

A photograph of two young Black men standing in a lush green field, possibly a vegetable garden. They are both wearing bright orange shirts and are smiling at the camera. The man on the left is wearing a polo shirt, while the man on the right is wearing a t-shirt. They are holding hands. The background is filled with various green plants and trees.

Driving financial inclusion through renewable energy



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INTRODUCTION

In sub-Saharan Africa, low-income households do not ordinarily have access to formal financial services, with opportunities for improving quality of life limited to savings, insurance and borrowing. To address this issue, in 2012 the Africa Enterprise Challenge Fund (AECF) provided funding for a cluster of renewable energy companies that offer innovative microloan and pay-as-you-go (PAYGo) payment services to their customers. Enabling people to own a range of clean energy products, such as Solar Home Systems (SHS) and Improved Cooking Solutions (ICS), these companies either provide finance to low-income households directly, or partner with microfinance institutions to deliver credit for the purchase of assets.

In 2013 AECF's Renewable Energy and Adaptation to Climate Technology (REACT) team began to receive reports that the delivery of these renewable energy products and services was having a positive impact on financial inclusion. According to these reports, the different payment mechanisms made available through the schemes were helping low-income households to become financially enfranchised and empowered.

Indeed, through these models hundreds of thousands of un-banked rural customers have now been given the opportunity to build credit histories through micro repayments, or use paid-off assets as collateral to access additional third-party finance. By partnering with fin-techs and banks, and by using machine learning

and predictive analytics to process transaction data, renewable energy companies are able to tailor products to individual customers. They are also able to bring financially and technologically inexperienced customers into modern payment systems, such as mobile money.

Encouraged by these developments, the REACT team wanted to confirm whether this financial inclusion effect was taking place structurally, or whether it was just happening in isolated cases. REACT also wanted to understand how it could strengthen these impacts and stimulate its partners to increase their contribution to financial inclusion. To answer these questions, AECF engaged L-IFT to conduct an investigative study, the results of which are summarised in this report.

ABOUT THIS REPORT

This report presents the findings of the study commissioned by AECF, and conducted by L-IFT, entitled ‘Does Renewable Energy Drive Financial Inclusion?’ The aim of the study was to explore the extent to which business models funded by AECF that have a secondary benefit of creating credit histories or delivering assets can also deliver access to finance – either from the original project partners, or from third-party sources. The study identifies key factors affecting the success of these models and draws systemic findings that can be applied to both current and future investees in existing and new markets.

Taking place between July 2018 and March 2019, the study adopted a mixed-method approach, which included:

- Literature review
- Interviews with REACT partners
- Case studies based on field investigations among REACT partner clients
- Data mining of the Financial and Energy Diaries Uganda (FEDU) study
- Extensive additional FEDU survey with 1,778 respondents across 12 districts in Uganda
- Expert interviews

The study triangulated the findings from these components to form its opinions and identify actionable recommendations. It is hoped that the data collected during the study will be used elsewhere to drive further progress in renewable energy and financial inclusion.

The authors of this report have endeavoured to keep all content concise and accessible to encourage the widest readership possible. In addition to sector stakeholders, the report is intended for all staff within REACT’s partner companies, including those working in sales, customer care and administration. A summary document can be found online at www.aecfafrica.org/knowledge-hub

AECF and L-IFT hope you enjoy this report.

ABOUT AECF

Launched in 2008, AECF is a development institution which supports businesses to innovate, generate jobs and leverage investments in an effort to create resilience and sustainable incomes in rural and marginalised communities in Africa.

As of the end of 2018, AECF has invested in 268 businesses across more than 40 value chains and 26 countries in sub-Saharan Africa. AECF focuses specifically on agribusiness, renewable energy and climate technologies, while also addressing the cross-cutting themes of gender, youth and fragile contexts. In just over a decade, AECF has impacted 17 million lives, provided over 12,000 jobs, and leveraged US \$700 million in matching funds from the private sector. AECF is headquartered in Kenya, with offices in Cote d'Ivoire and Tanzania.

AECF aims to alleviate poverty in Africa by unlocking the power of the private sector. AECF's strategy is to provide early and growth-stage renewable energy and agricultural businesses with:

- ***Catalytic funding***

AECF works to bridge the finance gap for those firms that need significant capital but are not yet large or profitable enough to benefit from

commercial finance. AECF's main financing mechanisms are repayable grants and loans. Recently, AECF launched its own results-based finance scheme in Kenya (still in pilot phase) and is considering other forms of catalytic finance.

- ***Advisory support***

AECF provides technical assistance to private sector firms to help them scale. This assistance is provided through both internal AECF expertise and external consultancy support.

- ***Market linkages***

AECF helps its investees to access commercial finance through AECF Connect. The programme introduces potential investors to AECF investees, helping more advanced companies in the AECF portfolio to scale and grow.

AECF aims to alleviate poverty in Africa by unlocking the power of the private sector to impact rural and marginalised communities. AECF's strategy is to provide early and growth-stage renewable energy and agricultural businesses with:

AECF AND THE RENEWABLE ENERGY SECTOR

Through REACT, AECF provides funding for renewable energy financing. The REACT programme is designed to:

- Catalyse the private sector to increase the supply of cleaner fuels.
- Raise awareness of the dangers of indoor air pollution.
- Demonstrate how new knowledge in renewable energy technologies can be implemented to benefit the poor, especially women.
- Provide evidence on challenges in policy formulation and implementation.

While REACT targets countries across East, West and Southern Africa, the projects and investees included in this report are based mainly in Kenya, Tanzania and Uganda.

Limited access to sources of energy continues to undermine the productivity of households and businesses, while the burning of fossil fuels generates high emissions and reduces living standards. REACT supports the private sector in bringing renewable energy technologies to Africa's rural and peri-urban

communities. While REACT is expanding into a range of renewable energy technologies, to date its funding activities have centred mainly on Solar Home Systems. Solar Home System partners are therefore the principal focus of this report.

ABOUT L-IFT

L-IFT is a for-profit social business specialising in 'diaries research methodology'. This methodology can be applied to a range of purposes, such as impact measurement, product development, customer satisfaction, and programme design. L-IFT is primarily focused on financial inclusion, digital finance and strengthening the financial sectors of the countries in which it works. L-IFT also has expertise and is building data in the fields of energy, livelihoods, youth, entrepreneurship, SME development and the intersection of health and financial management.

CHAPTER 1

OBJECTIVES AND RESEARCH QUESTIONS

To date, there is limited evidence that owners of renewable energy products are systematically able to leverage their paid-off assets, or use repayment histories to gain access to third-party financial services. In order to improve the design of future assistance, and to capture more accurately the benefit generated by AECF's renewable energy investments, it is important to understand the pre-conditions for any systemic change in access to finance. It is also important to know if there are more fundamental issues that are precluding the successful operation of current models.

To get to the heart of these issues, this report will answer the following questions:

How are private businesses implementing energy service delivery and financial inclusion across the off-grid energy sector in sub-Saharan Africa?

This question is answered through three case studies featuring prominent REACT Solar Home System partners which are available at the end of this report, and through data from a large-scale survey across 12 districts in Uganda.

To what extent are off-grid energy consumers using paid-off clean energy products as assets to 1) graduate to other products and services; and/or 2) leverage third-party finance for other uses?

This question is addressed through the Ugandan survey, the case studies field work, and key expert interviews.

Are there other ways in which renewable energy companies are stimulating financial inclusion?

This question is primarily answered through the case studies, key expert interviews, and the Ugandan survey.

How can future AECF investments help accelerate access to financial services for low-income energy households?

This question is discussed and addressed in the final chapter. Several of the points raised in this chapter are based on the inputs from key experts, as well as REACT partner interviews.

CHAPTER 2

METHODOLOGY

The study on which this report is based used a mixed methodology, combining a number of approaches which delivered complementary findings.

To recap, the tools used were:

- Literature review
- Interviews with REACT partners
- Case studies based on field investigations among REACT partner clients
- Data mining of the Financial and Energy Diaries Uganda (FEDU) study
- Extensive additional FEDU survey with 1,778 respondents across 12 districts in Uganda
- Expert interviews

Each of these components is considered here in turn:

Literature review

The literature review concentrated on a few larger and focused studies. To meet the selection criteria, these studies had to be:

- Conducted in the last three years
- Focused or partially focused on the theme of finance or financial inclusion within the renewable energy sector
- Spread across African countries

In addition, the study tracked all relevant blogs and other shorter publications that have become available during the past half year across several public, recognised platforms

(for example, CGAP, NextBillion, UNCDF CleanStart, CFI, FinDevGateway). It tracked several blog sites back over two years, while also drawing on a speech, made by the founder of a prominent Solar Home System Company, which has had considerable impact on the financial inclusion sector.

Interviews with REACT partners

A total of eight interviews took place with eight REACT partners. The interviews followed a list of questions that were communicated to the interviewees beforehand. The questions and other checklist items were used as guidelines, with the discussions allowed to take a natural course to enable each REACT partner to communicate elements they found important.

The interviews took place in July and August 2018. Each interview lasted between 58 and 65 minutes. Full recordings were made (with the interviewees' permission), and L-IFT's team prepared a verbatim transcript of each interview. Where the spelling of a name or location was not clear, the interviewee was consulted post-interview for confirmation. These documents are kept confidential and used for reference only.

Company	Exceptional	Expected learning
Fenix International (Ready Pay), Uganda	• Delivers large-scale outreach of a PAYGo deployment that switches off in the event of non-payment or delayed payment • Provides loans for education costs • Provides loans for non-energy items • Focuses on lowest income segment	a1. Clients' understanding of their repayments; building credit history and opening new financing doors a2. Clients' own perceptions of the advantages of the products, compared to other sizeable expenditures they may have had a3. Clients' appreciation of the new loan offers and connection to the energy device b1. Understanding how effective and strong the partnership is with MTN to reach the poor and vulnerable b2. Learning whether access to Fenix's financial services is first-time access to finance, or whether it reaches those who already have access to loans b3. Understanding why the unreached do not access Fenix-type products (is it a financial inclusion issue or another one?)
SolarNow, Kenya	• Gives direct loans that are paid off gradually (slightly different from PAYGo) • Does not have the switch-off feature • Focuses on an SME market to reach the poor • Old-school in approach; does not use sophisticated data analysis tools, but has one of the highest repayment rates (according to their own reports) • Intends to give clients their financial histories	a1. Learning whether clients understand the financial inclusion ladder offered by SolarNow a2. Learning whether clients understand the value of financial history records, and whether they have actually been used. Learning whether it is strategic for SolarNow to give these records out instead of locking their clients into their own product upgrade cycle a3. Investigate whether the SME approach reaches the poor b1. Learning whether normal people are aware of SolarNow's offer despite its relative focus on SMEs b2. Learning how those households who reported having SolarNow at baseline are doing currently (more than two years later) b3. Establishing whether SolarNow is reaching low-income people b4. Learning whether access to SolarNow's financial services reaches financially excluded people, or those who are already financially included b5. Learning why those unreached by SolarNow services remain unreached
Azuri, Kenya and Uganda	• Offers micro-insurance • Submits positive credit records to credit bureau • Considers it important the loan is backed by an asset, and that the loan is used in the agreed manner (contrary to loans from banks) • Actively helps their customers to move up the financial access ladder • Takes back products, refurbishes them and offers to others at reduced price	

Case studies based on field investigations among REACT partner clients

The three case study companies were selected in line with the following criteria:

- Having a clear and distinctive approach to financial inclusion, setting them apart from their competitors
- Having implemented the approach at scale
- Having shown willingness to participate
- Having operations in Uganda or Kenya

The companies selected, and the reasons for their selection, are set out in the table below. All three case studies are found at the end of this report.

