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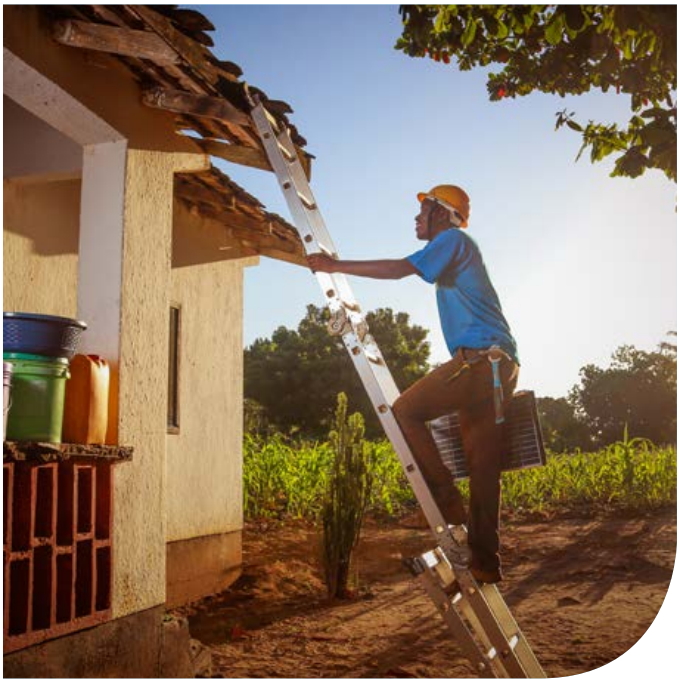
REACHING SCALE IN ACCESS TO ENERGY

Lessons from practitioners

CASE STUDIES



May 2017

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SCALING OFF-GRID ENERGY: A GRAND CHALLENGE FOR DEVELOPMENT

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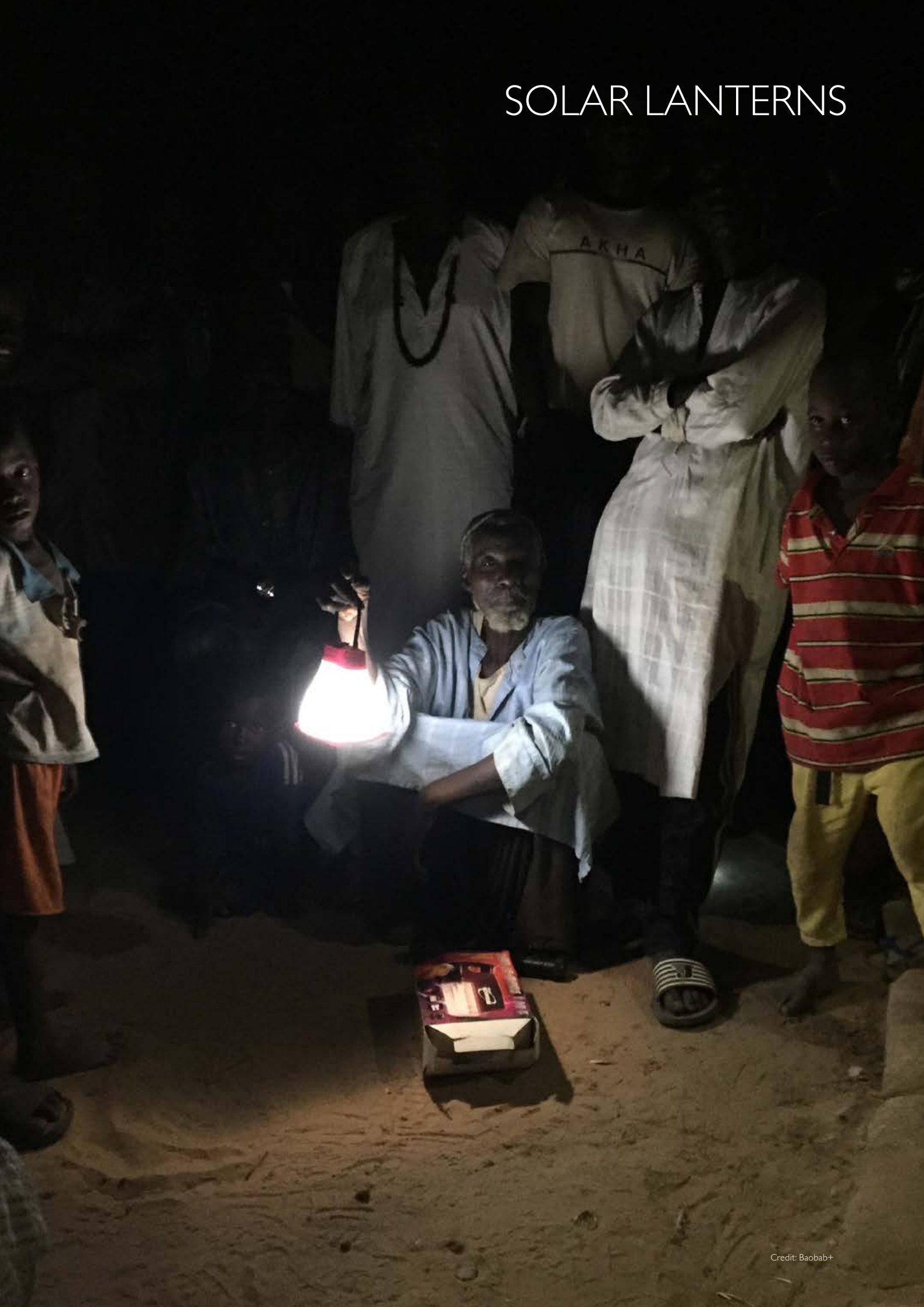

Credit: Baobab+

www.dlight.com

d.light is the largest manufacturer of pico solar products with 16 million lanterns and over 350,000 SHS sold mainly through partners across 62 countries

Organization

d.light was founded in 2007 by Sam Goldman and Ned Tozun, both Stanford MBA graduates, with the mission of providing solar energy solutions for households and small businesses around the world.

Within a few years, it has become the world leader in the production of quality solar lanterns, with products sold in over 62 countries, and offices in Kenya, India, China and the US. One key to success has been the ability to combine own distribution with large distribution partnerships early on such as Total, which is a leading global distributor of lanterns sold through its 4,000+ gas stations.

The $5 solar lamp model – A1 – is d.light's award-winning and one of the best-selling lanterns that has enabled the company to reach further down the affordability segment among low income households. d.light also aims to move its customers up the energy ladder. It manufactures pico-Solar Home Solutions (SHS), and is developing larger systems and higher power appliances like TV. The 18.5" variant of d.light TV won at the 2015–16 Global LEAP Awards Outstanding Off-Grid Television Competition for the best TV in medium size category.

Leveraging its proprietary Pay-As-You-Go (PayGo) technology and a robust backend platform to manage consumer financing, d.light offers grid-like experience to its customers in a package that includes user-friendly payment systems, high-quality customer support and industry-leading products.

Value proposition

d.light positions itself as the full range, high quality products and services provider that offers three types of products:

(i) Entry-level solar lanterns: The range starts from as low as $5; product life of ~5 years; 4–8 hours of light per charge, 2–3 times brighter light than kerosene lamp;

(ii) Multifunction solar lanterns: The range starts from ~$20 with mobile phone charging, 4-16 hours of light per charge, 10 times brighter light than kerosene lamp;

(iii) Entry level Solar Home Systems (SHS): The range starts from ~$100, with 2–3 light points, 1 portable lantern / torch and a radio, 16–25 hours of runtime per charge, and 8–12 times brighter light than kerosene lamp

Depending on the distribution channel, customers can buy these products in cash or on credit, in particular through consumer finance provided by MFIs, who bundle the product with a large asset loan. d.light also offers one of its SHS through its proprietary PayGo technology which enables a customer to procure the SHS for a nominal deposit of $20–25 and then pay for the product in easy daily instalments of $0.4–0.5 over a period of 12 months.

The company also has a SHS, which includes a solar TV and/or solar fan, and comes with expandable solar panels and battery capacity. All d.light products are Lighting Global certified and come with 2-year replacement warranty.

Operations

d.light designs its products in San Francisco and manufactures in China. Distribution partners are managed by the offices in East Africa and India. d.light is fully integrated in Kenya, Uganda, Nigeria and India and local teams in other countries manage local partners and provide technical and marketing support. Distributors range from large retail networks such as Total SA to Micro Finance Institutions (MFIs) who extend their own line of credit – for instance, SKS Microfinance.

d.light also helps its distributors grow sales and profitability, e.g. sharing best practices in consumer education and product demonstration.

