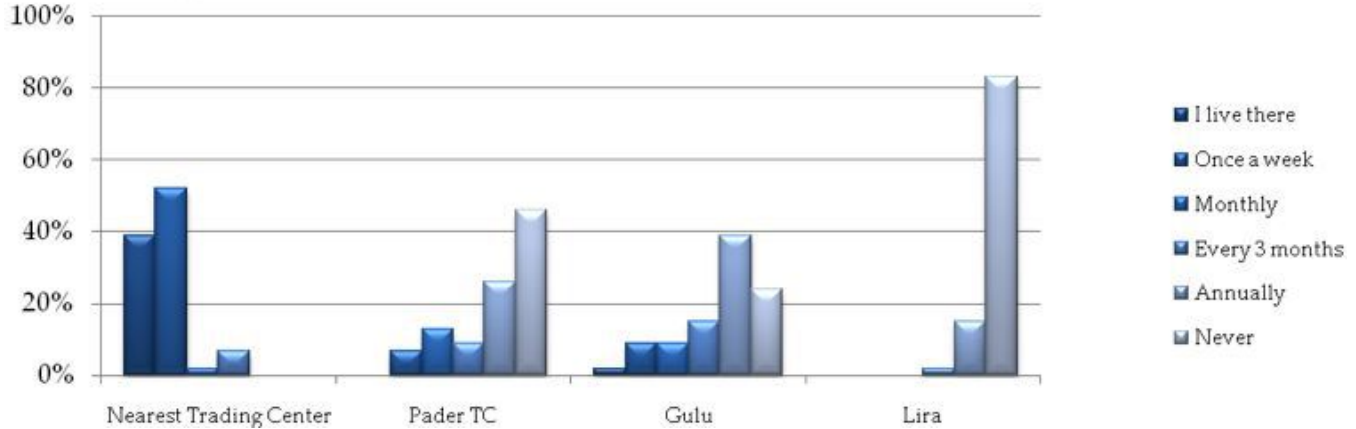
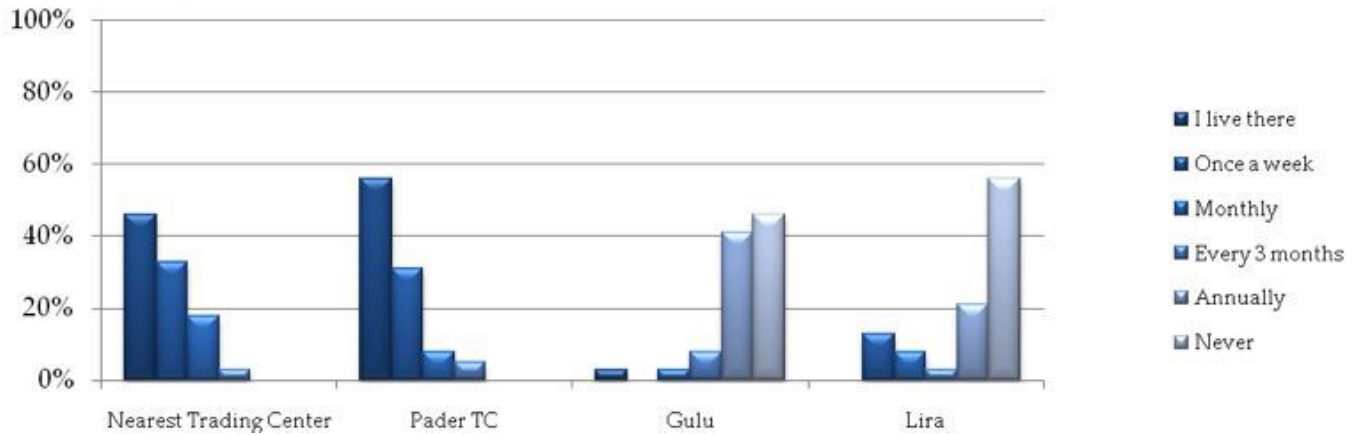
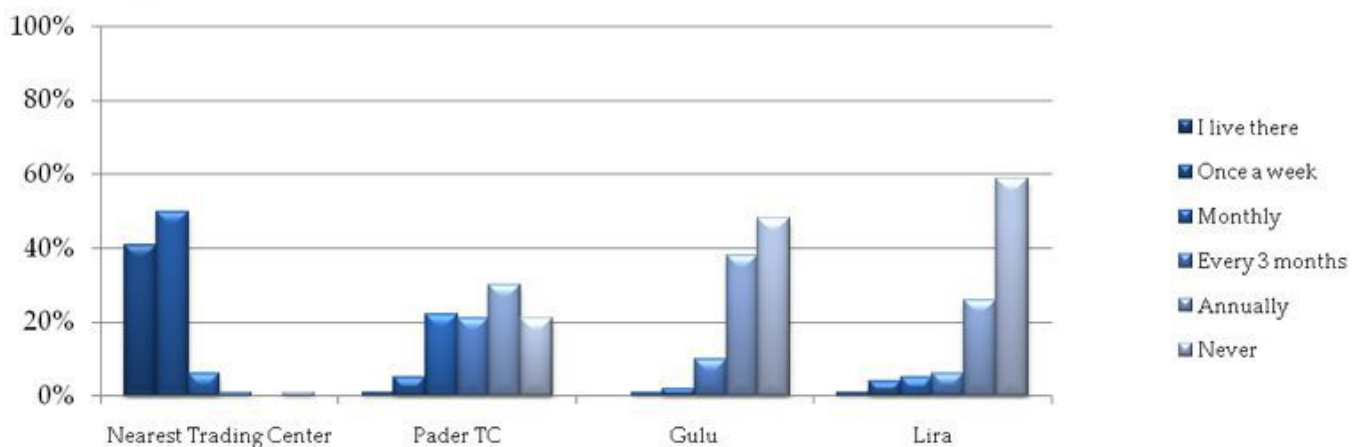