Data mining of the Financial and Energy Diaries Uganda (FEDU) study

From the pre-existing L-IFT data on FEDU, the following data analysis was conducted:

- Location and number of Solar Home Systems
- PPI scores of the people who have Solar Home Systems
- Total income for the six-month interview period, with the aim of comparing total income across the group
- Amount spent on energy, split by solar users and non-users, and as compared to overall income

In addition, the study reviewed all data analysis that had already taken place for other users and leveraged this for the present REACT study. This review contributed to the design of the follow-up interviews with the FEDU respondents.

The findings set out in this report combine the pre-existing data results and the follow-up survey findings, presenting a detailed picture of energy and financial access across two years and four months.

Extensive additional FEDU survey with 1,778 respondents across 12 districts in Uganda

Based on detailed mining of the pre-existing FEDU data, the focus of the present study, and the specific goals of the selected case study companies, L-IFT designed a series of questions for follow-up interviews with FEDU respondents. The questionnaire was a combination of financial inclusion and energy themes. In total it included 180 questions, broadly covering:

- Current financial inclusion (account, savings, loans)
- Digital finance (mobile money usage)
- Savings groups
- Current energy inclusion (forms of electricity, additional device acquisition, experiences with adoption of new light devices, reasons for adoption)
- Hours of access to light, how much time spent in darkness
- Health issues (coughing, stinging eyes)

- Expenditure on energy
- Perception of PAYGo and other energy financing options
- Awareness of solar brands

The questionnaire was scripted in SurveyToGo, a mobile phone survey software, and went through several rounds of testing and improvement. This process included:

- Dry testing via mobile (to check scripting, sequence, wording)
- Testing between researchers during training (to check appropriateness of questions, clarity of meaning, and any additional instruction requirements)
- Testing on a few respondents (to provide final touches)

Of the 29 researchers who implemented the follow-up survey, 25 had conducted the original FEDU research. The survey used the full respondent list (2,109 people) from the baseline survey that took place in August 2016. A surprisingly large number of respondents were successfully traced, and practically all were willing to participate. All 25 researchers involved in the FEDU research participated in a three-day training course in Mbale.

The follow-up survey used the same structure of four supervisors, one for every three districts, and a WhatsApp group for sharing challenges and ensuring question clarity during the survey.

The follow-up survey took place between 21 November 2018 and 10 January 2019. A few researchers were allowed to continue until the end of January, as health issues delayed their start-date.

Expert interviews

Towards the end of the study, L-IFT conducted four interviews with sector experts. At this point, findings from the case studies and the follow-up interviews were already largely available. The experts consulted were:

- Kat Harrison, Acumen
- Hee Sung Kim, UNCDF CleanStart
- Daniel Waldron, CGAP
- Julie Zollmann, Independent

A standard checklist with a number of discussion points was developed. In addition, specific questions were designed for each expert, based on their experience and past publications. Each expert was interviewed through video conference and the interview was audio-recorded (with their permission). Detailed transcripts of the interviews were used for reference.

CHAPTER 3

LITERATURE REVIEW FINDINGS

During the study, the three primary sources consulted were:

- ‘Energy Access and Off-Grid Solar Usage in Uganda’ (UNCDF/Schatz Centre)
- ‘Escaping Darkness – Understanding Consumer Value in PAYGo Solar’ (FIBR/CGAP)
- ‘Powering Opportunity – the Economic Impact of Off-Grid Solar’ (GOGLA)

‘Energy Access and Off-Grid Solar Usage in Uganda’, published in February 2019, presents a number of unexpected findings that are relevant to this study. First of all, the study clearly concludes that the adoption of solar devices has not resulted in increased or deeper usage of digital finance. Importantly, the study demonstrates that none of the households currently using PAYGo to finance solar energy would want to use PAYGo again for a subsequent solar purchase. However, 70% said they would want to make a subsequent solar purchase from the same company.

The study speculates as to why people would prefer to buy their next solar device with cash. Proposed reasons include the additional costs incurred through PAYGo, and the frequency of payments. The authors recommend this issue is studied further to achieve more conclusive findings. The study also concludes that small portable lanterns offer fast and significant energy savings for households, while Solar Home Systems do not. The study demonstrates that the adoption of solar leads to reductions or complete discontinuations in the use of traditional (polluting) fuels.

Originally, the study set out to describe the ‘energy ladder’. The assumption was that people first adopt a small, entry-level solar device, then move up the energy ladder as they become familiar with the device and begin to understand the associated benefits. The study demonstrated that the same income groups would buy different levels of products, and that those starting with a simple portable lantern seldom progressed to a more advanced system. Indeed, where multiple purchases occurred, they related to the buying of several portable lanterns. The study concludes that the main factor determining whether a household adopts a small or large device depends on the salesperson they first meet, and how convincing or not they are.

‘Escaping Darkness’ stresses that Solar Home Systems have the primary function of providing light and helping people to escape darkness, which brings improved light quality, more study hours, safety, comfort, and fresh air. The added benefits include households being able to recharge mobile phones, use radios and, most importantly, watch TV. The study points out that TV and radio provide a window onto the world, and that the reliability of solar is key. Paying over time is required to bring solar within reach of low-income households; however, those interviewed claimed to be paying more on solar than on previous energy sources. At the same time, ownership was a much more popular option than leasing. According to this study, men typically make the decision to adopt solar, and this can present certain challenges, with some women forgoing essential foods to meet PAYGo payments. Furthermore, the PAYGo payment contract is not always understood; it is also very long-term with little financial transparency provided.

‘Escaping Darkness’ makes the following recommendations to providers:

- Implement an explicit strategy to reach low-income customers
- Tailor operations to cash flow realities in the markets where they operate
- Simplify contract terms and communications to ensure understanding
- Communicate a realistic value proposition to customers, funders, and investors

These communications build on the findings that insufficient low-income customers are presently being reached; repayment schedules are imposed and often hard to meet; contracts are insufficiently explained or understood; and communication to customers needs to improve.

‘Powering Opportunity’ is based on data collection among seven ‘leading’ PAYGo solar providers. For this study, customers were interviewed at the moment they obtained their solar system and then three months later. The document paints a very positive picture about economic impact, namely that “for the majority of households (58%), Solar Home Systems helped unlock new economic activity”, with 36% reporting increased income of US \$35 per month on average. These are truly impressive results, particularly as they are achieved within just three months of adopting solar.²

At the MasterCard Foundation’s SoFI 2016 conference, Nick Hughes, co-founder of M-PESA and M-KOPA, made a keynote speech which began:

“M-KOPA is now a business which is about five years old. We sell pay-as-you-go energy, but I hope at the end of this session, you’re going to walk out of the room thinking ‘that’s not an

energy company at all, it’s a finance company’.”

Hughes spoke these words to an audience of hardened financial inclusion experts who, at the end of the speech, were indeed convinced that PAYGo may be the most promising and innovative approach to financial inclusion. The combination of the original PAYGo system and the customer data M-KOPA holds enables M-KOPA to sell the customers a range of follow-on products on credit. These products may or may not be related to energy, and include TVs, cookstoves, agricultural devices and mobile phones.

Elsewhere, a recent CGAP blog, ‘Solar to pay school fees’, explains how a company offers its clients loans for school fees. These loans are offered to good clients at the three points in the year when school fees are due in Uganda. Clients may have finished paying off their ReadyPay solar, or they may be halfway through their PAYGo payments. For the former, the ReadyPay lock-out system is re-activated and the school fee loan is paid at the same daily fee as before for 100 days. For the latter, the daily fee is increased during 100 days, effectively doubling.

Several other blogs and discussions were consulted during the literature review. In each, solar PAYGo and solar credit history are mentioned as potential drivers for clients looking to climb further up the financial inclusion ladder, either through the PAYGo lock-out system or through their financial records.

¹ The document refers to SolarNow to be compared to 21 companies, but in all graphics there are 25 cases presented.

² Please consult Annex 4 for Acumen’s detailed definitions of these indicators and ways of measurement.

CHAPTER 4

REACT partner interview findings

As part of the study eight REACT partners were interviewed for one hour at a time.

Financial inclusion models

During the interview process, the following financial inclusion models and approaches came up in discussion:

1. No clear plans yet for aiding financial inclusion beyond current devices/(PAYGo) or for selling additional devices like TVs
2. Plans for selling follow-on energy-related and unrelated devices using PAYGo and credit history, but clients not sufficiently mature
3. PAYGo solar selling additional, energy-related devices using both repayment data and lock-out system
4. PAYGo solar moving to sell additional energy-related and unrelated devices using both repayment data and lock-out system
5. Pivoting to become a licensed micro-credit institution, offering credit for clean energy and other items
6. PAYGo solar offering optional micro-insurance as top-up for PAYGo payment
7. Apart from offering additional products based on PAYGo repayment history (without lock-out), offering clients credit history print-out for accessing loans at banks

8. Creating a marketplace platform where customers can access a range of clean energy devices on credit and immediately see their payment plan. The platform carries out a credit rating which defines which device can be obtained, and gives lenders access to clean energy loanees covered by credit risk assessment

Financial inclusion as a goal or a means

Every company taking part in the interview process considered themselves a clean energy or renewable energy company. Even the company that had taken out a micro-credit institution license in Tanzania still considered financial inclusion a secondary goal after energy access. In this respect, the companies mostly did not track to what extent their customers were becoming more financially included, and could not even share anecdotes, apart from very specific initiatives from Fenix in Uganda on school fees loans, and from Azuri in Kenya and Uganda on micro-insurance.

The interest in and existing knowledge of financial inclusion varied substantially from company to company. However, this may simply reflect the background and position of the individuals who were interviewed, rather than the company's overall standing on this issue.

Digital finance

All interviewed companies use mobile money or mobile wallets for their payment system. In different countries, different channels are used. In countries such as Kenya, Tanzania and Uganda, payment systems are mainly based on mobile money. Indeed, across East Africa clean energy companies capitalise on the fact that mobile money is reasonably widespread, and in many cases PAYGo repayment schemes have specific menus that can be easily accessed via a mobile phone provider.