The d.light brand is now globally recognized and

has proved its ability to create customer loyalty. For instance, recent studies show that about 50% of d.light SHS customers have previously used a d.light lantern. This is a strong asset in markets that are increasingly flooded with low-quality generic and counterfeit solar products.

Scale, impact & sustainability

Scale: d.light is the largest supplier of pico solar products with 16 million lanterns and more than 350,000 SHS (50% through PayGo) sold globally through partners across 62 countries. Their estimated market share in volume is over 45% in South-East Asia, and more than 35% in Sub Saharan Africa.

Impact: As of March 2017, d.light estimates that it has reached over 70 million people, including 18 million school-aged children, while contributing to energy savings of $5.6 billion and reduction of 25 million tons of CO_2.

Sustainability: d.light is profitable and since inception it has garnered over $70 million in commercial investments and grants, including a recent $40 million in 2016, of which $20 million in equity from Norfund, KawiSafi Ventures, Energy Access Ventures, New Quest Capital Partners, Omidyar Network), $10 million in debt from SunFunder and DWM and $10 million in grants from USAID, Shell Foundation and UNCDF.

Sources: Interview with Ned Tozun, CEO & Founder, in August 2015 and with Rohit Jain, Finance and Global Partnerships Manager

https://www.ashden.org/files/reports/D.light%20case%20study.pdf
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Contact: Ned Tozun, ned@dlight.com

greenlight planet™

www.greenlightplanet.com

Greenlight Planet has manufactured and sold over 6.5 million solar lanterns and solar home systems to off-grid households across 50 countries

Organization

Greenlight Planet (Greenlight) was started in 2009 by the engineering students Anish Thakkar, Patrick Walsh and Mayank Sekhsaria, with $600,000 in seed funding. In their first year, they sold 10,000 "Sun King" lamps in India. By 2016, Greenlight had scaled up and expanded internationally to become one of the leading manufacturers and distributors of off-grid solar products globally.

Greenlight has kept broadening its customer base, by diversifying its product portfolio and its distribution channels. It now sells higher-end products, e.g. the "Sun King Home" solar home system for households who want more than basic lighting, but also launched in 2016 an entry-level product, the "Sun King Pico" lantern, to compete with the low-quality products that have spread on the market.

Greenlight also started the Sun King EasyBuy product line in 2016, a pay-as-you-go (PAYG) solution for high-end products. It partnered with Angaza Design for the PAYG metering (remote shut off) technology and back-end, and has set up dedicated teams to support PAYG operations.

Value proposition

Greenlight now offers a comprehensive range of five lanterns and two SHS (6-12W, three lights, and phone charging), and is currently exploring DC radios and TVs. It flagship product remains the Sun King Pro series, a $35 lantern equipped with one or two USB phone charging ports and a detachable solar panel, that provides 15 times brighter lighting than kerosene lanterns.

All products have a 5-year battery life, a 2-year warranty, can provide 36 hours of lighting per charge (depending on the brightness mode selected), and are certified with Lighting Global quality standards. Greenlight products also provide economic benefits to end users. For instance, the Sun King Pro is paid back in less than 6 months thanks to savings on kerosene and phone charging.

Customers may buy products directly from Greenlight or from one of its partners, either in cash, on credit (through MFIs), or with PAYG financing schemes. While financing options have unlocked large customer segments, they can be costly for such small products. For instance, the Home SHS is retailed at $80 in cash, but amounts to $125 with a 9-month PAYG contract. This price yet remains highly competitive with other companies selling pico-SHS on PAYG.

Operations

Greenlight manufactures its products in China, and distributes around the world, largely in East and West Africa, South Asia and more recently, Southeast Asia and Latin America. It has two main distribution channels. The first one, commercial partnerships with international distributors, accounts for the vast majority of sales. Distributors include gas station networks (e.g. Total), MFIs (over 35 globally), social businesses and NGOs. With the launch of entry-level products, Greenlight is increasingly working through traditional retail, in particular in India and Kenya.

A smaller percentage of sales come from direct sales channels, in Kenya, Myanmar, Nigeria and Uganda. Through this direct sales network, Greenlight sells and finances end consumer purchases of Sun King EasyBuy products.

The Sun King EasyBuy solution is sold both via partners and direct sales. In both cases, the need for customer care is higher than for cash sales. Greenlight decided to sell solar lanterns as well as multi-light solar home systems through pay as you go technology, while most competitors would sell only larger systems. The objective is to create a first link with customers and build longer-term relationships.

Lastly, Greenlight keeps piloting innovative distribution models. For instance, it partnered with ECS in Zambia, an organization selling fuel pellets and clean cook stoves equipped with a battery-powered fan. Greenlight and ECS have plugged the cook stove on the Sun King Home system, and are now selling it as a PAYG bundle, where customers pay regularly to acquire the solar home system, the cook stove, and have pellets delivered at their doorstep.

Scale, impact & sustainability

Scale: Greenlight has sold 6.55 million products in more than 50 countries. It employs 300 full time staff in 11 offices, in 5 countries.

Impact: Greenlight products reached around 25 million off-grid users, who are now saving on fuel expenses, generating additional income (e.g. increased work hours at night), or enabling their children to study longer at night. Greenlight states that it has offset 900,000 metric tons of CO_2 since inception.

Sustainability: It raised $10 million in 2015 in a Series B funding, led by Fidelity Growth Partners India to support its expansion in Africa and South-East Asia.

Sources: Interviews with Anish Thakkar, co-founder, September 2015; Melissa Lo, Marketing Director, and Divya Arya, Marketing Manager, November 2016; Patrick Muriuki, Global Partnerships Manager East and Southern Africa, and James Awiti, Country Market Manager Tanzania, December 2016; Ashden Awards case study Greenlight; company website.

Contact: Anish Thakkar, anish@greenlightplanet.com

www.renewit.com

Renewit has manufactured over 3.5 million customized and standard solar products and equipment, selling to distributors globally

Organization

Founded in 2007 in Hong Kong, Renewit is a global equipment manufacturer, specialized in telecom and consumer electronics and LED lighting. It has diversified into quality-certified household solar products, which represent more than 50% of the group's business today. Renewit has kept expanding its range, and is now also manufacturing DC powered appliances, solar kiosks and minigrids.

The company has recently been moving away from entry-level solar lights to manufacture larger systems, for which demand is growing much faster: medium and large SHS now represent more than 40% of its sales volume (vs. 10% in 2014), while pico-solar fell to less than 10%.

The distribution strategy also had to evolve, as sales with historical clients (telecommunication operators and pico-solar distributors) have slowly saturated. Renewit hence now works more with local or regional players (e.g. farming unions), who serve a large base of relatively wealthy households in remote rural areas that are yet untapped.

Value proposition

Renewit manufactures over 50 different standard products ranging from 0.5W solar lights priced at approx. $4 apiece (free on board) to 100W solar fridges or multipurpose solar-powered smart kiosks at $2,500 (free on board). Products come in different sizes and watt capacities, with different warranty deeds and optional features (e.g. phone chargers, wifi routers, USB appliances, radios, TVs).

Renewit puts a clear focus on quality control and flexibility, meeting Lighting Global certification standards on all products and having return rates close to zero (in 2014-2015, 0.05% for 1 million lanterns shipped, 0% for 2,500 kiosks). Half of the production is Renewit-branded: the company has several brands of solar products that distributors may prefer to use instead of their own. The other half is white-label products, branded for local and international companies. The company also designs and develops customized products exclusively for some clients.

Renewit has developed many low-cost items to be sold cash or through short credit plans, which would be twice cheaper for the end-consumer than similar items sold through PAYG schemes.

Operations

Renewit designs, engineers and manufactures all products in its own Chinese facilities, with the view to generate economies of scale and keep full control on quality, before shipping to its clients.

Renewit's client portfolio includes telecom operators (40% of sales), farming unions, but also solar product distributors, MFIs, NGOs, and large consumer good corporations. As distributors diversify more and more their offerings, Renewit increasingly receives smaller orders of just a few thousand units each, and demand for customization increases. To remain competitive, Renewit had to adapt its business model, from being pure manufacturer to becoming a service provider, working closer with its clients (e.g. co-designing products, offering communication materials or introducing them to potential partners).

Scale, impact & sustainability

Scale: Since inception, Renewit has sold 500,000 pico-solar products and 2 million lanterns with phone charging. Sales have been increasing rapidly over the past year.