**Atanga Respondents:**



**Awere Respondents:**



**Lacekocot Respondents:**

**Pader TC Respondents:**

**Pajule Respondents:**


The infrequency with which respondents based around the five towns travel beyond their nearest trading center highlights the need for companies to bring products closer to households rather than expecting households to come to them. It is a mistake to think that a sales location in the nearest larger town is enough to successfully penetrate this market. The target affordable solar power consumer is the same consumer that does not travel beyond their immediate trading center. These are the consumers that are now able and willing

to purchase mobile technology and do so because it lowers their transaction costs. Potentially, solar products will lower these consumers' transaction costs similarly. If these consumers must travel a great distance at high personal expense to purchase solar products, however, they will not lower their transaction costs whatsoever. Additional travel expenditures obliterate any immediate cost savings offered by solar lantern investment, effectively eliminating the allure of a solar solution. Moreover, and as discussed in detail earlier, household access to heightened expendable income mirrors harvest seasons or VSLA operating cycles that vary according crop or group or community. Without a local sales presence, solar companies cannot accurately and intelligently target their marketing and sales plans to mirror specific influxes in consumer income or need. Correspondingly, a local sales presence in major town centers is crucial to the successful sale of solar products Pader District.

## 4. RECOMMENDATIONS

Using Pader District population projection data and Mercy Corps' own market assessment data, we can estimate potential aggregate solar lantern sales in Pader. If Pader District inhabitants would reallocate their annual mobile recharging expenditures to the purchase of a solar lantern, solar companies could reasonably sell 147,201 lanterns. Moreover, if household users of paraffin, batteries, and candles would simply reallocate their annual fuel expenditures to the purchase of a solar lantern, solar companies can expect to sell 72,156 solar lanterns to paraffin users, 4,828 solar lanterns to torch users, and 4,025 solar lanterns to candle users.<sup>12</sup> See Appendix A for more details. Though these sales numbers are possible, they will be more probable if the Mercy Corps team and its partner solar companies adhere to the following recommendations.

### Adopt appropriate sales strategies

**Pader District inhabitants are viable candidates for solar power consumption if targeted appropriately.** Though most respondents are income and asset poor, they also have access to savings and belong to associations that offer credit for life cycle needs. Few Pader District households would purchase large-scale solar systems; if intelligently targeted and informed, however, a vast majority of Pader inhabitants are ideal affordable solar power customers.