Kenya is often referred to as the most digital country in Africa, followed by Uganda and Tanzania. In Kenya, establishing a mobile money payment system is relatively straightforward and clean energy companies benefit from a wealth of experience among agents and a knowledgeable customer base. In other countries, such as Zambia and Nigeria, mobile money is not widespread and there may even be regulatory issues.

In the literature reviewed for this study,³ there are examples of clean energy companies that actually make digital finance/agent networks part of their business model. However, none of the companies interviewed mentioned this approach. The interviewees took mobile money for granted and, when asked, naturally assumed that payment would be made via mobile money. Few interviewees mentioned challenges with the channel, although some cited instances where non-payment may occur due to the inability to find an agent, agents closing down, or cases of system failure.

During the interviews, the companies did not recognise the role they play in driving financial inclusion through mobile money payment systems. Clearly, through PAYGo and other payment schemes, customers repeatedly use mobile money over a sustained period

of time. This process familiarises customers with mobile money and may well lead to more intensive usage for other purposes.

The relationship between clean energy and digital finance is the other way around. Through clean energy, people are more likely to have their mobile phone charged and thereby have more continuous access to mobile communications and mobile money.

Financial history

Several companies were aware of the financial history their customers are building through their payment track-record for solar or other devices. Most companies were aware of the value of this track-record for their own follow-on sales, particularly for customers who would need to access additional credit. Some companies were already actively using the payment track-record from their first PAYGo plan and basing the subsequent offer on that. Those who repaid on time were offered plans with lower deposits for follow-on devices.

Credit scoring and credit bureaux

Several of the companies interviewed mentioned credit-scoring for their first-time customers. One company's approach (the marketplace platform) is built on a credit scoring system for all customers, even those without any known financial history. This credit scoring is based on registered mobile phone numbers and enables customers to see immediately which products are available to them. Another company is receiving support from the MasterCard Foundation to assess the creditworthiness of potential clients.

³ Two CGAP blogs of July 12 and 17th, 2018, "The Case of Off-grid Solar Companies as Mobile Money Agents" and "Building Payment Rails in Frontier Areas through Off-grid Solar" tell the story of Zola Electric in Côte d'Ivoire. However, this case was not referred to in the interview, even though briefly mentioned subsequent offer on that. Those who repaid on time were offered plans with lower deposits for follow-on devices.

One company said they report repayment histories to the credit bureau in Tanzania, even though they do not use the credit bureau to assess creditworthiness. It was explained that this is because most new customers will not return any data on their enquiry. Another company regularly uses the credit bureau for its new activities in Kenya, but said the credit bureau in Uganda seldom returns useful information, even if customers are wealthy and have a business. One solution could be for such companies to invest in credit bureaux in the countries where they operate, and in turn for credit bureaux to incorporate all clean energy repayment data. For large companies, current bureau fees are not prohibitive, although they could be too high for companies selling smaller systems.

Reaching low-income households

With possibly one exception, all interviewed companies admitted they were not reaching the poorest of the poor. Indeed, the overhead costs of PAYGo and other gradual payment forms prevent companies from selling single solar lanterns on a payment plan. The companies that had the lowest per-day (or per-day equivalent) payments were Fenix's ReadyPay (which will have a US \$0.15/day option and three-year plan), Mobisol in Rwanda (US \$5.19 per month, which works out at US \$0.173 per day), and Zola Electric (which has a €5 per month option, which works out at US \$0.193 per day).

Moreover, none of the companies reported to systematically collect data on their customers' income or wealth. While some demographic data is collected at the moment of obtaining the solar device, this does not include information on wealth or income. Evidently, any change in customer income after a solar device is acquired is not measured either.

Considering that REACT focuses specifically on low-income households and communities, it came as a surprise that several of the companies stated they are reaching the upper poor or even non-poor. When asked, only a few companies had plans or indeed ideas of how to reach down to lower income levels.

Initiatives to reach down included Mobisol's development of a 20W system (their current lowest-cost system is 50W), which has been rolled out in Rwanda. ReadyPay is now introducing a lower-cost day-price (see above), while SolarNow claims it does reach some very low-income people, particularly in the remotest rural areas. However, SolarNow's main impact on poverty alleviation is achieved as their clients build enterprises with SolarNow systems, creating jobs for which lowest-income groups are likely to be hired.

Several of the interviewed companies said they would use grant money (if such was available) for reaching down lower. One company said they would use grants for writing off any loans to lowest-income customers. This would enable the company to experiment with lowest-income groups and find out in practice what repayment rates can be achieved, and test whether it is financially feasible to serve this segment.

CHAPTER 5

KEY EXPERT INTERVIEW FINDINGS

The study also involved interviews with four experts. Each expert offered unique specialist insight into the financial inclusion aspects of renewable energy as well as, to some extent, the renewable energy aspects of financial inclusion. These interviews lasted a little over one hour each. They covered an impressive range of topics, ideas, and recommendations.

What is financial inclusion?

Each of the experts insisted that the term ‘financial inclusion’ may have quite different meanings for different people. They all preferred the definition of people ‘having access to a range of appropriate and affordable financial services’, which would enable the user to better manage their finances. They also advised that, due to the significant disparities between different countries and regions, the extent to which renewable energy can drive financial inclusion can only be accurately assessed at individual country level.

Digital finance

Originally, the study assumed that the largest contribution of renewable energy to financial inclusion would be the more intensive usage of digital finance. However, the experts did not discuss or confirm this causal link to any great extent. According to Lean Data, Acumen’s impact measurement initiative found that just 10% of the pay-as-you-go customers who pay via mobile money had to open a mobile money account in order to make repayments. Most of them already had such accounts, including customers in Uganda, where ReadyPay focuses strongly on reaching the poor. Therefore, overall, the experts claimed that digital finance

was not significantly driven by renewable energy.

Some studies have demonstrated that renewable energy does increase the use of digital finance, but only insofar as the pay-as-you-go device is purchased via digital transaction. According to these studies, the PAYGo experience does not have the hoped-for effect of stimulating an uptake in digital finance for other payments, such as bills, airtime, subscriptions or shopping.⁴

However, the role that access to energy plays in enabling digital finance through mobile phone recharging was acknowledged by the experts as a crucial contribution. Availability of renewable energy in rural areas makes it possible for people to keep their phones charged and, therefore, to continuously use their mobile wallets, helping to overcome a key barrier to digital finance. However, none of the experts knew of any studies to demonstrate this effect. To achieve and expand this type of impact, it is not necessary for households to purchase an entire Solar Home System; a small, standalone lamp with phone recharger would be sufficient.

Access to credit

The experts all agreed that the pay-as-you-go model often deepens people’s access to credit. A very large portion of PAYGo customers claim that PAYGo credit is their first formal source of credit. In some studies, these people said they did not expect any microfinance institution to consider them credit worthy, which means this first step in accessing credit would not have been possible without PAYGo.

⁴ See conclusions from the Energy Ladder Study, UNCDF, 2019

The experts' opinions varied as to whether this first step onto the credit-ladder would structurally enable PAYGo customers to access credit in the future. The experts mentioned three companies that genuinely consider their customers' lifelong value and offer subsequent loans, be it through renewable energy or other services (M-KOPA, ReadyPay), or actively providing customers with their credit history to make loans elsewhere (SolarNow).

However, the experts warned that the PAYGo renewable energy sector is expanding very fast, and there is a risk that lending will be extended to people who cannot afford the credit. Some of the experts even thought that certain companies are not sufficiently evaluating creditworthiness. This, they said, was partly due to the push to achieve high sales, and partly because a good credit evaluation is costly. Even for Solar Home Systems, margins do not allow for thorough assessments, such as home visits.

First-step credit access, or long-term credit access

Some PAYGo companies claim to be enabling structural access to credit, as well as to non-energy items. While they are genuinely focusing on this, according to the experts this is not yet a structural phenomenon. Whether it will be a structural phenomenon will depend on how much effort companies can continue to invest in this area.

Credit bubble?

The experts interviewed indicated that none of the energy companies are prepared to disclose whether or not they are giving credit to people who were previously served by other energy companies. Some suggested there may be a credit bubble at the customer level, with people able to borrow more than they can repay and

take out multiple energy loans.

While there is clearly a huge push to sell, there are still very large numbers of unreached people, so most experts felt there was sufficient space for each to continue to sell. The companies do not publish their portfolio at risk, and in the main are not reporting to credit regulators the way microfinance institutions would need to do. Therefore, the loan defaulting in PAYGo renewable energy is simply not known. There are a number of companies who voluntarily report to a credit bureau, but this is a cost to them with benefits only coming years later, and only then if all other renewable energy companies report as well – which they are unlikely to do, unless there is an obligation imposed upon them.

PAYGo versus microfinance

Most of the discussions with the experts were related to PAYGo companies. One expert claimed that PAYGo was vastly more successful at reaching people and scaling than microfinance loans. However, another expert related experiences of microfinance in Nepal, which was at least as successful and scalable in that market. Therefore, the conclusion may be that both approaches can be successful; it depends on the country, the availability of digital finance and microfinance, and the local regulatory framework.

Asset finance: opportunities for improvement

Secondhand market

For asset finance to function properly, it is necessary to have a secondhand market, meaning assets can be repossessed and resold. However, most companies will not buy back products. Even people who want

to upgrade to a larger system cannot return their smaller system, with companies typically advising them to pass it on to a family member or sell locally.

Modular offer

Related to this issue is the fact that the Solar Home Systems are not offered in a modular form. Ideally, customers want to start with a small system and, as they start paying that off, increase the number of lights, or add a radio, or even, after a while, a television. In practice people may take on more credit than they want because there is no option to add components later; however, according to one expert there is no reason why these units cannot be sold in modular form.⁵

Small entry-level size

Currently the PAYGo offer is only available for Solar Home Systems with a minimum price of around US \$150. The companies studied for this research all focus on larger equipment, and there is no offer of small stand-alone solar lanterns or even solar-lanterns with mobile phone recharging. The companies explained that the cost of credit assessment, the technology of the lock-out, and the setup of gradual repayment, cannot allow for the sale of devices lower in cost than a Solar Home System.

Indeed, overall it is more difficult to finance smaller, cheaper systems compared to larger, more costly systems. This means that companies can only reach and serve the poorest customers if they receive a subsidy.

⁵ The companies interviewed all claimed that the technology makes it impossible to set up a secondhand market and sell modular units. In particular, batteries cannot be taken back as it is impossible to establish whether they are damaged or not.

Is renewable energy reaching low and lowest-income groups?

All experts consulted signalled that PAYGo companies are not currently reaching the truly poor. The experts mostly considered this the inevitable consequence of the specifics of PAYGo. One expert strongly advocated for increased focus on stand-alone solar lanterns, as these are able to reach the poorest households successfully and appropriately. Even a small lantern costing just US \$10 could significantly help a household move onto the energy ladder; in the absence of a mini-grid, its acquisition would constitute a positive step forward for any low-income family. Another expert suggested that funding priorities need to change in order to encourage companies to engage with smaller technologies such as solar lanterns.