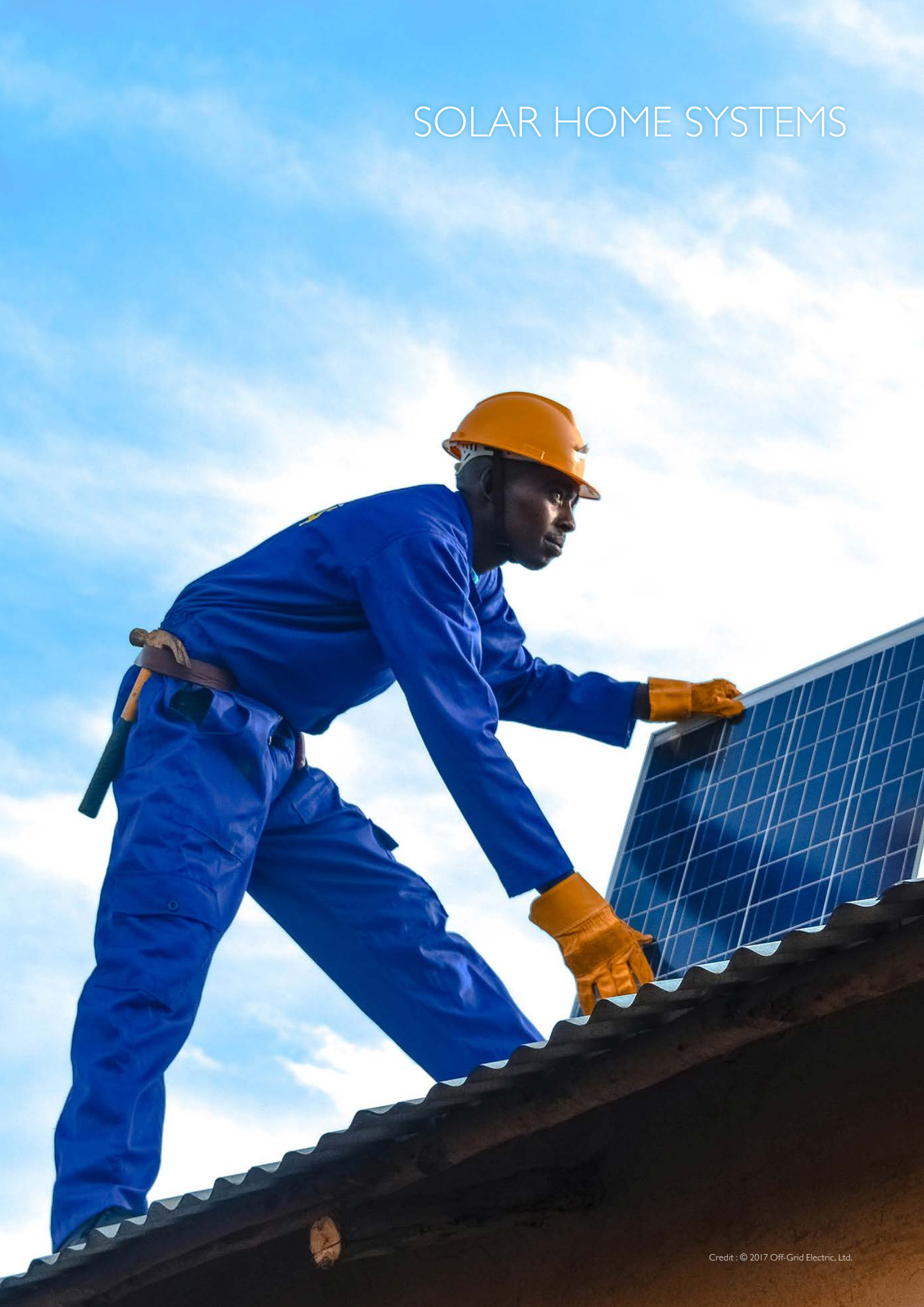
Impact: Renewit does not measure its social impact, as it is not in direct contact with end-users.

Sustainability: The solar line is profitable and has been entirely financed in-house.

Sources: Interview with Richard Atwal, Director, December 2015 and November 2016; company website.

Contact: Richard Atwal, richard@renewit.com

SOLAR HOME SYSTEMS



Credit : © 2017 Off-Grid Electric, Ltd.

www.baobabplus.com

Baobab+ leverages an MFI network and PAYG technology to provide rural African households with a full range of products and services

Organization

Microcred, a multinational digital finance company present in 8 countries with 557,000 clients, launched Baobab+ in Senegal, Côte d'Ivoire and Madagascar in 2015 to distribute (and finance) pico-solar products, SHS, tablets and water filters. Baobab+ leverages the strength of Microcred brand and network; 36 local branches in Senegal, 216k active customers, about 14% of Senegalese households.

The first step in Baobab+ development has been to offer existing Microcred customers pico-solar and SHS products financed by a simple "top up" (as high as 7% of the loan) when they took a new loan. As over 65% of customers accepted this attractive offer, this enabled Baobab+ to sell 17,000 units in the first 16 month of operation and reach breakeven.

In parallel, they attempted to launch a direct pico-solar salesforce to reach non-Microcred customers but quickly realized that competition was fierce and, most importantly, that what customers really wanted were SHS that could be made affordable with PAYG. Baobab+ then shifted its efforts to launch a PAYG pilot with Greenlight Planet. Results so far have been very encouraging: 1k SHS have been sold in 4 months, most importantly with sufficiently high salesforce productivity and low defaults to ensure good profitability.

Contrary to some PAYG players, Baobab+ has inherited from it MFI origins an obsession to keep default rates low and, because it has not – so far – raised money from external investors, has focused on quickly achieving cash break-even at the expense of growth.

Baobab+ are already distributing Lifestraw water filters in Senegal and tablets in Côte d'Ivoire. It also acts as a recruiter of rural customers that Microcred found too expensive to reach. Confident that they have a solid, two-pronged business model ("top up" in MFI branches and PAYG direct salesforce), Baobab+ is actively preparing its next stage of growth and replication in the other Microcred countries.

Value proposition

Overall, Baobab+ stands for competitive and reliable service and products.

In Microcred branches, customers that get a loan (typically for productive use) are offered a range of quality products (Sun Bell lanterns, Sunking Pro and Home, Little Sun, Lifestraw water filters, tablets) than they can easily purchase thanks to a modest (less than 7%) top up on the loan. This top up is pre-approved. While Microcred keeps on growing its number of customers, as most of them get a new loan every 10 months and 65% do take advantage of the top up opportunity, Babobab+ needs to continue expanding its product range in order to keep its sales through this channel stable or growing over time. The customers reached through this channel are urban and peri-urban households with sufficient revenue generating activities to be Microcred clients, i.e. less than a third of Senegalese households.

Baobab+ direct salesforce reaches out to rural, off-grid households. Most families know about solar lanterns and are convinced of their benefits. Their sole resistance to buying is their concern about the reliability of the device and of the after sales service. This is where Baobab+ affiliation to Microcred 36 physical branches and 700 service points is a distinctive plus.

Operations

Baobab+ sources its products from global manufacturers (solar from Greenlight Planet and BR!GHT, water filters from Lifestraw and tablets from Huawei) and imports them through the local Microcred subsidiaries.

For sales through Microcred branches, Baobab+ delivers the products to the branches in consignment and gets paid when the sale occurs.

For sales through direct salesforce, Baobab+ leverages the network of Microcred branches and agents (700 "correspondents" in Senegal) to physically distribute the products to its sales agents who deliver and install the products in the customer premises. Baobab+ has been experimenting with two types of sales agents: experienced sales professionals who receive an attractive fixed salary plus variable commissions, and young graduates paid primarily through a very attractive variable commission scheme. Both options are still pursued with a clear objective of ensuring high levels of productivity and very low churn.

Baobab+ uses the Angaza PAYG platform to handle both Greenlight Planet and BR!GHT products, and provides its sales agents with smart phones or tablets to activate the devices. Payment collection is currently implemented through various methods: direct collection by agents, payments made at Microcred agents and mobile money transfers (Wari, Orange Money).

While Baobab+ default rate is very low, when repossession of devices is necessary, sales agents are in charge of implementing them.

Scale, impact & sustainability

Scale: Microcred launched the Baobab+ pilot in August 2015 in Kaolack (rural Senegal) and started rolling-out in the rest of the country in 2016. By May 2016, 2,600 households were equipped with Baobab+ products. The PAYG pilot is only 4 months old and has reached the 1000 units sold milestone early February.

Impact: Rural customers have very limited and unsatisfactory access to lighting (batteries for torches and candles at 100FCA, rather than kerosene lamps) and phone charging ($0.15 charging fee in generally distant locations). Baobab+ offers an extremely attractive deal: $0.40 per day for a SunKing Home (3 lights and 1 USB) over 11 months.

Sustainability: Because Baobab+ is able to leverage Microcred physical presence and brand, it has been able to (almost) reach breakeven (i.e., covering all overhead including Microcred's allocation) after 18 months of operations.