### Target mobile phone use as an entry point for solar sales

Pader District inhabitants spend a lot of money on mobile phones. The vast majority of those interviewed (88%) use mobile phones and most of them pay about 500 UGX twice a week to continue this use. Ugandans have adopted mobile technology for a very simple reason: mobile phones reduce the costs of their transactions. As the expense to adopt mobile technology has steadily decreased, the rate of adoption has dramatically increased. The costs associated with charging mobile phones, the monetary expense, the time away from productive activities, and the distance that consumers must walk to charge phones, remain large barriers to even greater mobile phone adoption. Affordable solar products that couple lighting and mobile recharging effectively eliminate this barrier. As such, **the best opportunity to sell solar products is by selling those that couple lighting with mobile phone recharging.** Solar companies should not only promote these dual-purpose solar units, but should primarily promote solar as a product to cut mobile costs. Mobile use represents an effective point of entry for solar market penetration. Consumers perceive their current lighting means as adequate. As a result, consumers will also more likely to be willing to adopt solar technology as a means to cut mobile phone expenses than as a source of lighting. With time and greater adoption, however, a larger number of consumers will come to recognize solar as a cost-saving alternative to their current lighting means, spurring even greater adoption.

### Decentralize sales strategies

Pader District inhabitants rarely travel beyond the trading center that is closest to their primary residence. These trading centers are not major hubs of activity that offer a breadth of commodities for sale but smaller, local trading centers with minimal deviation in product availability. Unfortunately, no solar power products are offered for sale anywhere in these small trading centers throughout Pader. Ugandans adopt mobile technology because it reduces their transaction costs, including transportation expenses; they are not likely to adopt a like technological upgrading product that increases their transaction costs. Consequently, even though solar power is offered for sale in neighboring large town centers, Pader inhabitants know almost nothing about its availability nor are they likely to travel to learn enough to incite solar product purchase. Additionally, the best potential solar customers are those that have access to cash or informal credit. Pader consumer access to cash and credit varies according to harvest season and often according to VSLA operating cycle. A company that works in neighboring districts cannot manipulate its sales strategy according to its potential customers without understanding these intricacies of the local market. And, a company that is based in a neighboring district rather than in the nearest trading center will not learn these intricacies. **In order to reach the Pader market, solar companies must decentralize their sales structures and go to Pader directly.** It is not enough to have a sales presence in neighboring Lira or Gulu town centers; solar companies must adopt a

<sup>12</sup> These numbers are based on Mercy Corps assessment data for current household level fuel expenditures and Pader District population projection data where the cost of an affordable solar lantern is estimated at 50,000 UGX.

strategy that enables them to have a large sales presence in the smaller town centers that are frequented by consumers.

### **Adopt a viable financing scheme**

Pader District respondents purchase fuel for light in small amounts and use light in short segments. Further, as a result of their incremental payment method, they may not be cognizant of the high long-term expenditures associated with their fuel use for lighting. At the same time, though, users budget a small percentage of their weekly earnings or savings to purchase fuel for lighting. Paraffin, batteries, and candles all meet consumer lighting needs by allowing them to spend small amounts over a long period of time. Consequently, current lighting expenditures as well as opportunities for cost cutting not only represent an entry point for solar sales but a barrier as well. Households are willing to adopt new technology if it cuts their expenses and they have shown this through their willingness to adopt mobile technology. However, households are also unable to raise the necessary funds to adopt cost-cutting technology all at once by making a singular solar power unit purchase. This is particularly true because households view their current lighting source as adequate. **Meeting consumer demand by creating an incremental payment system or by establishing a rent-to-own program might be ways to overcome this barrier** and to more comfortably meet current consumers' expenditure structure.

### **Adequately inform targeted consumers**

Most Pader inhabitants are unaware of their total expenditures on both fuel for lighting and the costs of recharging their mobile phones. Lighting and mobile recharging are largely stagnant in use and expenditure across household, but both of these figures are high. As consumers purchase inputs incrementally and rarely track overall expenditures, their annual lighting and mobile recharging costs are considerable. Yet, consumers do not recognize this. When conventional lighting and recharge method costs are compared to those associated with solar use over time, they become staggering. The majority of Pader District households are not only unaware of their annual expenditures, but they are unaware of an energy source alternative that will save them money. It is not enough to adequately place products in smaller, more accessible town centers; consumers must receive adequate information on product availability and accessibility as well as comparative product pricing. Moreover, because such high rates of solar market spoilage are recorded across solar product projects and the onset of a comparable solar spoilage is beginning in Pader, it is imperative that consumers understand what differentiates a quality product from an inferior product and a quality company from an inferior one. **Armed with sufficient price comparisons as well as information about product quality, consumers are more likely to adopt affordable solar power products.** This is one area that the Mercy Corps Pilot Project can help bolster. By partnering with viable, recommended solar companies Mercy Corps can ensure that the first large-scale Pader consumer interaction with affordable solar products is quality controlled. Moreover, Mercy Corps can work with selected companies to provide education and awareness for consumers.