What are the gender aspects of PAYGo solar?

Two experts referred to a study which had encountered several households where the men had decided to obtain the PAYGo solar system, but where the women were responsible for repayment. In some households, the adoption of solar had resulted in reduced food purchases, because women prioritised the PAYGo payments. Moreover, there were some indications that women felt the total price of PAYGo solar was too high and an irresponsible financial commitment, but had not had a say in the decision.

On the other hand, women, children and men equally benefitted from the solar system, and women in particular valued the security aspect of solar. The ability to have a light on outside the house at night was especially important to households without adult men.

What could AECF/REACT do to improve the sector?

The four experts combined had a considerable list of suggestions:

1. Help the sector to become linked to the national credit bureau. This process would include both reporting positive and negative credit information about all clients to the credit bureau, and consulting the credit bureau about PAYGo solar clients before making a credit decision. To do this would be costly for PAYGo solar companies during the first years, and the benefits would be limited. REACT could come in to make this shift a requirement.
2. Altogether the sector would benefit from more transparency and reporting standards. It could develop a system like MixMarket for microfinance. It would be important to have benchmarks and clear consumer protection standards in place.
3. To reach lower-income groups, it would be important to experiment with decentralised credit offers. For instance, allowing local entrepreneurs to manage credit either formally or informally, or enabling people with larger batteries to charge small lanterns for low-income households for a small fee (lower than the cost of kerosene).
4. There is still a large knowledge gap among companies regarding consumers. For example, what do consumers really think about their energy and what are their priorities? This kind of information will help companies to tailor their products effectively.

CHAPTER 6

FINANCIAL AND ENERGY DIARIES UGANDA

Between 2016 and 2018, L-IFT began its Financial and Energy Diaries Uganda (FEDU) research across twelve districts: Mbarara, Sheema, Ntungamo, Mukono, Buikwe, Kayunga, Jinja, Inganga, Mayuge, Mbale, Tororo, and Manafwa. The study consisted of four stages with the following samples:

- A. Baseline August 2016: 2,109 respondents (in the data analysis below, only the 1,327 respondents who also participated in the endline are included; those participating in just the baseline have been left out)
- B. Diaries conducted over six months (13 biweekly interviews) between Oct 2016 and April 2017, with 588 regular respondents
- C. Endline April/May 2017: 1,327 respondents
- D. Follow-up survey November/December 2018: 1,778 respondents

The study explored people's financial behaviour and energy behaviour in great detail. Due to the many repeat diary interviews, the data provides fine-grained information about energy expenditure and energy benefits (e.g. hours of light, hours spent in darkness against their wish). It also provides insight into the respondents' financial lives, covering their income, expenditures, savings, loans and assets. Some additional elements were also tracked in the diaries, namely health, happiness and stress.

The baseline and endline interviews explored numerous financial inclusion and energy inclusion indicators, such as financial literacy, awareness of and attitude to financial service providers, and clean energy equipment (or

traditional lighting and cooking systems). These interviews also benefitted the findings, as they provided a larger, more random sample, while the respondents helped to control the effect the diaries may have had on people's behaviour.

The follow-up survey was specifically designed for this AECF study. It focused on people's adoption of solar, the type of systems they adopted, their reasons for adoption, and the financing mechanisms they used. This study used several different approaches to assess whether renewable energy drives financial inclusion. One of the approaches included mining an existing dataset on Financial and Energy Diaries dating back to August 2016, as well as conducting a follow-up survey with the same group of respondents in November and December 2018.

This extensive field research provides a number of valuable insights, and is available for further exploration via the L-IFT data portal, www.lift-fedu.com. The following chapter sets out the main findings.

CHAPTER 7

MAIN STUDY FINDINGS

This study explored the relationship and driving forces between access to renewable energy and financial inclusion. The various sources studied have shown a range of interactions between these two forms of development.

First of all, there are several definitions of financial inclusion, or interpretations of what constitutes financial inclusion, which should be considered. According to the World Bank, financial inclusion means “access to useful and affordable financial products and services that meet people’s needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way.” The Bank of Uganda describes financial inclusion as “having access to and using a broad range of quality and affordable financial services which help ensure a person’s financial security”. Meanwhile the Centre for Financial Inclusion refers to “a state in which all people who can use them have access to a full suite of quality financial services, provided at affordable prices, in a convenient manner, and with dignity for the clients...reach[ing] everyone...including disabled, poor, rural, and other excluded populations”.

Reductions in energy exclusion

Between August 2016 and April/May 2017, the ‘energy excluded’ segment of the research population – i.e. those without solar, grid, mini-hydro or mini-grid sources, and reliant on kerosene, torches and candles – reduced from more than half (52%) down to 48%. By November/December 2018, this figure reduced further to 37%. In total, 15% of the population achieved energy inclusion, which was almost one in three of those who had previously been

energy excluded. The portion of people with solar increased from 13% in August 2016 to 24% at the end of 2018; an 89% increase.⁶

The two forms of electricity (grid and mini-hydro/mini-grid) combined increased from 36% to 43%, roughly 20% in 27/28 months, representing 7% of the overall population of respondents. Clearly, solar really took off in the 18 months to December 2018, growing faster than grid connectivity. **See Figure 1 on Page 23.**

Access to solar via lanterns

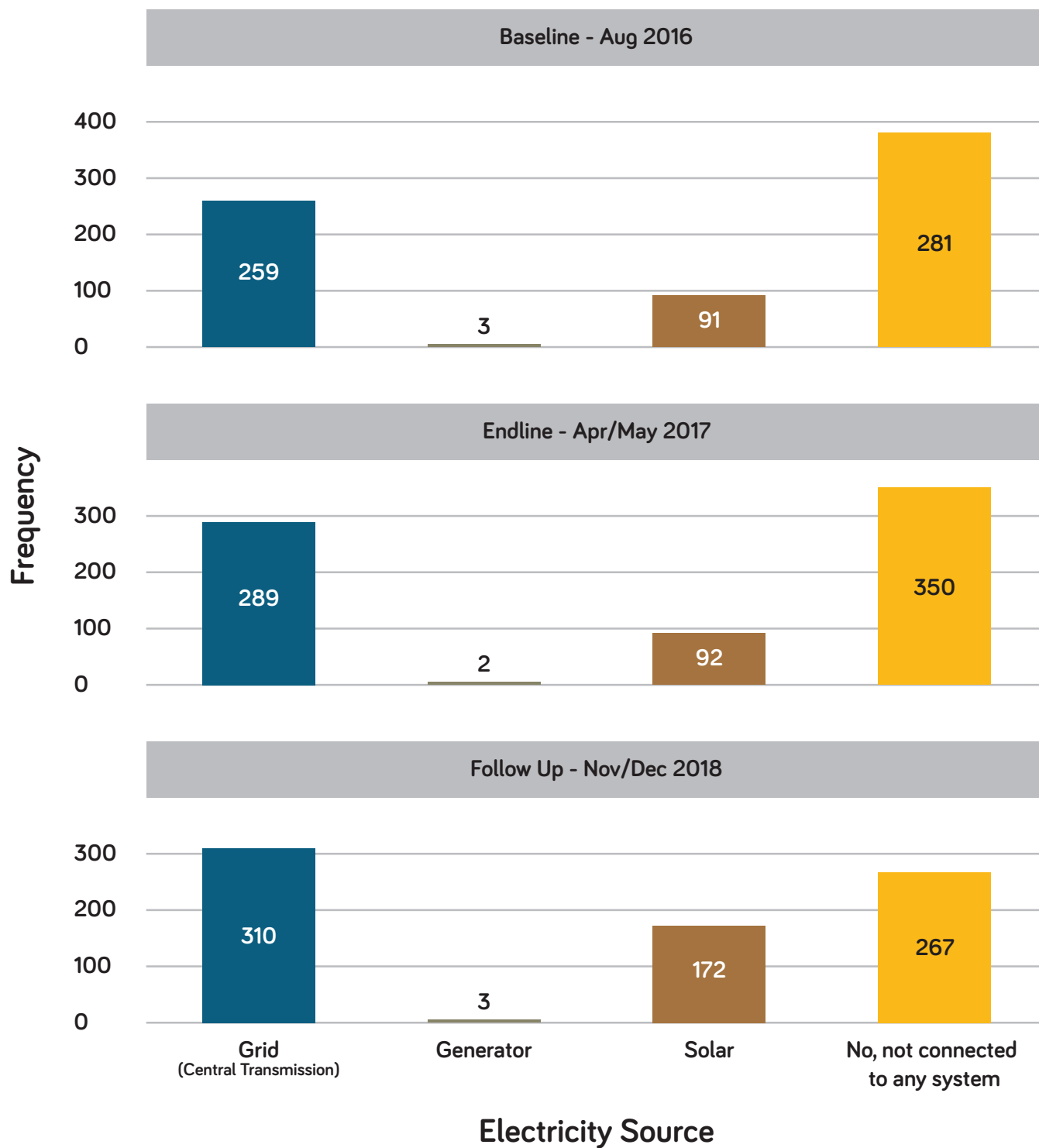
Those people who accessed solar mostly purchased solar lanterns, or lanterns with a phone-charging option. Altogether, Solar Home Systems are making only modest headway, despite the clean energy sector’s considerable focus on them. Out of 1,778 respondents, 116 (6.5%) had a Solar Home System with several bulbs, and an additional 16 (1%) had a larger Solar Home System with a TV.

Accessing formal credit

Of the respondents who obtained a solar device on credit, overwhelmingly this was their first form of formal credit. Only 13% had previously had a formal loan, while 58% had never had a loan before, and 25% had only had informal loans in the past (e.g. from family or friends). For the 49 respondents (just 2.7% of the total cohort) who obtained solar on credit/loan/PAYGo, 28 had never had any type of loan before, meaning this process helped them achieve greater financial inclusion. This was particularly the case for lower wealth bands (poor, upper poor), who have a higher

⁶ Here those respondents who were interviewed for diaries over six months are excluded from the sample. They received a small solar lamp as a gift after the diaries, and therefore had artificially higher access to solar. Those people presented here, 727, all participated in baseline, midline and follow-up had a Solar Home System with several bulbs, and an additional 16 (1%) had a larger Solar Home System with a TV.

Figure 1. Reductions in energy exclusion



incidence of first-time loans than those in the 'comfortable' wealth band.

Mobile phone charging and online connectivity

Of all respondents with a mobile phone (practically all), one quarter said they use solar for recharging their mobile. The other 75% said they use electricity. Of those using solar, the majority claimed to use their own solar at home, whereas 29% said they used solar from others for a fee, and 15% said they recharged via other people's solar without paying. Solar is substantially helping those living without access to the grid to use their mobile phone, which presumably also helps with access to mobile money and other forms of digital finance.