Sources: Interviews and site visits with Alex Coster (MD), Sandrine Marmolejo (Project leader in Senegal), and Mamadou Ndaye (Sales director Senegal)

Contact: Alex Coster, acoster@microcred.com

fenix intl

www.fenixintl.com

Started in 2009, Fenix has distributed over 110,000 SHS on PAYG in Uganda, in partnership with MTN

Organization

Fenix International (Fenix) was founded in 2009 by two American entrepreneurs, Mike Lin and Brian Warshawsky, bringing together management experiences from East Africa and Silicon Valley. The company, based in Kampala and San Francisco, offers SHS to off-grid households, with a complete value chain approach, from design to manufacturing, sales, financing, customer experience, and aftersales service.

Since 2009, Fenix has built an exclusive partnership with MTN Uganda, the largest mobile operator in the country, to leverage their brand, mobile payment infrastructure, and distribution network. After an initial 2-year pilot, Fenix started commercial operations in 2012, and launched its PAYG offering in 2014. It reached 13,000 customers in 2014, 50,000 in 2015, and over 100,000 SHS by end 2016.

Fenix aims at building long-term customer relationships, by offering secured and highly upgradable systems, and delivering exceptional customer service. It has become the number one PAYG provider in Uganda, and one the global leaders in the sector. Fenix has raised nearly $12 million in debt and equity to support its growth, and plans to launch sales in three new countries in East and West Africa in 2017.

Value proposition

Fenix targets low-income rural households living off the grid. A majority of customers are self-employed (e.g. farmers, small business owners, shop keepers) with irregular income, and could not afford a SHS without financing.

Fenix has developed its own PAYG platform, ReadyPay, enabling customers to purchase SHS over 24-36 months via microinstallments paid over MTN Mobile Money. After each payment, they receive a unique code which they enter into their SHS to recharge credit. When credit expires, the system is automatically locked. To accelerate awareness and trust in the ReadyPay brand, Fenix has co-branded its units with MTN and leverages MTN's distribution footprint to make ReadyPay sales and aftersales service readily accessible nationwide.

Fenix offers five SHS bundles. The entry-level and best-selling SHS includes a 10W solar panel, 22Wh battery, 2 LED lights, and a phone charging cable. It sells for $14 down payment and $0.15 per day for 36 months, making it one of the most affordable SHS kits in East Africa. Customers get early payment discounts to help reduce the total finance price, and may also purchase in cash at an even lower price. The higher-end system is a TV kit sold for $80 down payment and $0.88 per day during 24 months.

All systems come with 3-year warranty and service. After a first payment cycle, customers can upgrade their systems with extra accessories (e.g. lanterns or radio) or access financial services (e.g. education loans). SHS can be easily upgraded with additional panels: batteries of entry-level systems, initially capped at 22Wh, can be unlocked to 44Wh with an activation code, and Fenix has recently introduced an 80Wh battery to power larger TV, lighting, and phone charging systems.

Fenix is currently working on a version 2.0 of its ReadyPay system, which will be GSM-enabled. It also keeps adding new products and services as upgrade options under the ReadyPay brand.

The trusted brand, visibility, and nationwide accessibility provided through MTN, together with the affordability and expandability of ReadyPay units and customer experience focus, allows Fenix to capture the largest addressable market in Uganda. In turn, MTN has realized accelerated customer acquisition; increased ARPU, customer stickiness, mobile money transaction volume and value, and rural penetration; and improved agent performance, retention, and service. For example, 99% of Fenix customers in Uganda are first-time MTN Mobile Money users, who go on to transact an average of 4-5 times per month for the 2-3 year duration of their first ReadyPay loan.

Operations

Fenix designs all its products in Silicon Valley, where it employs about 12 R&D staff, and manufactures them through partners in China. The products are then shipped to Uganda for distribution.

Fenix uses over 90 MTN outlets throughout the country for warehousing and sales, against commissions for the outlet owner. Sales activities are organized around these shops by Fenix's 1k+ commission-based agents, trained in Kampala and supervised by 35+ managers.

Activities include both village-level animations and above-the-line marketing (e.g. radio, TV, billboards). With its focus customer experience, Fenix relies strongly on word-of-mouth: 55% of customers come from referrals. Upon installation, Fenix calls each customer to ensure that they are properly using the product. Ongoing customer service is provided through a toll-free call center which is offered in over 25 different languages and open 7 days a week, 14 hours/day. In the field, Fenix ensures dedicated ReadyPay technicians are available across 21 service centers located around the country.

The full customer journey has been designed to encourage repayments: secured anti-tamper hardware, centralized vetting process, incentives for sales agents on portfolio quality, voluntary returns, and proactive customer finance service (SMS, phone, home visits, and eventually repossessions).

Fenix is using its proprietary software and apps to monitor payments, aftersales, and inventory, to make its operations scalable.

Scale, impact & sustainability

Scale: Fenix has sold over 110,000 SHS and counts 83,000 active solar leases by end 2016. The company is starting operations in Kenya and Zambia, with pilots in Senegal and Cote d'Ivoire. It has 330 full time employees and 1k commission-based agents.

Impact: Fenix enables off-grid households to access clean energy, save money, and increase income generation activities. It estimates that it has generated $19.5 million in customer savings, replaced 120,000 kerosene lamps, and saved 720,000 tons of CO_2 emissions.

Sustainability: Fenix is targeting corporate profitability by end 2017. It has investment rounds in 2009, 2012, and 2015 from Engie, Schneider Electric, Orange and other impact investors, and is going through another round in early 2017. Fenix also received grants from AECF, GSMA, and USAID.

Sources: Interview with Caitlin Burton, Business Development Director (Feb 2017), Charlotte Schroder, Consumer Finance Manager (Feb 2017), and Erin Boehmer, Data scientist (Feb 2017), company documents, www.fenix.com

Exchange Rate: 1 USD = 3,600 UGX

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www.lumos-global.com

Started in 2012, Lumos has distributed over 30,000 large SHS (80W) in Nigeria on a PAYG model, in partnership with MTN

Organization

Lumos was co-founded in 2012 by two entrepreneurs, Davidi Vortman and Nir Marom, coming respectively from the telecom and renewable energy sectors. It partners with mobile network operators to distribute SHS on pay-as-you-go, and aims to sustainably provide access to affordable, reliable, and clean solar energy to millions of people.

The first pilot, in Guinea in partnership with Cellcom, was discontinued after the Ebola crisis. Lumos then settled in Nigeria where it has built a strong win-win partnership with MTN Nigeria, the country's largest operator (60 million subscribers) since 2014.

MTN co-brands Lumos products, distributes them across its outlets, enables mobile payments via airtime (as an alternative to mobile money, which penetration in Nigeria is below 8%), and ensures first-tier customer support. In return, MTN get a share of revenue from Lumos sales, and can increase customers' spending on airtime, adoption, and loyalty.

By early 2017, Lumos has a distribution network of over 150 MTN stores across Nigeria. It counts over 30,000 customers and has become one the global industry leaders. It has further raised a record $90 million in 2016 to support growth in Nigeria and replication to new countries.

Value proposition

Lumos sells a single product on a long-term lease, which positions the company more as a service provider than a product distributor. Customers include both off-grid households (about 80% of sales), small business owners and community institutions (e.g. schools, health centers, mosques). A majority customers are using petrol generators, and are hence already equipped with appliances.

Lumos SHS includes an 80Wp solar panel, a control unit with a battery, two LED bulbs, eight power sockets, and a mobile phone adapter. Customers pay a down payment of around $65 (NGN 19,500, including one month of electricity) before making regular payments via mobile phone (deducted from MTN airtime). In absence of payments, SHS are remotely locked out.

Prices vary from $3.3 for five days to $156 for one year, with a mandatory purchase at least 20 days per month. After five years of regular payments, customers become the owners of their systems, which are permanently unlocked. Lumos offers full warranty and service during these five years.

The SHS can power small appliances like fans, TVs, radios, or laptops. Since 2017, Lumos started to offer DC-AC converter so customers can use their old appliances. The next generation system should be upgradable and allow to power larger appliances.

Operations

Lumos leverages its partnership with MTN throughout the value chain to maintain light and scalable operations. Products are designed in the corporate R&D, manufactured in China, and shipped to Nigeria. MTN handles logistics from Lumos warehouses to outlets (franchised stores) where SHS are promoted and sold.

In new MTN stores, Lumos sends full-time sales agents and trains MTN staff who eventually takes over. A significant proportion of sales are generated via word-of-mouth, encouraged with a customer referral program (seven-days of free electricity for bringing a customer). Lumos also runs above-the-line activities such as radio campaigns, billboards or roadshows.

Lumos call center screens customers' willingness and ability to pay through an interview and a review of MTN payment history. Vetted customers pay a down-payment at the MTN store, where they get their SHS before taking it home. A Lumos-trained technician comes and installs it. Lumos used to offer DIY installation, but has discontinued it to ensure proper fittings and improve its service.