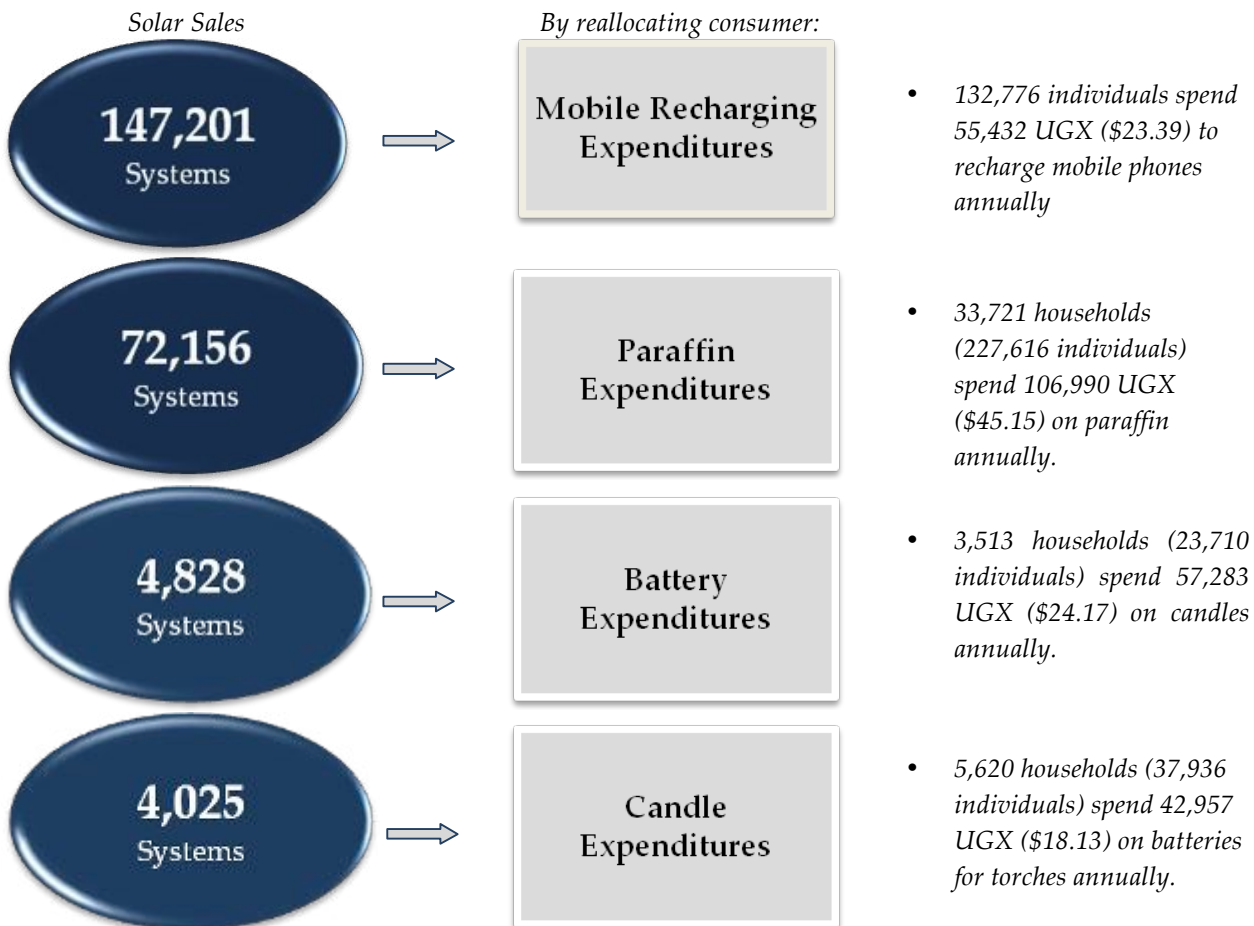
## APPENDIX A: AGGREGATE MARKET ASSESSMENT

Using Pader District population projection data and Mercy Corps' own market assessment data, we can measure the potential aggregate Pader affordable solar market as follows.