PAYGo Solar Home Systems and uptake of mobile money

Of those people who use digital payments to pay for their solar system, most had mobile money beforehand. In Uganda, there are only a few instances where mobile money has to be adopted to access the PAYGo payment system. This is in line with findings from Lean Data/Acumen which show that only 10-15% of PAYGo clients sign up for the scheme without having accessed mobile money before.

Perception of PAYGo

PAYGo is a much-lauded technology innovation, whereby people are given the option to pay gradually for their solar system, whereas usually systems get switched off when payment is delayed. When thinking of solar energy and financial inclusion, most people immediately think of PAYGo and assume this is substantially driving wider and deeper financial

inclusion in countries like Uganda. This study presents some interesting nuances regarding PAYGo and people's perceptions of it.

The case studies at the end of this report, demonstrate that the majority of those people who use PAYGo greatly appreciate the option to spread payments over a year or more. They also prefer that the solar system switches off when they pay late, as this disciplines them to pay on time and prevents fines and accumulating costs. Some of the PAYGo users, however, said they would prefer to have PAYGo without the lock-out function, as it is very public: neighbours can see when a household's lights are out, which is a clear indication of late payment. These findings were in sharp contrast with findings from a recently published Energy Ladder publication,⁷ in which none of the clients who were currently using PAYGo wanted to use this payment option to obtain their next solar device. In this publication, respondents mainly wanted to switch to savings and outright ownership, rather than acquiring their solar device on credit. From the AECF/L-IFT study, conducted among a limited number of PAYGo clients (39), the majority were content and expressed no desire to switch to another payment option.

This study also discussed the PAYGo offer with non-adopters in the large-scale follow-up survey that was conducted with 1,778 respondents across 12 districts of Uganda. Non-users of PAYGo have quite a different perception of this option and many are unclear what it is or how it works. Only 21% were confident they knew what PAYGo meant, another 26% had heard of it but did not know what it was, and more than half (53%) had never heard of PAYGo at all. Once the offer of PAYGo was explained, 45% were positive and considered it an attractive method of payment; 42% thought PAYGo made it more attractive to obtain solar, but where systems included a

⁷ https://mailchi.mp/4df554badf5b/energy_ladder UNCDF and Schatz Energy Research Center, "Energy Access and Off-Grid Solar in Uganda - Examining solar adoption and the role of flexible payment mechanisms as a driver for energy access", February 2019

lock-out option, the number of interested non-users declined to 33%.

People gave a range of reasons for disliking the lock-out option. These included additional household costs; having to buy kerosene when the lights go out, and the public 'shame' issue mentioned above. However, when comparing the lock-out function to being fined for late payment, many people said they would prefer the lock-out for fear of accumulating debt.

Through the responses elicited in this study, it is clear PAYGo is not yet widely understood or known, and those who have not adopted this payment option display quite strong resistance to it. Some of the PAYGo companies may assume the market is 'everyone', while in reality a substantial portion of the Ugandan population may never want to use PAYGo.

Access to energy by wealth band

As **Figure 2 on page 26 shows**, solar energy mostly reaches the middle wealth band, the 'upper poor'. Since August 2016, solar has also begun to reach the 'ultra poor', up to 19% by the end of 2018 from just 3% two years and four months earlier. This group, however, remains primarily energy excluded (81%), since no one within this group has grid access.

From the blue areas in the graph below, it is clear that energy exclusion is almost disappearing for the two highest wealth bands. Those labelled 'comfortable' have gone from 39% exclusion down to just 15%.

So, does renewable energy adoption drive financial inclusion?

There are a number of mechanisms through which adoption of renewable energy leads to forms of financial inclusion. These mechanisms are listed below and assessed as to what extent

this study confirms their validity. **See Table 1 on Page 27.**

When considering the variety of positive influences from renewable energy on financial inclusion, this study has affirmed that renewable energy can drive certain aspects of financial inclusion. On the basis of this study's findings, the two strongest impacts are on access to first-time formal loans, and on fuel cost savings. Access to renewable energy also leads to increased financial literacy and more intensive usage of digital finance.

Altogether, the conclusion is that there is a mutual benefit between renewable energy and financial inclusion. In particular, this study demonstrates that renewable energy is indeed driving financial inclusion, if in very specific ways.

Now that this relation has been confirmed, the next questions to consider are:

- **Is renewable energy *significantly* driving financial inclusion?**
- **Can renewable energy claim to substantially reduce financial exclusion?**

To answer these questions, it is necessary to assess how widespread renewable energy's impact on financial inclusion is. And to do this, it is important to consider the frequency with which renewable energy solutions impact financial inclusion, as well as how large these financial inclusion effects are on the entire population.

There are few studies where energy inclusion and renewable energy adoption have been studied for a population as a whole (unlike financial inclusion, which is periodically monitored through Findex as well as Finscope in several African countries). Most information about renewable energy is focused on the

Figure 2. Reductions in energy exclusion

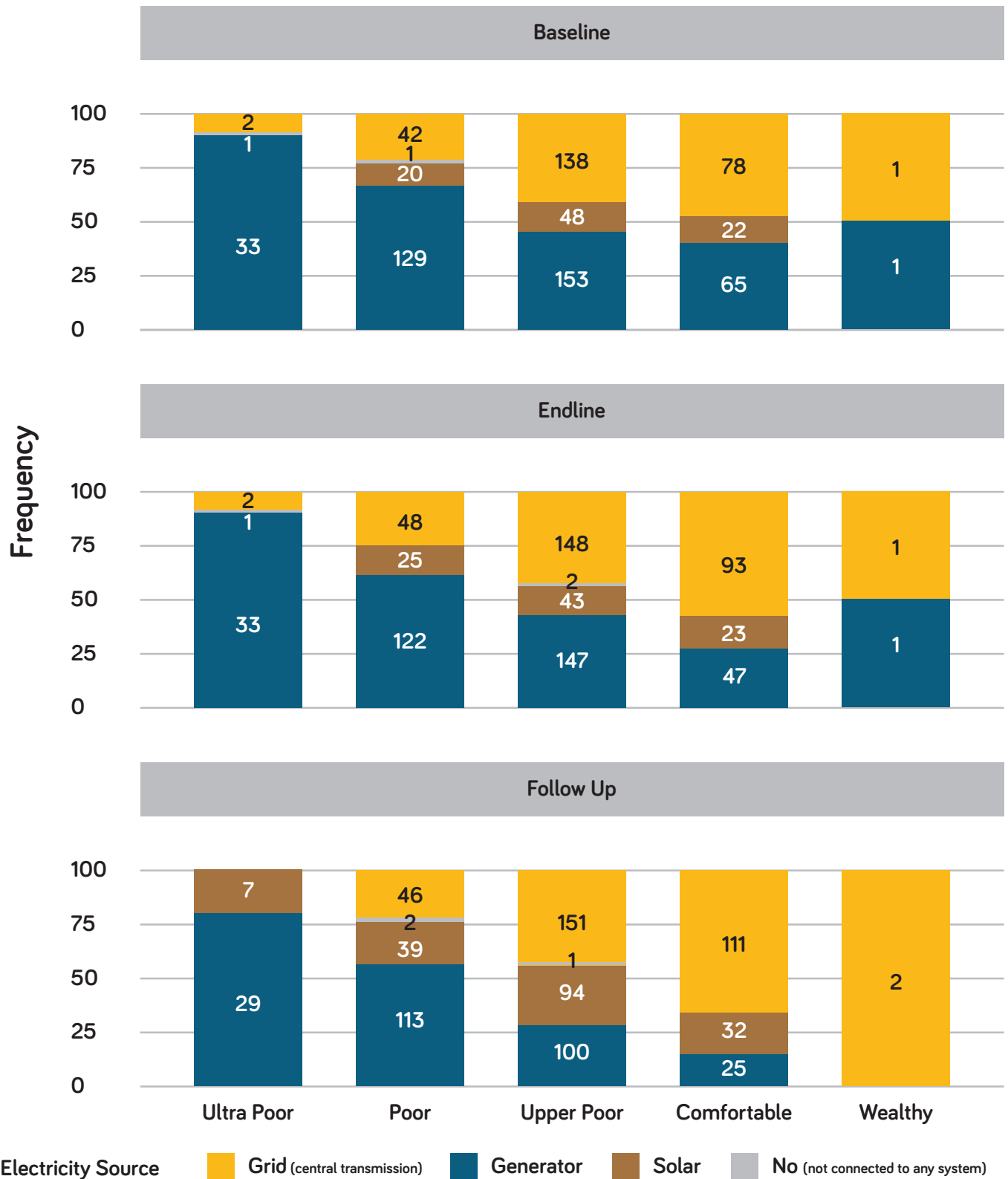


Table 1. So, does renewable energy adoption drive financial inclusion?

Mechanism	Rating	Explanation
Renewable energy drives adoption of digital finance since payments for Solar Home Systems require people to use digital finance channels (e.g. PAYGo is via mobile money).	★ ★ ★	In this study, few cases of mobile money adoption were found. Most renewable energy adopters already use mobile money. In countries with underdeveloped digital finance payments, renewable energy providers often use alternative channels, such as microfinance and banks.
Renewable energy adoption leads to new forms of digital finance (e.g. people use mobile money to pay for something for first time).	★ ★ ★	Most digital finance users were not used to paying for goods or repaying loans via mobile money. However, this first-time usage did not appear to lead to other transactions beyond renewable energy payment requirements.
Renewable energy results in more intensive usage of digital finance, implying deeper access to finance.		Those who pay for Solar Home Systems with digital finance certainly show a significant increase in the amount and frequency of usage. Since people only paid roughly 1% of their transactions via mobile money, these energy payments constitute a significant increase.
Renewable energy drives first-time access to formal loans.		The majority of people (58%) using PAYGo and their credit mechanisms for renewable energy reported this to be their first formal loan. Even for those who had loans before, the majority were informal (25%). Only 13% had had formal loans previously.
Renewable repayment records enable people to take on additional renewable energy loans.		Several renewable energy companies are offering their clients additional loans, for example to expand solar access. However, many clients do not want to become repeat PAYGo clients. ¹² In other data people were interested in repeat PAYGo for renewable energy.
Renewable energy loans enable people to obtain subsequent loans for other purposes than renewable energy.	★ ★ ★	The study did not find evidence of people using their renewable energy repayment records to obtain loans from other organisations. This is most likely because too few of the 1,778 sample are renewable energy clients, and those that are lack awareness of these options. However, there are definitely companies out there offering education finance and loans for other products (including bicycles).
Renewable energy brings exposure to financial services which leads to financial literacy.	★ ★ ★	A significant portion of those paying for solar systems gradually understood that this track record opens new doors. They also displayed reasonable understanding of how due diligence takes place on loan applicants, and how reporting to a credit bureau (positively or negatively) would affect them. They understood that being a reputable client of a Solar Home System company may help.
Renewable energy enables households to save better.	★ ★ ★	Access to the simplest renewable energy devices leads to significant reductions and savings on light fuel costs. The simplest and cheapest portal lanterns result in the largest savings (the lifetime of these lanterns demonstrated to be the same or even longer than Solar Home Systems). Whether these savings on fuel costs also lead to increased ability to accumulate savings has not been studied yet. These savings work the same way for mobile money agents, some of whom can operate better due to solar power, both in terms of charging their phones, which drives mobile money business, and lighting their shops, which enables them to stay open for longer.
Renewable energy enables digital finance.	★ ★ ★	25% of those involved in the study recharge their mobile phones through solar. Thanks to solar, people can use their mobile phone and, therefore, mobile money as well.