Lumos is responsible for monitoring payments and service. Mobile payments via MTN airtime are instantly communicated to Lumos thanks to an integrated billing system, and SHS are remotely activated with a machine-to-machine platform (SIM card in each system). Lumos also handles service cases via a toll-free customer care line (which is progressively being transferred to MTN). Technical issues that cannot be solved on the phone are escalated to a team of field technicians. SHS are refurbished in a national service center.

Lastly, Lumos has a dedicated retention team who monitors usage and payments, calls customers to avoid late payments, and visits them in last resort. Systems are repossessed after 60 days without payments.

Scale, impact & sustainability

Scale: After a two-digit month-on-month growth in 2016, Lumos has reached over 30,000 SHS in 2017 and targets over 220,000 SHS by 2018.

Impact: Lumos enables its customers to replace kerosene, candles, charging services, and petrol fuel, by cleaner affordable and convenient SHS. According to a customer survey, 81% of users report a decrease in their energy expenditure.

Sustainability: Lumos is on its way to reach country-level sustainability. In 2016, it has raised $90 million, including $50 million debt from OPIC and $40 million equity from Pembani Remgro Infrastructure Fund and other investors. Lumos had previously received grant funding, including from DFID and GSMA.

Sources: Field visit and management interviews, February 2017; Company documents; GSMA, Mobile for Development Utilities, Lumos: Pay-as-you-go solar in Nigeria with MTN, 2016

Exchange Rate: 1 USD = 300 NGN

Contact: Ron Margalit, Principal Impact Financing, ron.margalit@lumos-global.com

www.m-kopa.com

M-KOPA has sold 500,000 PAYG SHS in East Africa since 2011

Organization

M-KOPA ("kopa": Swahili for "borrow"), headquartered in Nairobi, was started in 2011 by Nick Hughes (founder of M-PESA, the largest mobile money scheme globally), Chad Larson and Jesse Moore, to sell affordable SHS on PAYG.

M-KOPA launched its first trial units in Kenya in June 2011, and started commercial sales in June 2012. M-KOPA is the largest distributor of PAYG SHS globally with over 500,000 units sold by April 2017, across Kenya, Tanzania, and Uganda.

Over years, M-KOPA has kept improving its product range to better meet customers' needs and ensure scalability. It initially started by distributing and financing systems built in collaboration with d.light, before moving to a proprietary design, which enabled M-KOPA to take extra control over reliability and service. The following iterations reinforced product security against tampering, and introduced more add-on options.

Building on its success, M-KOPA started licensing its products and software, its first licensee being PEG Africa, which is now one of the largest SHS distributors in West Africa.

M-KOPA has received numerous awards and keeps on a fast growth trajectory – it now looks at expanding to new countries in Africa and Asia.

Value proposition

M-KOPA offers two SHS packages, an entry-level one and a TV kit, and add-on products.

The entry-level SHS includes an 8W solar panel, a battery, four multi-LED light bulbs (three overhead with wall switches, one portable flashlight), a control box, a phone charging port (five connections), and a radio. A built-in GSM sensor monitors real time performance and detects issues with the hardware, and also enforces the payment plan. Current customers pay a $30 down payment (Safaricom customers with a credit score can get a small discount) then the equivalent of $0.50 per day via mobile money, to temporarily unlock their system. After 400 days of payment, the system becomes free for use.

Users may pay for multiple days at once and can hold off on payments for 30 days in case of financial distress. After 120 days of non-payment, the account is written-off and reported to the credit reference bureau. M-KOPA shuts off the devices but does not repossess them. Customers may get back their down payment if they bring back the SHS in good condition.

The major selling point is that customers can save $750 in energy costs over four years of use (average daily spending of $0.50-$0.70 on kerosene and phone charging). All systems come with a two-year warranty.

The premium package, which M-KOPA offers since February 2016, comes with a 16" TV for $80 down payment and $1.25 a day for 365 days. M-KOPA also sells add-on products, such as improved charcoal stoves or mobile phones, on a payment plan for customers who have finished payment on their first device. These energy efficient cook stoves generate significant savings and hence increase ability to repay (over 20,000 units have already been distributed).

Operations

An in-house engineering team in Kenya handles product design. Contracted firms in China do the manufacturing, supported by M-KOPA staff. The company sells its products through a network of about 1,500 commission-based sales agents (mostly full-time) and retail partners.

When a client is interested, the agent conducts background checks, recorded for credit assessment. The registration is completed via M-KOPA call centre, which checks ID and details, and makes sure people understand how the scheme works. Customers install their system themselves, and pay their daily fees

through M-PESA in Kenya, MTN or Airtel in Uganda and Vodacom in Tanzania. M-KOPA processes the data via its proprietary cloud platform, M-KOPAnet.

Beyond registration, the call centre has three other functions: (i) hotline to answer client requests, (ii) "installed base cultivation" to encourage late payers to credit and inquire about payment interruption, and (iii) "post plan cultivation", to encourage acquisition of new items on credit.

Lastly, M-KOPA runs over 100 service centres where customers can receive a new system in case of defects.

Scale, impact & sustainability

Scale: By April 2017, M-KOPA had sold 500,000 systems. It is currently reaching 3,500 new SHS per week. It also intends to increase production to 10,000 units a week, thus aiming at reaching 1 million clients in Africa by 2018.

Impact: M-KOPA estimates that it has generated $300 million in energy savings by January 2017 and offset 260,000 tons of CO_2.

Sustainability: M-KOPA had received over $60 million in payments from customers by November 2016 (starting 2012). It is in a strong growth phase, supported by over $30 million raised in equity and $25 million in committed debt (taking into account November 2015 as the last round). M-KOPA equity investors include Generation Investment Management, Grayghost Ventures, LGT VP, Lundin Foundation. Other partners include Commercial Bank of Africa, BMGF or Shell Foundation.

Sources: interview with Chad Larson, Chief Credit Officer and Co-Founder, www.techcrunch.com; www.ft.com; company website.

Exchange Rate: 1 USD = 104 KES

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www.plugintheworld.com/mobisol/

Since 2010 Mobisol has sold over 65,000 large SHS (80 to 200W) on PAYG in Tanzania, Rwanda and Kenya

Organization

Mobisol is a German company selling solar systems (SHS) to off-grid households and small enterprises in rural Africa. Mobisol was founded in Berlin in 2010, and launched its first pilot in Tanzania and Kenya in 2012. By 2016, it has become the market leader in Africa in large SHS, with over 65,000 SHS sold and about 7MW installed capacity. It has expanded to Rwanda in 2014 and Kenya in 2016.

Early on, Mobisol received support from various donors, including AECF, GSMA and DEG (German Investment and Development Corporation). It is now backed by commercial investors, and recently completed the "biggest round of equity financing for the off-grid solar industry"[1].

Mobisol is on a fast growth trajectory (>80% yoy growth in 2016) and plans to expand to new countries in the coming years. The management is also exploring new growth opportunities, such as franchising, strategic and government partnerships, etc.

Value proposition

Mobisol targets the emerging middle class in African villages, with large and aspirational SHS (between 80W and 200W) bundled with DC appliances. It has conducted customer research to design its value proposition, revealing for instance that TVs can drive adoption, or that households who own a TV would run it over 5 hours per day.

The entry-level (and best-selling) package includes an 80W SHS (panel, battery, controller), four lights, a phone charger, a solar lantern, a radio, and a 19" TV. Customers pay a down payment, then $26 per month over three years. The other packages come with respectively 120W and 200W panels, larger TVs and additional appliances. Customers may also buy the SHS in cash, with an upfront discount.

Customers use mobile money to pay their installments, in incremental payments. The SHS are remotely shut off if customers are late, thanks to a mobile-to-mobile proprietary technology. Mobisol also provides three years of warranty and free service.

Mobisol's engineers keep exploring new use cases and products, in particular appliances such as fridges, water pumps, or machinery. The batteries of the existing SHS are slightly oversized, which would enable the users to add more appliances. Also larger systems are being piloted with small businesses (e.g. in combination with welding machines). Around 30 percent of Mobisol customers are already using their SHS for income generating activities and earn an incremental income of 35 USD on average per month.

Operations

Mobisol's product and software design is done in-house, in the Berlin headquarters. The electronics are manufactured in Germany, while panels, batteries, and appliances are manufactured in China. They are shipped to Africa, where they are assembled.

Sales and marketing activities combine national promotion efforts, local market demonstrations, and door-to-door activities. Mobisol works with a large network of sales agents, paid on commission, trained during two weeks in the field and at the in-house training center ("Mobisol Akademie"). In order to encourage word-of-mouth, Mobisol has set up a customer referral program. Technicians and other field staff also earn a commission when they identify new customers.