### Potential Aggregate Solar Lantern Sales

If Pader District inhabitants would reallocate their annual mobile recharging expenditures to the purchase of a solar lantern, solar companies could reasonably sell 147,201 lanterns. Moreover, if household users of paraffin, batteries and candles would simply reallocate their annual fuel expenditures to the purchase of a solar lantern, solar companies can expect to sell 72,156 solar lanterns to paraffin users, 4,828 solar lanterns to torch users and 4,025 solar lanterns candle users. These numbers are based on current household level fuel expenditures and District population data. The cost of an affordable solar lantern is estimated at 50,000 UGX.

### Solar Sales Figures





## Aggregate Informal Financial Access

### Cash Savings Figures

**24,588**

households have cash savings

**165,970**

individuals have cash savings

### Savings and Credit Group Affiliation

**18,266**

households belong to a savings and credit group

**123,292**

individuals belong to a savings and credit group

### VSLA Affiliation

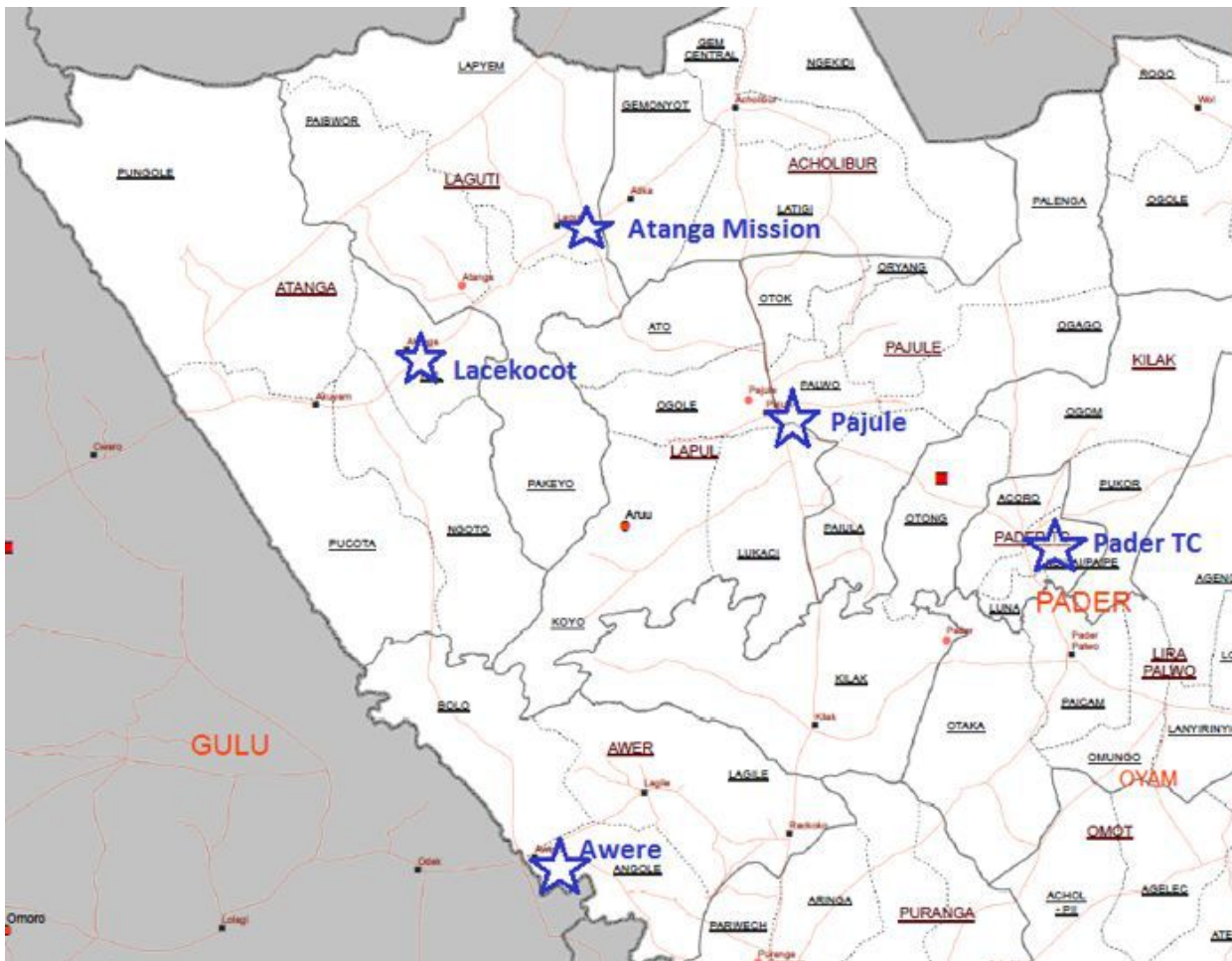
**15,891**

households belong to a VSLA

**107,264**

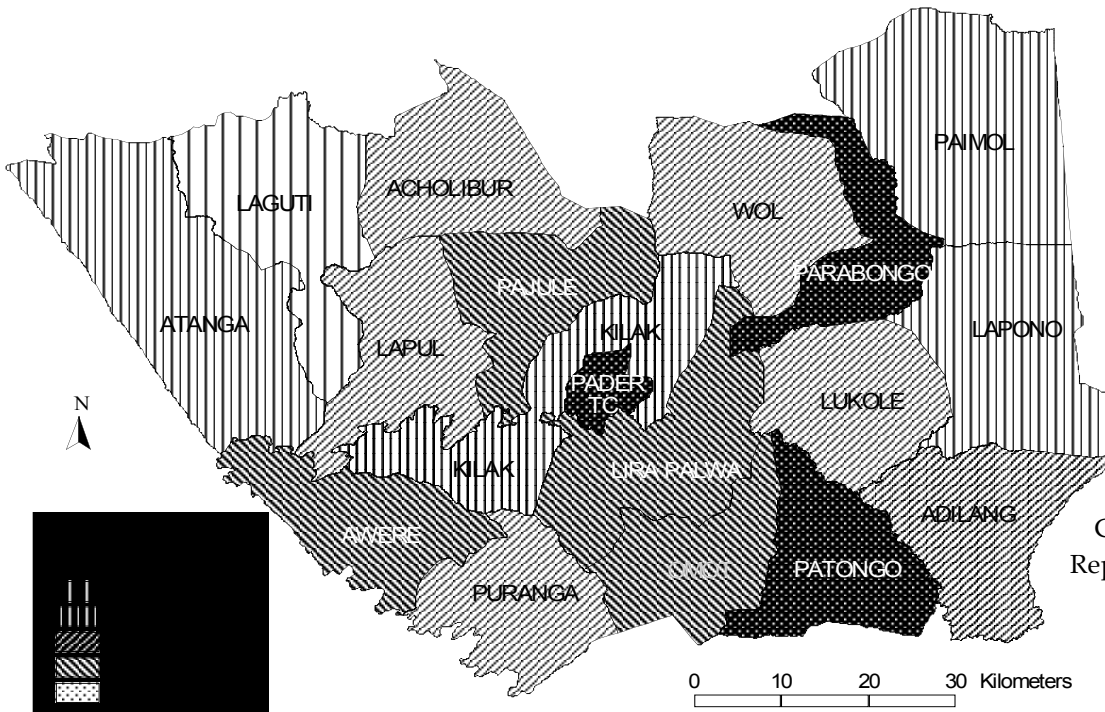
individuals belong to a VSLA

## APPENDIX B: MAP OF PADER DISTRICT TOWNS



# APPENDIX C: MAP OF PADER DISTRICT SUB-COUNTIES

Shows Population Density by Pader and Agago Sub-County\*