In reverse, there are also ways in which financial inclusion, and particularly digital finance, is driving energy access, as set out in the table below:

Mechanism	Rating	Explanation
Digital finance makes both PAYGo and normal micro-credit repayments possible.	★ ★ ★	Many of the solar companies explained that their business can operate according to its model because of digital money. They also explained that in countries without mobile money, it is far harder to operate.
The mobile money distribution network also serves as a distribution network for solar.	★ ★ ★	Each solar company has its own specific sales and service approach, but several of them rely heavily on the mobile money agents.
The experiences, technology and data systems of digital finance and telecoms companies has driven renewable energy approaches.	★ ★ ★	There are several examples in the literature where the experience and technology of telecoms and digital finance have been leveraged by renewable energy. Examples include SIM cards in lock-out systems, data capture at distance, and Machine Learning for identifying likely churn and non-payment.

¹² See the publication "Energy Access and Off-Grid Solar Use in Uganda", UNCDF, February 2019

customers of specific companies and leaves out any non-customers.

This study had access to one of the few pieces of research conducted across an entire population, the Financial and Energy Diaries Uganda FEDU study. This is a relatively large energy inclusion study with ‘reasonably’⁹ random samples from 12 districts. L-IFT implemented the FEDU from August 2016, and for this present study added one follow-up interview for all 1,778 FEDU participants.

The FEDU demonstrates that access to solar is substantially on the rise in Uganda for the population at large. In August 2016, just 12% of the respondents had solar. Eight months later this was still 12%, while in that same time access to grid and mini-grids combined had jumped from 33% to 38%. Between baseline and endline, those excluded from energy reduced from 52% to 48%, and by endline this had sharply declined to 37%. In November/December 2018 solar usage was up to 24% of the population and grid and mini-grids combined covered 42% of the population. Meanwhile, energy exclusion had reduced to 37%. Clearly, therefore, solar has a positive impact on energy exclusion, but its effect is still considerably less than that of the grid.¹⁰

The somewhat limited reach of solar is by no means surprising. Of course, solar companies are growing rapidly, but for many their reach is still considerably below 1 million clients, and is generally below half a million. Uganda counts about 9 million households (if we assume average household size is five people); as a comparison, the same study shows that only 2.1% had a microfinance loan at baseline, 1.7% at endline, and 1.6% at follow-up interview. In those same interviews, banking loans were 4.2%, 4.7% and 5.7% respectively. In comparison to microfinance, solar is reaching a significant portion of the population, albeit with

a lower reach than grid and mini-grids.

Another phenomenon encountered in Uganda was that of people having the option to access the grid, but opting for solar instead. There are varying reasons for this, including connection costs, and fears regarding reliability and safety (electricity is often regarded as dangerous in Uganda). As a result, the grid has fewer connected households, and fewer households to shoulder the costs of connection and electricity provision. This may create a catch-22 situation, in which the opting out results in unnecessarily high prices, which in turn results in further households opting out.

Summary findings from the three primary sources

To recap, the three primary sources consulted in the preparation of this report were:

- Literature (public and confidential sources)
- Interviews with the companies
- Data mining of an independent random study in Uganda

The first source, the literature, presented quite a positive picture on impact, both social and economic. Regarding financial inclusion, the literature also pointed to evidence (if anecdotal) that access to energy results in access to finance.

⁹ Some biases may have been introduced, since the sample was taken from around the researcher’s house, but it is unlikely these biases were towards one or another type of energy behaviour.

¹⁰ The percentages mentioned in this paragraph are for those people in the FEDU study who did not receive any solar lantern as a present, 727 people.

The second source, the interviews, showed that the companies are focused on clean energy, and that financial inclusion is a beneficial by-product of their work rather than an explicit goal. This source only weakly supports the assumption that clean energy companies bring about financial inclusion, although some of the companies' insights and impacts may not have filtered down to the individual interviewees.

The third source was the independent study in Uganda during which 588 people were tracked over eight months (including intensively during six months through 13 biweekly interviews), and another 739 were interviewed at baseline and endline. This source was data mined; it demonstrated that solar users are generally the middle wealth group (not the poorest, not the richest), while access to grid is strongly wealth related. The study showed how solar performs compared to other energy forms, according to indicators such as hours having light, hours spent in darkness and a few health aspects. Whether access to solar brings about financial inclusion will be established from this source in the next phase of the assignment.

CHAPTER 8

REFLECTIONS ON THE RENEWABLE ENERGY SECTOR

Before turning to the final concluding chapter of this report, it is worth considering some additional features of the renewable energy market beyond its financial inclusion aspects.

The jump from kerosene to Solar Home System

Many renewable energy adopters go straight from a single kerosene lamp (in some cases a simple ‘tadooba’, which is an open-wick can) to using a Solar Home System with several lamps, a phone charger, torch and radio. This progression is like skipping two steps on a staircase, and does not seem an obvious or logical entrance route into renewable energy.

Customers’ modular visions do not align with companies’ systems

Renewable energy customers, and even those who have not yet adopted anything, communicate clearly that they would like to gradually move from entry-level to advanced-level energy devices. Ideally, they would like to start with one or two lamps, then add phone charging, before progressing to torch, radio and finally, TV. However, the solar energy companies interviewed explicitly stated that they do not offer modular systems. People have to choose either a small or large Solar Home System, and do not have the option to modulate or customise as they go. Indeed, adding devices to a smaller home system is not really possible due to limited battery capacity, meaning a whole new system would be needed to accommodate upgrades and acquisitions.

Absence of a second-hand market for solar

Solar devices are relatively costly items, but currently there is no second-hand market for solar. Many companies explain that it is practically impossible to assess the quality of a battery, even those that are completely sealed. Furthermore, misuse can deteriorate even quite new batteries, while appropriate usage can extend battery life substantially. This is the main reason why solar companies do not take back items and only rarely offer refurbished models. Many solar companies explicitly tell their clients that when they want to upgrade, they should sell or pass on their smaller system.

Those from the lowest wealth band lack energy access

Access to energy is strongly correlated to wealth. Those people with the highest Poverty Probability Index (PPI) scores overwhelmingly have access to energy, particularly grid. Those with the lowest PPI scores mostly have no access. This means that lowest income group represents a sizeable market and therefore a good business opportunity. So far, solar companies have sold primarily to middle-wealth groups (with PPI scores of 41 to 60). However, households in the lower wealth bands would be more appropriately served with less costly models, such as solar lanterns or solar lanterns with phone charging, which simultaneously provides an opportunity for companies to reduce their investment overheads.

Typical spend of energy excluded households

Expenditure levels for pre-solar or pre-grid households (i.e. what is spent on kerosene) is quite hard to establish. According to the publication 'Energy Access and Off-Grid Solar Use in Uganda', it is on, average, US \$2.80 per month for those who adopt a solar lantern, and US \$6 for those who adopt a large solar system. These expenditures present a significant opportunity to switch to solar, and

achieve a higher level of energy inclusion, without it costing anything to the household. At very least, such a move could result in net savings within a reasonable period. It would indeed be fair assume that cheaper, smaller solar energy solutions that provide both cost savings and energy access gain would be a popular option among off-grid communities.

However, the reality is different and those people who stand to gain most from a switch to solar for the larger part are continuing to use costly and low-quality kerosene lamps.

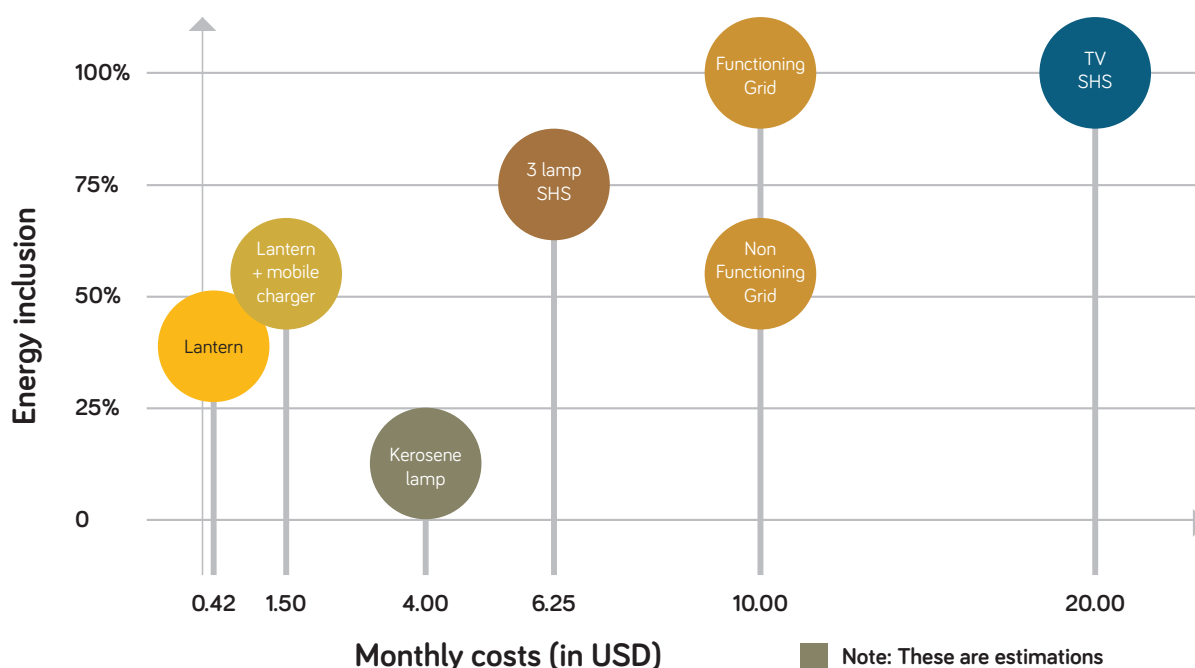


Figure 3: Energy solutions according to cost and energy inclusion (assuming two years pay- off period)

As the above Figure 3 shows, kerosene provides the lowest level of energy inclusion from the energy options available across solar and grid. However, it is by no means the cheapest, and two solar options have a lower monthly cost. Switching from kerosene to small-scale solar therefore presents a clear 'win-win' scenario (Figure 4), accelerating energy inclusion, reducing costs, and improving health outcomes. Shifting from kerosene to larger solar options is a slightly different prospect, with clear energy gains but additional financial costs.