Once a customer is interested in Mobisol products, he must go through a credit assessment process before signing up. He then picks up his SHS at one of the Mobisol stores, called "Mobishops", spread all over the country. Customers bring their SHS home, and

1 www.bloomberg.com/news/articles/2016-10-04/investec-buys-stake-in-berlin-based-off-grid-solar-developer

call a certified technician who comes and completes the installation within the next 48 hours. The actual installation takes about one hour.

After this, maintenance and service is provided free of charge during 3 years. Lastly, the customer finance team deals with late payers, calling or visiting them to maintain a low default rate.

Scale, impact & sustainability

Scale: By end 2016, Mobisol has installed over 65.000 SHS in East Africa. The company has over 700 full-time staff on payroll and another 800 commission-based agents and technicians

Impact: Mobisol provides clean energy solutions to over 300,000 people, not only replacing expensive and inefficient alternatives (candles, kerosene, etc.) but also enabling new usages (TV, radio, etc.). It enabled over 20,000 entrepreneurs to generate revenue from phone charging, haircutting, etc.

Sustainability: Mobisol has so far focused on growth. The key drivers will be to maintain a high portfolio quality, while expanding the product range and selling new appliances to customers. In 2016, it completed a large equity round, led by Investec, with IFC and FMO as co-investors and amongst others secured senior loan financing from the Finnish Fund for Industrial Cooperation and Deutsche Bank Global Social Finance Group.

Sources: Management interview in Berlin, December 2016; Site visit in Tanzania, December 2016; Company documents; www.plugintheworld.com/mobisol/

Exchange Rate: 1 USD = 2,000 TZS

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OFF·GRID ELECTRIC

www.offgrid-electric.com

Founded in 2011, Off-Grid Electric has sold over 100,000 PAYG SHS in Tanzania and Rwanda

Organization

Off-Grid Electric (OGE) was started in Tanzania in 2011 by US entrepreneurs Xavier Helgesen, Erica Mackey, and Joshua Pierce. It started manufacturing and distributing SHS in April 2012, with grant funding from USAID DIV and AECF.

OGE quickly became one of the market leaders, as well as top fundraisers, with over $100 million of cumulated funding (grant, debt, equity). This enabled OGE to grow at a fast pace, tripling its customer base between 2014 and 2015.

OGE has also relied on strategic partnerships to expand. For example, in December 2016 it announced the launch of a joint venture with EDF in Ivory Coast, called ZECI, with the aim to electrify 2 million people by 2020.

Lastly, OGE has recently evolved its business model from 'renting' SHS (customers were paying monthly for energy supply, but were never acquiring the systems) to 'selling' them, with 3-year instalment plans on PAYG. This new model is better addressing the demand for ownership while improving cash flow planning.

Value proposition

OGE sells SHS under the Zola brand. The entry-level system, which includes a set of 4 lights, phone charging, a lithium battery and a meter, is sold at $8 per month over 3 years (hence affordable to most low-income segments), plus $15 down-payment. The premium system, coming with 8 lights, a radio, and a 24-inch TV, is sold at $45 down-payment and $17 per month over three years. Customers can also buy SHS in cash, with a 20% discount.

Payments are made via mobile money. While these can be made daily, the majority of customers pays every 1-2 weeks. OGE carefully screens its customers to ensure ability to pay and commitment, but maintains a flexible payment schedule since most rural households have irregular revenues (e.g. smallholder farmers depending on harvest).

Upon payment, OGE sends a passcode to customers by SMS, who enter it in the SHS meter to activate their credit. The SHS automatically shuts off when paid time runs out. Customers receive a reminder 24h before expiration. OGE lastly sets up a 24/7 toll-free service line for aftersales services and offers free repair/replacement in case of damage during 5 years.

OGE vision is to build long-term relationships with its customers, selling them add-on products (e.g. TV, radios, fans) as their needs evolve. OGE SHS hence have a slightly higher capacity, so more appliances can be plugged in.

Operations

OGE has fully integrated operations, from design to distribution and after-sales, with the aim to ensure high quality of service all over the value chain. Appliances are also tested in-house, and can only be used with OGE SHS. It distributes its products directly through hundreds of door-to-door agents, OGE retail outlets across Tanzania and Rwanda, or via partners' retail stores.

OGE systems allow to remotely monitor customer usage and payments. In Tanzania, payments can be made via the platforms of three different mobile operators (Airtel, Vodacom and Tigo). Maintenance is provided via one of the regional service centers across Tanzania. OGE systematic calls its customers, to make sure they are happy, and tracks satisfaction using the Net Promoter Score indicator.

Lastly, OGE has its own academy to train Tanzanian university graduates to become full-time OGE sales agents, call center operators, technicians or administrators.

Scale, impact & sustainability

- **Scale:** By end 2016, OGE has reached over 100,000 households. The company has over 500 staff.
- **Impact:** OGE estimates that the systems sold by March 2015 were offsetting 8.1k tonnes CO_2 per year and enabled customers to save $5-10 per month on kerosene, and that the studying time for children has been multiplied by 2.5.
- **Sustainability:** OGE is still in a fast growth phase. It has raised over $100 million, from donors and investors including USAID, the Packard Foundation, DBL, responsAbility, Helios, DWM, SolarCity, Vulcan Capital, and Zouk Capital, and others.

Sources: Interview with Xavier Helgesen, co-founder and CEO, December 2016 and Graham Smith, Senior Director, November 2015 and; offgrid-electric.com; Ashden case study

Contact person for the project: Xavier Helgesen, xavier@offgrid-electric.com

www.simpanetworks.com

Since 2011, Simpa Networks has sold over 25,000 SHS and appliances on PAYG in India

Organization

Simpa Networks (Simpa) is an Indian company selling solar products on finance with PAYG technology. It started developing and testing a proprietary meter and PAYG financing model in 2011 in Karnataka, in a partnership with SELCO, one of the pioneer organizations in the Indian solar industry.

Simpa has since then developed its own direct distribution channels in North India, and its own range of SHS and appliances (including fans, lights, and satellite TVs). It has become the country leader of PAYG solar, with over 25,000 SHS sold by 2016.

It now plans to accelerate, by (i) densifying its presence in historical areas, with direct distribution and retail (pilots launched in mid-2016); (ii) expanding to new Indian states, and (iii) engaging with partners like MFIs and corporates for B2B sales.

Simpa has secured financing from DFIs, corporate funds, and local banks to support its growth. It has recently signed a deal with the Indian bank RBL, which will provide direct financing to Simpa customers.

Value proposition

Simpa is addressing two market segments: low to middle-income households (90% of sales) and small shop owners (10%). A majority of Simpa customers are connected to the grid though receive less than 12 hours per day of grid electricity. Customers use Simpa products as a reliable backup solution. The company is selling both complete SHS (50% of sales) and modular systems that interconnect with customers' existing UPS or inverter systems.

The best-selling Simpa product is a SHS that comes with 80W of panel, two lights and a fan. The newest product, which comes with lights and a satellite TV system is generating significant early attention. Financing is offered over 12, 24 or 36 months for most products Cash sales accounts for about 10% of sales.

Customers pay their installments to either Simpa technicians or village-level payment points. Simpa's meter displays the number of days remaining before the next payment due date. If customers don't pay on time, their system automatically shuts off. Once they have completed all payments, the system permanently unlocks. All SHS are installed by technicians and come with free service during the lease period. In addition, batteries are warrantied for 2 years, and panels for 10 years.

The rationale for selling modular components is that many customers are already equipped with batteries or appliances. For instance, one popular product with shopkeepers is a 50W panel combined with a fan, for daytime cooling and mosquito control. Simpa's new SmartPanel technology will allow remote monitoring and control of the solar panel itself.

Operations

Simpa currently has 8 branches, set up as profit centers. Each branch counts around 3 managers, 15 sales agents, and 15 technicians, covering a total of 100-150 villages. All branch staff is on payroll, working full-time. In addition, Simpa works with over 500 village-level entrepreneurs (VLEs), called "Urja Mitras", identified among influential villagers to generate leads in their community. About a third of VLEs are also customers themselves. VLEs work for Simpa a few hours a week, and are paid on commission only.

In order to acquire new customers, sales agents run regular below the line marketing activities (e.g. village fair, demonstration vans), involving VLEs. New customers need to go through a digitized credit assessment. After they have paid their down payment, a technician comes to install their SHS within 4-5 days.

Technicians visit each customer at least once a month, to collect cash and ensure that the SHS are working properly. They 'top up' the meter by entering a unique code, that they generate by sending an SMS to Simpa platform. Before 2015, Simpa used to collect payments in physical outlets at market towns, but this proved inconvenient for many customers who needed

to travel over 5km every month. The new model, inspired from Grameen Shakti in Bangladesh, involves technicians in the collections process and has been successful in improving repayment and satisfaction.