\*Source: Pader District Census 2002 Analytical Report

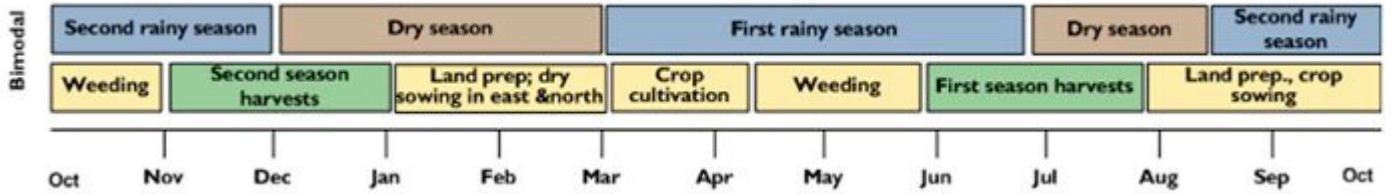


## APPENDIX E: PADER DISTRICT POPULATION PROJECTIONS

Sub-County	No. of Parishes	No. of Villages	2011			2012		
			Male	Female	Total	Male	Female	Total
<b>Acholibur</b>	4	57	14,700	15,500	<b>30,200</b>	15,500	16,200	<b>31,700</b>
<b>Angagura</b>	-	-	13,200	13,800	<b>27,000</b>	13,900	14,500	<b>28,400</b>
<b>Atanga</b>	4	69	8,900	9,500	<b>18,400</b>	9,400	9,800	<b>19,200</b>
<b>Awere</b>	4	41	16,200	13,600	<b>29,800</b>	17,100	14,200	<b>31,300</b>
<b>Kilak</b>	4	-	4,100	3,300	<b>7,400</b>	4,300	3,500	<b>7,800</b>
<b>Laguti</b>	3	38	7,400	7,500	<b>14,900</b>	7,800	7,800	<b>15,600</b>
<b>Lapul</b>	4	59	12,300	12,400	<b>24,700</b>	12,900	13,000	<b>25,900</b>
<b>Latanya</b>	-	-	8,000	8,300	<b>16,300</b>	8,400	8,700	<b>17,100</b>
<b>Pader T/C</b>	3	27	7,000	6,500	<b>13,500</b>	7,300	6,800	<b>14,100</b>
<b>Pajule</b>	6	86	16,200	16,400	<b>32,600</b>	17,100	17,200	<b>34,300</b>
<b>Puranga</b>	4	54	11,500	10,800	<b>22,300</b>	12,200	11,300	<b>23,500</b>
					<b>237,100</b>			<b>248,900</b>

Source: DPU Data base

## APPENDIX F: PADER DISTRICT BI-MODAL SEASONAL CALENDAR



## APPENDIX G: ORGANIZATIONS OPERATING IN PADER DISTRICT

1	ACORD
2	AM
3	ARLPI
4	Arbeiter Samariter Bund (ASB)
5	Associazione Volontari Per Servizio Internazionale (AVSI)