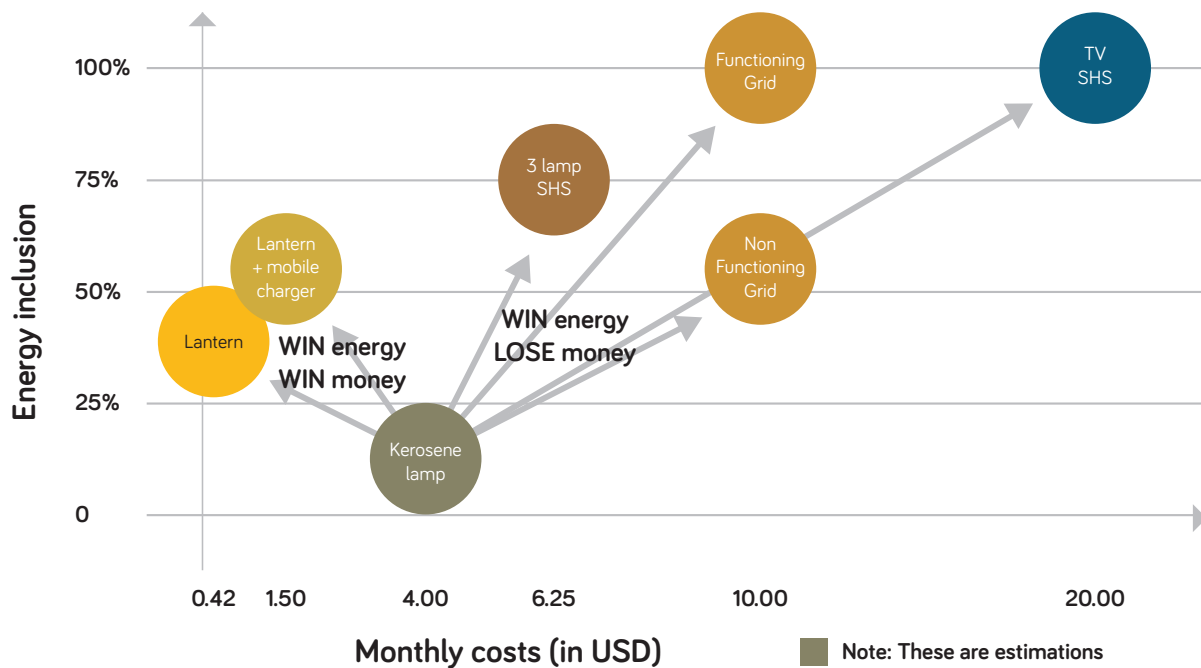


Figure 4: Energy solutions according to cost and energy inclusion

Most solar companies are prioritising larger solar solutions

Many solar companies clearly communicated that PAYGo requires them to concentrate on larger solar systems. For stand-alone lanterns, the PAYGo technology and payment system are too costly. As a result, while PAYGo enables affordable options for middle-income households, it is steering companies away from the smaller devices which are the only appropriate option for low-wealth groups.

Most solar companies offer limited range

Most companies only have two-to-three system options, rather than a full range on offer. This means that customers have little choice, particularly as in many locations there is only one local solar supplier. As a result, many households may end up with a system that is not an obvious match for their financial and energy requirements.

New solar systems are being bought before old systems are paid off

Solar has become steadily cheaper. As a result, a Solar Home System bought three years ago is likely to be half the power of a system bought today at the same price. Due to PAYGo and other gradual repayment methods, some people are still paying off devices they obtained several years ago, even though their weekly payments would now buy a much larger system. Some cases were encountered in the field where households had a new system installed (e.g. this time with a TV) while the old system was still in their house. Clearly companies are happy to sell customers a second Solar Home Systems before their first is fully paid off. Such households may not complete the payment for the old system, and the lock-out function would have little impact.

Solar also used in on-grid areas

In some countries, the bulk of solar is bought by people who actually have electricity from the central grid, but due to load shedding and other challenges, also adopt solar as a back-up. It is understandable that people want a back-up system, particularly in areas with frequent power outages. However, a back-up system could, in most cases, consist of a battery and 12-volt (or lower) lights, instead of solar power, with these batteries charging quite economically while the electricity is running. In this respect, the adoption of solar in these scenarios is unnecessary, and also makes it difficult to monitor access to energy in off-grid areas.

CHAPTER 9

CONCLUSIONS

The AECF/L-IFT study, 'Driving Financial Inclusion Through Renewable Energy?', provides a wealth of key findings and observations. The following conclusions bring together some of the core insights that could help to shape future activities and developments within the renewable energy sector. They also feed into the recommendations featured in the next chapter.

Conclusion 1: There is currently insufficient focus on solar lanterns

Currently the renewable energy sector is concentrating on Solar Home Systems, and solar lanterns are not receiving the attention they deserve. To achieve a substantial growth in renewable energy, and indeed in financial inclusion through savings, this study found that solar lanterns could be a better entry point for low wealth groups, enabling them to move up the energy ladder at neutral costs (i.e. the current costs of kerosene, candles, batteries and phone recharging could give them access to a lantern). The cost for lanterns is low, even for the highest-quality models, but lanterns provide a large energy return and help households achieve energy access. In the medium term, even after six to seven months, they already result in significant household savings.

Conclusion 2: More focus is required on the real poor

Currently as a sector, there is little focus on the real poor. Most renewable energy companies are serving mid-range clients, and even those focusing at a lower level do not truly reach

the lowest wealth groups. These households need solar energy more than other households because they are considerably less likely to access the grid for reasons of cost and location. Moreover, the real poor actually present a larger market for solar because they are much more likely to still use kerosene, while middle income households have more opportunities to access the grid.

Conclusion 3: Extend credit options to solar lanterns

PAYGo and credit systems are becoming increasingly technology based. As they become more and more sophisticated, they are moving away from and beyond the reach of the poorest households and communities. It is important to remember that credit can still be offered through traditional channels that require no technology, such as local shopkeepers, savings groups, or individual households.

Conclusion 4: Develop a second-hand market

The absence of a second-hand market for solar has several negative implications for the sector. It makes it difficult to upgrade from a simple model to the next model up. For those offering solar on credit, the absence of second-hand sales options also makes it hard to repossess and recuperate the value of the outstanding amount. While solar and batteries are not the most natural candidates for second-hand sales, according to experts such a system would be technologically possible and should be investigated further.

Conclusion 5: Work towards modular systems

Most solar companies claim that solar is not suitable for a modular system model. In particular, the battery is the high-cost element within a solar system; it is vulnerable to over-usage and may be severely damaged if too many devices are connected. Nevertheless, batteries can be wired in, and a smaller system can be turned into a larger one if batteries and solar panels are connected properly and in the right proportion. Such modularity would help customers across Africa to gradually fulfil their energy dreams.

CHAPTER 10

RECOMMENDATIONS

Based on the key findings from the AECF/L-IFT study, the following recommendations are intended for all companies working in the renewable energy ecosystem in Africa and beyond.

A. Recommendations for achieving deeper financial inclusion

While clean energy companies are indeed bringing about certain forms of financial inclusion, the impact could be further enhanced. In particular, records relating to first loan repayments could be leveraged more and clients should be able to access their repayment data to help secure additional loans. The strong relationships between solar companies and clients could also bring further financial inclusion benefits in terms of access to savings and insurance, without necessarily focusing on credit.

Recommendation A.1. Provide clients with their repayment history (and their credit rating)

Companies should be encouraged or obligated to provide clients with their repayment history. This would have several potential benefits. First of all, clients would learn that their detailed information is available, which may encourage them to repay on time and take care of their financial history. Secondly, this history may increase awareness among clients about the benefits of repayment records and how they can lead to additional credit or other benefits (in theory, such records could also help them access micro-insurance).

Recommendation A.2. Consider savings services

Much of the focus within the renewable energy sector is on credit, which is a major driver of solar sales. However, companies could also start to promote savings and develop savings services that would simultaneously bring about energy access and better financial health. For instance, clients who pay more than their PAYGo obligations, and effectively save for future lean periods, could be rewarded with interest on their savings or free days of solar. This approach would benefit both the solar company, who has more certainty the client will meet their future payment obligations, and the client, who is under less stress to pay during lean periods and reduces the risk of lock-out.¹¹

B. Recommendations for collaboration and data sharing within the sector

The sector could be greatly enhanced if standardised reporting and data sharing measures were introduced.

¹¹ Please note, the suggestion is not for traditional savings products that only regulated financial service providers can provide. This recommendation suggests that people save by repaying their solar faster during some months, which allows them to pay slower during lean months. For the users this is perceived as saving in faster paying months. In the hire-purchase sector, customers can pay deposits for goods for some time before obtaining those goods and have credit for the remainder of the cost.

This is also not savings from a regulatory point of view, but for the users it works in the same way as other forms of saving.

Recommendation B.1. Standard measurement on poverty/wealth: Introduce wealth measurement for all clients at the moment of purchase/adoption of new device.

If companies maintained income level records or poverty profiles of clients, the sector would better understand who is being left behind. It would also be possible for the sector to measure whether access to energy is impacting people's financial circumstances. Moreover, some companies may be incentivised to focus on the poorest groups once they can monitor across the sector. It is recommended to adopt the Poverty Probability Index (PPI) due to its ease of use (just 10 to 12 questions per country) and prevalence of use among other organisations and sectors (including the microfinance sector).

Recommendation B.2. Credit bureau-style data exchange: All solar companies should exchange customer repayment data and consult this data before selling on PAYGo

As solar is now expanding on a significant scale in several African countries, many customers are starting to upgrade to second PAYGo systems before their first system is paid off. It would be good practice if the sector commits to not issuing second or third loans for solar until first loans are fully repaid. This will be beneficial for the clean energy companies and will likely protect the customers from over-indebtedness and negative credit ratings. To support this process, credit reporting and consulting could be hosted by an existing credit bureau.

Recommendation B.3. Standardised impact measurement: Increase participation in Acumen Lean Data system

Lean Data is an initiative by Acumen and gathers detailed data on representative samples of clean energy companies. Acumen shows how companies perform on impact compared to their peers in the sector, enabling companies to benchmark and drive improvements where necessary.

C. Recommendations for reaching lower-income households

At the moment, the clean energy sector is quite focused on PAYGo financing which has substantial overhead costs. As a consequence, they cannot offer small solar options, such as stand-alone lanterns.