As India is moving fast towards digital payments (with government bans of old banknotes and push for a 'cashless economy' since November 2016), Simpa plans on leveraging mobile payments to increase money collection efficiency.

Scale, impact & sustainability

Scale: By December 2016, Simpa had sold over 25,000 systems, creating around 200 full-time jobs, and offering additional income opportunities to over 500 VLEs. It is growing at a fast pace and is targeting rapid month over month growth in 2017.

Impact: Simpa estimates that it has provided 120,000 people with clean energy, and saved over 900 tons of CO_2 emissions since inception.

Sustainability: Simpa has always prioritized profitability and commercial sustainability. Simpa is backed by high-impact global investors investors including the ADB, USAID-DIV, IFC, OPIC, Khosla Impact Fund, Schneider Electric, GDF Suez Rassembleurs d'Energies, and others. With its new partnership with RBL Bank and others, Simpa is financing the majority of its new customer growth through off-balance sheet, third-party financing.

Sources: Management interviews (CFO, COO, VP revenue and operations, VP product management, VP growth and new businesses), December 2016; Site visit in Mathura, December 2016; www.simpanetworks.com, company documents

Exchange Rate: 1 USD = 68 INR

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STIFTUNG SOLARENERGIE
SOLAR ENERGY FOUNDATION

www.solar-energy-foundation.org

Solar Energy Foundation (SEF) provides solar energy products and services to off-grid poor populations in Asia and Africa since 2005. SEF has installed more than 200,000 products

Organization

SEF started its operations in Ethiopia in 2005 and has expanded since to Kenya, the Philippines, and most recently to Cambodia and Uganda. Based in Germany, SEF is a hybrid structure whose main goal is to empower local entrepreneurs to create their own solar company, thus creating an international network of independent local partners (e.g., Solar Technologies Manufacturing in Ethiopia, SunTransfer Kenya, Hybrid Social Solutions Inc. in the Philippines).

The foundation owns SunTransfer Germany, a for-profit company distributing solar products to the local partners, and Sun-Connect, a cooperative that provides them with working capital. The local partners sell products to end-users, mainly through rural solar centers. SEF has installed more than 200,000 products and impacted 2 million people since inception.

Since 2009, SEF has designed an ecosystem of organizations, called the Solar Federation, to address rural development in a holistic way. In addition to SEF and SunTransfer, started in 2004 and 2007, SEF created the cooperative Sun-Connect in 2014 to provide distributors with financing (supplier credit to local partners, also allowing them to offer end-user finance) and Sendea in 2015, to support early stage solar companies through training, mentoring and financial and technical advisory. Sendea's ultimate goal is to push the international network initiated by SEF and accelerate sharing of best practice.

On the operational side, SEF has implemented new technologies and moved from RFID-card based monthly payments to a pay-as-you-go system, including a pay-as-you-go controller settled at the customers' house (SunControl Home) and a software managing the loans and payments of the customers (M-solar), now included in 80% of products sold. SunTransfer Ethiopia met regulatory hurdles in 2012 and had to downsize its solar centre activity: the main distribution channels in Ethiopia today are Total gas stations.

The foundation is now looking for more partners in Africa.

Value proposition

SunTransfer and Sun-Connect distribute different products in each country, as the local partner companies tailor their portfolio independently. Products range from small devices (e.g., 1.5W panels powering a LED lantern and a phone charger) and home appliances to larger fixed solar home systems with a payment charge controller (e.g., 70W panels powering TVs, fridges, stoves) through smaller modular systems (e.g., for radios, fans, tablets).

Distributed products also are solutions for health clinics, schools and solar water pumping. All devices are designed so that batteries can easily be replaced at the end of their life span. In all countries, customers can benefit from trainings on how to use, charge and maintain solar products, installation at home if needed, maintenance for 3 years and financing solutions. Customers can pay monthly instalments in cash at the centre or remotely through mobile banking. In exchange, they get a code to enter in their SunControl Home system to activate the solar home system (if they fail to do so, the system shuts down). While SEF competitors mostly sell products alone and compete on prices, SEF local partner companies differentiate themselves with this range of services offered in addition to products and the proximity of their selling points.

Operations

SEF's strategy to enter a new country is to set up a solar village, i.e., to install solar panels providing basic electricity supply on a subsidized level (based on donations) for all households in a given community, while identifying a local entrepreneur who can provide maintenance at least for the newly installed systems, and at best can set up his own company to expand the initial work of SEF.

This pilot serves as training for the local entrepreneur and his staff and shows proof of concept to potential partners (e.g., NGO's, MFI's). When a local partner then decides to set up his company, SunTransfer Germany can provide some seed capital but always remains a minority investor. SunTransfer is not necessarily their exclusive supplier either, although the 2-year supplier credit offered by Sun-Connect is only available to local partners who source exclusively from SunTransfer.

The local company can then sell directly to consumers through a network of decentralized solar centres like in Kenya (each serving 4 to 5 villages within a radius of 50 to 100km), or through partners' networks like Total gas stations in Ethiopia.

Scale, impact & sustainability

Scale: SEF local partners have 15 solar centers in Kenya and 3 in Cambodia. In the Philippines, SEF local partner is Hybrid Social Solutions, itself selling via partner organizations. In Ethiopia, SEF partner had 14 solar centers but had to downsize and create a new company, STM Ethiopia, which now operates 3 centers. From Germany, SunTransfer has sold 200,000 products since inception.

Impact: SunTransfer solar products replace kerosene lamps in rural areas. Ethiopian activities alone have created 120 local jobs since inception. SunTransfer Kenya created more than 50 jobs.

Sustainability: SunTransfer and Sun-Connect were profitable in 2015 and had revenues of several million dollars overall. Major revenues for SEF come from 2% profit margin made on solar products sold by SunTransfer in Germany. The cooperative Solar-Connect had $1,060,000 (EUR 1 Mio) of assets as of February 2017 and provides dividends of ~3% to its investors (investors are required to purchase a minimum of 10 shares at $227 each).

Sources: Interview with Harald Schützeichel, Founder and Director, March 2016, Previous Hystra reports, Company documents and company website.

Exchange Rate: USD 1 = UGX 3,400

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www.solarnow.eu

Since 2011, SolarNow has sold and financed over 16,000 SHS in rural Uganda

Organization

SolarNow is a Uganda-based enterprise founded in May 2011, selling and financing SHS in rural areas with a strong focus on quality and after-sales services. Buyers benefit from a 2-year credit, along with free maintenance and warranty. This helps earn credibility and mitigate the risks taken by customers buying such products.

In 2014, the company moved from a franchise model to a branch model to improve its control over the quality of its services. All branch staff are now SolarNow employees.

SolarNow responded to client demand by recently enlarging its product range with low-voltage TVs, fridges and water pumps. Customers can now upgrade their basic solar system according to their growing living standards.

The company has sold over 16,000 solar systems (March 2017) since its creation and started operations in Kenya in 2017. The company operates 48 branches with 475 staff and a monthly revenue in excess of $500,000.

Value proposition

The large range of SolarNow products answers all local needs in electricity, from those of small households, to small shops (barber, grocer, restaurant) to large public infrastructures (schools, hospitals).

The best-selling product is adapted for small farm houses, costs $340 and includes a 50W solar panel to power 4 phones, a radio and 6 lights, for a duration of 8 hours.

The company is accelerating in selling productive systems, from 50W to 5kW (system prices up to $20,000). These systems are customized to the needs of professional farmers (irrigation, cooling, harvest drying), schools, hospitals and shops. Clients' payplans are customized to fit their varying seasonal income pattern.

In addition to good quality products, SolarNow's value proposition includes high quality services. Firstly, SolarNow allows its customers to pay their solar products in 24 monthly instalments (average instalment of $30) with an interest rate of 35% (lower than what clients could get at banks, if those accepted to lend them money). Secondly the firm offers 5-year after-sales service through its branches settled all over the country. This package of services is what truly differentiates SolarNow from most of its competitors selling similar solar products but with non-existent or weak credit and after-sales services.

Operations

The production of components (batteries, inverters, lights, TVs, radios, fridges, power stations and PV modules) is outsourced to 8 manufacturers mainly in China. Engineers of each branch put together the products, directly at customers' place, 2 weeks maximum after the purchase.

SolarNow currently has 5 senior managers, 48 branches in charge of selling products and after-sales service and a total of 320 sales agents. Each branch is composed of a branch team leader and 7 client service officers, who are in charge of selling solar products, collecting payments and ensuring after-sales service by visiting the customers by bike or by mini-truck. A well-managed branch team sells 20 systems per month, for average revenues of $16,000.