6	BRAC Microfinance
7	CARE
8	CARITAS
9	Christian Children Fund
10	CESVI Uganda
11	Cooperzione International (COOPI)
12	Catholic Relief Services (CRS)
13	Concern
14	Diocese of Kitgum Child Care Project
15	Food and Agricultural Organization (FAO)
16	Food for the Hungry
17	Family Health International (FHI)
18	GOAL
19	Invisible Children
20	International Aid Services
21	Lutheran World Foundation
22	Mercy Corps
23	Norwegian Refugee Council (NRC)
24	Population Services International (PSI)/PACE
25	OHCHR
26	Pyschosocial Organization (TPO)
27	UNFPA
28	UNHCR
29	UNICEF
30	USAID-NUTI
31	War Child (UK & Holland)
32	World Food Program
33	World Health Organization
34	WORUDET (Women In Rural Development Network)
35	World Vision Uganda
36	ZOA Refugee Care

**GLOBAL HEADQUARTERS**

Mercy Corps  
15 SW Ankeny Street  
Portland, OR 97204  
503.292.3355  
[www.mercycorps.org](http://www.mercycorps.org)

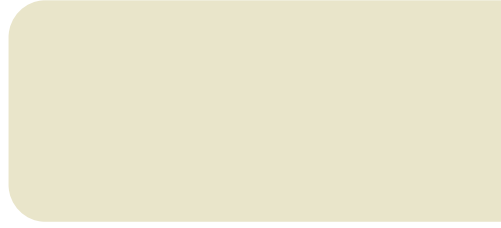
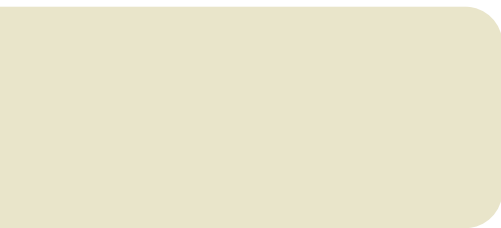
**EUROPEAN HEADQUARTERS**

Mercy Corps  
40 Sciennes  
Edinburgh, EH9 1JN  
United Kingdom  
+44 (0) 131 662 5160

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**APPENDIX H: FINANCIAL INSTITUTIONS OPERATING IN PADER DISTRICT**

1	Stanbic Bank
2	DFCU Bank
3	BRAC Microfinance
4	Agaru SACCO



You must be the change  
you wish to see in the world.

~ Gandhi



Be the change