Recommendation C.1. Experiment by offering small solar on credit to lower-income households through local shopkeepers or savings groups

The lowest income groups spend considerably on energy (minimum of US \$2 per month per household). In theory, it should be possible to offer these households the smallest solar lantern costing around US \$10 in total. However, these people cannot afford to pay upfront, and no institution can economically offer them credit for such a low amount. However, shopkeepers and savings groups can. Shopkeepers know their clients well and know who they can trust to repay. Shopkeepers have their clients locked-in, because non-

payment means households cannot access local groceries or convenience items. Likewise, savings groups are excellent mechanisms for accessing small levels of credit, and this channel could be used for obtaining small solar lanterns.

Recommendation C.2. Offer upgrade options to phone-charging solar lanterns through local shopkeepers, savings groups or existing PAYGo clients

This recommendation is an extension of recommendation C.1. Those people who have paid off their smallest solar lantern could be offered to return the lantern in exchange for a larger unit which also charges phones. When the return value of the original lantern is discounted, they could probably access the larger device with the same daily or weekly payments, while making savings on phone charging.

Recommendation C.3. Renting out solar lanterns

Existing PAYGo clients with a Solar Home System may well have sufficient solar power to charge one or two additional torches or lanterns during the day. They could offer their neighbours these torches/lanterns for a day fee similar to daily kerosene costs. The PAYGo household would benefit, receiving cash that will help them pay their PAYGo quota, while the other household would have access to better quality light. This would also be a good way for that household to gain experience of solar without any large financial commitment.

CHAPTER 11

CASE STUDIES: Fenix

Providing access to Emergency School Fee Loans

Fenix is a leading provider of solar home systems. It originally focused its activities in Uganda, where it goes by the brand name ReadyPay, and from the outset partnered with MTN, the largest Ugandan mobile phone and mobile money provider.

ReadyPay is distributed exclusively through the MTN agent network, which has enabled Fenix to spread fast and far. Fenix does not sell through a franchise network and its staff intensively support and respond to its clients, including through a multilingual call centre. In recent years Fenix has moved to Zambia and Côte d'Ivoire, with Nigeria and Benin soon to follow.

Long-term PAYGo financing

ReadyPay's mission is to provide 5 million people with inclusive energy, and to date it has reached more than 1.3 million people in Uganda alone. To reach lower income people they offer a range of PAYgo payment schedules lasting up to almost three years. Clients can pay daily, weekly, monthly or a mix, as long as they do not fall behind with payments.

Leveraging the MTN network

Fenix customers pay exclusively through MTN mobile money and ReadyPay's system has a direct communication link with MTN's system. Fenix has been able to extend to remote parts of Uganda through MTN's distribution network, and many of its units are sold through MTN agents. In Zambia and more recently Ivory Coast, Fenix also partners with the MTN mobile money offer.

Top-up school fee loans

Once Fenix client payment patterns are known, they may become eligible for subsequent financing. After six months, clients who are repaying well are offered top-up school fee loans before the completion of their repayment schedule. These clients are notified of their eligibility when school fees are due; in Uganda this is three times a year, which often impacts household cashflow. The school-fee loans are typically top-up loans, which incur a slightly increased daily fee on top of the solar home system payment. Fenix also informs its clients when they become eligible for additional hardware, such as extra panels, larger radios, and torches.

Customer profiles

ReadyPay customer PPI scores appear to peak around 41-45, which is indeed a lower income group than those reached by other solar home system providers.

All respondents with ReadyPay only ever had one solar device; their ReadyPay solar home system was their first experience of solar and they did not buy a subsequent solar device. Only one client had a larger solar home system with a TV, while 11 had the simple entry-level system. Most had bought their device 12 months previously (two-thirds), with a few (one-sixth) buying two years previously and one-sixth buying four years or more ago. All were still using their device.

Interestingly, only ReadyPay respondents were actively using their solar home systems to charge mobile phones for others at a fee.

Financial inclusion & awareness

Only one-sixth of the clients interviewed bought their system with cash. Reportedly eight purchased through PAYGo and two with an informal loan . The median cost was US \$120, the average was US \$110, and the maximum was US \$300.

The majority of those receiving ReadyPay PAYGo loans had never had any type of loan before, and most said they could not have afforded the device without the loan. Only three respondents thought that ReadyPay system makes it possible to obtain additional loans. However, the large majority had a clear understanding of the data that ReadyPay (Fenix) held about them, and how this would help ReadyPay and could also be leveraged by the clients.

Overall, Fenix expects more and more of its revenue to come from customers who move up the energy ladder with them, and who move up the financial inclusion ladder through school fees loans and other programmes.

CASE STUDIES: SolarNow

Flexible Financing

SolarNow is a renewable energy company offering solar solutions for micro- and small businesses, farmers, and higher-end household energy needs. Operating in Uganda and Kenya, SolarNow designs technologies which help to provide income, comfort and connectivity. SolarNow stands apart from competitors in that its system are fully upgradable, with the option to add more panels and additional or larger batteries.

A unique approach

SolarNow takes a unique approach to solar financing, offering finance without the PAYGo 'lockout' feature. This means that when a client pays late, the lights stay on and the pumps keep pumping. Such an approach risks undermining customer commitment and discouraging prompt repayments. However, customer care and trust go a long way to mitigating these risks, while SolarNow believes that 'lockouts' lead to loss of income, further reducing customers' ability to pay.

The company also offers solar solutions on credit, which needs to be paid off within 24 months. If a customer cannot meet their repayment, they are offered flexible refinancing options.

Sales points

Between July 2018 and March 2019, L-IFT staff made several visits to SolarNow shops to assess the customer experience. The shop staff were quite knowledgeable about the products and encouraged clients to think of solar as an opportunity to generate additional income, for example by powering water pumps for irrigation or chilling drinks for sale. In both instances, our visiting staff were particularly pleased with the range of options. And while the prices were substantial, the financing and monthly payments were clearly communicated and appeared consistent across all branches.



Customer profiles

SolarNow customers are mostly in the middle PPI scoring range (41 to 60), very similar to M-KOPA and ReadyPay customers. According to Acumen, SolarNow reaches somewhat higher wealth customers, which can be expected since they also offer higher-end and costlier systems.

Out of those respondents with SolarNow home systems, 79% had the entry-level system; just 14% had the more extensive system with TV; and 7% had another system (presumably water pump). The majority had obtained their system one year previously, and did not want to obtain additional solar as they were satisfied with their current amount.



Financial inclusion & awareness

Most of the systems were bought on credit, which the respondents mainly referred to as 'PAYGo', 'informal credit' or 'shop credit'. Just one out of five (21%) paid for their system in cash.

The devices bought cost on average US \$800, out of which US \$300 on average was on credit. Of those who bought on credit, 45% are repaying via mobile money, 27% are repaying directly via the agent, 18% via an MFI, and 9% via the SolarNow shop.¹

Of the SolarNow customers buying on credit, 56% had never had a loan before. Two-thirds said they could 'barely' have afforded the device without the loan, and one-third said without the loan the purchase would have been impossible.

One in three of the respondents thought their solar device definitely helped them access other loans, while roughly the same amount disagreed. All respondents saw the value of the loan flexibility, stating they would use the same type of financing for their next solar device.

Ultimately, the clients were aware of the value of their repayment data and how SolarNow was collecting and using this data. The majority (73%) thought SolarNow was using their data to understand them as a customer. The same number also thought SolarNow could and would give them this data so they could leverage it themselves, for example to obtain another loan elsewhere.

¹ The respondents may have confused the SolarNow shop with their agent or another shop providing agent services. SolarNow does not receive any cash payments in their shops, staff reported to L-IFT.

CASE STUDIES: Azuri

Solar with Health Insurance

Azuri Technologies is a key player in the solar home systems market. Azuri works in a number of countries simultaneously, rather than focusing solely on one country before moving to another.

In each country, Azuri sells its devices through local partners. In Kenya, Azuri collaborates with supermarkets in small and regional towns, using existing supermarket infrastructure rather than investing in costly shopfronts. In most cases, the Azuri logo is displayed on the shopfront and visitors are given demonstrations outside by Azuri staff.

Azuri's sales approach is to have one senior sales agent responsible for an area that can be covered by motorbike. In addition, local people are hired to support sales efforts and manage after-sales care.



Client background and choices

Despite previously using only basic energy equipment, such as kerosene lamps with open wicks, PPI scores indicate that Azuri client households are not among the poorest groups. Most of the households sampled comprised rural families living far from the nearest grid. Half of the respondents had used solar before, while for the other half Azuri was the first solar device they had ever owned.

The majority of respondents obtained a solar home system with several lights, a phone charger and a radio. Three out of 12 had a larger system with a TV connection.

All clients had obtained their device using PAYGo. The total cost was US \$200-280 for the smaller solar home systems and ranged from US \$550 to US \$845 for the systems with TV. Importantly, the respondents were aware of the amount of money they had borrowed, the total price, and the amount they still owed. All respondents arranged for repayments to be made via digital mobile money.

Appreciation of Azuri

Most respondents cited the sales agent as the major influence in their brand selection, with trust, clear explanations, good prices and home visits proving to be decisive factors. Another popular feature of Azuri systems is the partnership with Zuku, which enables client to access a range of TV and radio programmes.

Those who received home visits were particularly excited at the prospect of being able to expand their energy access, envisaging a future of comfort and convenience through energy-driven devices. All of the respondents said they want to obtain more solar devices.

Financial inclusion & awareness

For the majority of clients sampled, the loan for the Azuri solar home system was their very first loan ever. They stated that without PAYGo financing they could not have obtained the solar system.

About half the clients were convinced their PAYGo track-record was helping them access additional loans. Indeed, in general Azuri clients are aware of the importance of their new digital financial history and repayment record. And once explained, people also have a reasonable idea about the role of the credit bureau and its relationship with Azuri.

Health insurance add-on

Recently, Azuri has begun offering health insurance linked to solar PAYGo payments. The PAYGo customers pay a little more each week for the insurance, which covers doctor and hospital costs. However, at the time of interview only a few of the existing customers had heard about the scheme.

Most of the clients thought health insurance was an excellent idea. With one exception, they all said they wanted to take up the offer. In particular, their trust in and reliance on Azuri made the scheme seem more credible.

One major issue was around the moment of payment. The sales agents had explained that Azuri would pay for the health costs, so clients could claim free healthcare at hospital. However, senior Azuri staff clarified that in reality this was not the case. The client would

have to pre-finance their costs at the hospital and would be refunded later, making the offer considerably less attractive.

Azuri focuses on health insurance for several reasons. First of all, health costs are a major challenge for most clients, the majority of whom have unstable jobs and unpredictable income. Without money for healthcare, people often delay seeking help, which can exacerbate health problems and lead to greater costs. At the same time, poor health can impact people's ability to work, leading to further loss of income. Health insurance provides a vital solution to these problems; and as it helps clients to remain healthy and in work, it also enables them to meet their Azuri repayments. In this way, the scheme adds significant value to the Azuri business model.





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