Regarding after-sales, sales agents follow up by 1) calling back customers right after the installation to check satisfaction, and 2) getting in touch 6 months after the purchase. In addition, an after sales department is reachable at all times in case of any product issues.

Finally the company is implementing new devices that allow to remotely monitor system health, which should prevent service issues and stimulate upgrade selling. SolarNow's revenues come from the sales of its products and the interest rate charged to clients who choose to buy on credit.

Scale, impact & sustainability

Scale: SolarNow has sold over 16,000 systems as of March 2017. The company has branches covering all of Uganda and one branch in Kenya.

Impact: 49% of SolarNow clients are from the BoP. A solar system of 50W allows households to save about $15 per month, thanks to savings made on kerosene, diesel and other fuels. More, solar energy enables farmers to increase the productivity of their land, shop owners to operate in the evening and generate additional revenues.

Sustainability: The company makes a margin of 35% on its products plus interest income. Break even is expected by mid-2017 in Uganda. Revenues in 2016 amounted to $4 million and the company expects $10 million in 2017. Additional fund raising is planned for 2017 to fuel the growth in Uganda and the international expansion.

Sources: Interview with Willem Nolens, Founder and CEO, Company documents, Company website: http://www.solarnow.eu/, http://acumen.org/investment/solarnow/

Exchange Rate: USD 1 = UGX 3,400

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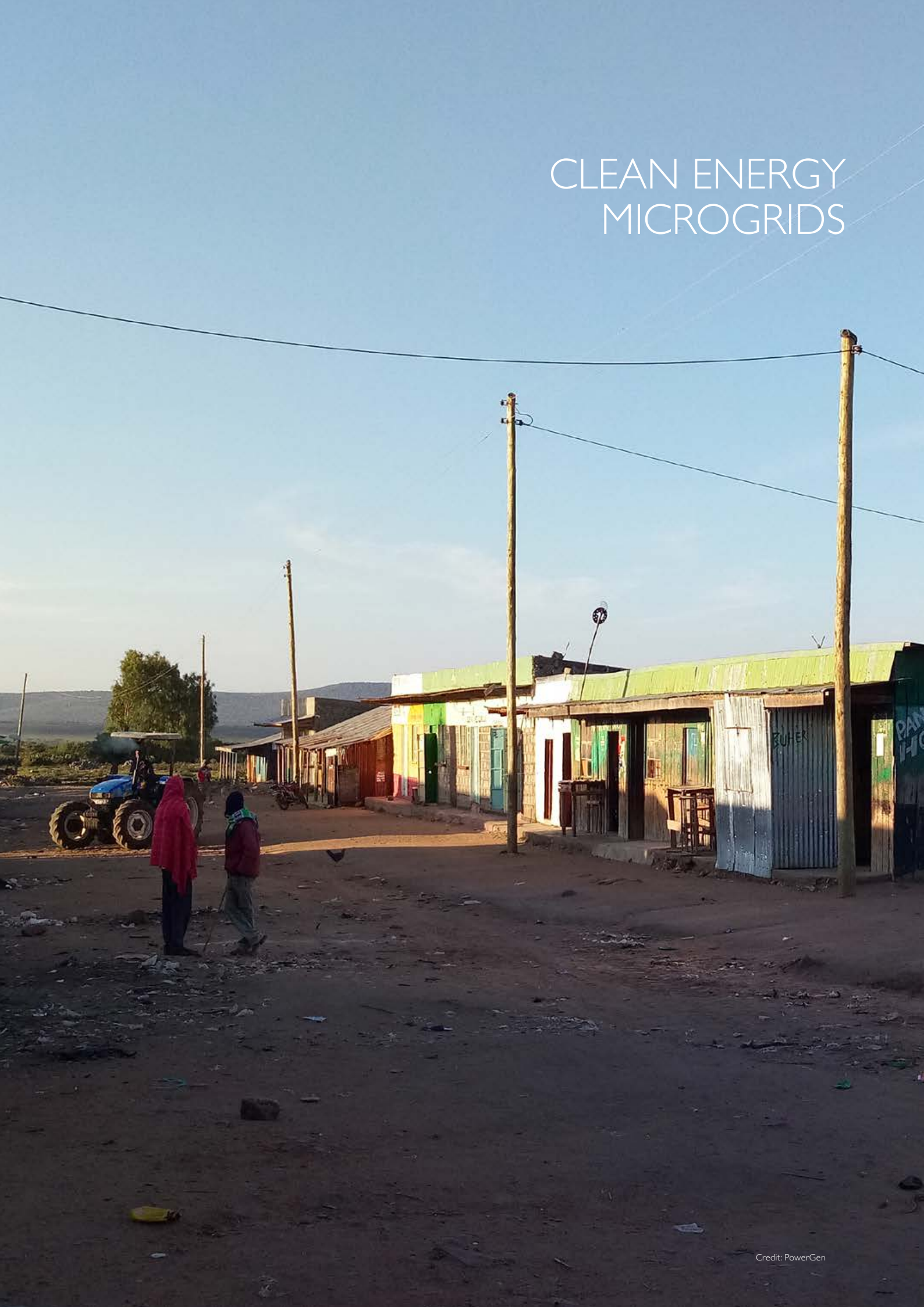
CLEAN ENERGY MICROGRIDS



Credit: PowerGen

www.devergy.com

Started in 2010, Devergy builds and operates modular microgrids for 120,000 households in rural Tanzania

Organization

Devergy is an energy company based in Dar Es Salaam, which builds and operates microgrids in remote villages that are not connected to the grid. It was founded by three engineers, Fabio De Pascale, Gianluca Cescon and Daniel Ponz, who started developing a grid technology in Europe in 2010.

They launched operations in Tanzania in 2012, with a successful pilot. Devergy has since then expanded to about 20 villages in the Pwani, Morogoro, Mbeya and Sumbwanga regions, and counts 120,000 connections by December 2016. Devergy has secured equity funding and grant commitments from leading investors and institutions to support its growth.

Value proposition Devergy targets low-income off-grid households and small businesses. Customers pay a connection fee of $20 for the cable, meter, light bulbs and phone charger installation. Devergy had tried to provide credit for the connection fee in order to increase affordability, but customers were less committed and more likely to become inactive, so this has been discontinued.

The company offers a range of six prepaid payment plans. The basic plan provides five hours of lighting and two phone charges per day, and can be purchased daily ($0.30), weekly ($1.75) or monthly ($6). Power is automatically shut off either at the end of the period (day, week, or month), or when all prepaid energy has been used. Customers can monitor their remaining credit via SMS, and top up via mobile payment or via local agents and shops in the village (who pay via mobile money, using customers' references).

Customers are then free to upgrade to premium plans, adding more power and appliances (e.g. TVs, radio, fans), which they can purchase directly from Devergy or from another retailer.

Devergy is currently working on a larger set of appliances (e.g. a fridge is currently being tested) and productive equipment (e.g. agro tools will be piloted with Energy4Impact in Q1-Q2 2017 with support from the Mott Foundation), which would have the potential to increase both consumption and social impact.

Operations

Devergy selects off-grid villages of 50 homes minimum, ideally surrounded by other villages when it could expand in the future. Before entering a village, it checks that it is not going to be connected to the grid soon and that there is mobile connectivity, which is needed for mobile payments.

The sales team enters a village by talking to its leaders first, engaging them to approach the rest of the village and present their service offer. When enough villagers agree (typically 5-10 families initially), they pay a connection fee and Devergy technicians install the first micro-grid within two weeks. Devergy has also set up a customer care line, which systematically calls every customer starting already before connecting them and following up later on any issue, either reported by the customer or automatically detected by the Devergy back-end software.

The grid consists of shared power generating towers (80W each, with panels and batteries) and smart meters installed at each customer's house. The networks vary widely in size and capacity. Towers and meters are all interconnected and connected to Devergy's monitoring system.

Devergy remotely monitors power faults, and provides maintenance with a team of technicians, paid by the day. It can easily upgrade the capacity of a microgrid when a tower maxes out, by installing another tower, hence keeping investment costs flexible.

Scale, impact & sustainability

Scale: Devergy has connected 1,200 households by December 2016. The company could rapidly connect more households, but is currently putting more efforts towards improving its financial sustainability with its current customer base

Impact: While Devergy does not formally measure social and environmental impact, it provides energy services to remote areas which are hardly reached by other off-grid energy providers. A survey by Acumen showed that 78% of their customers earn less than $2.50 per capita per day

Sustainability: Devergy is not yet financially sustainable but targets that, at scale, each network infrastructure could be paid back in 3-5 years. It is in particular working on increasing the average revenue per customer (e.g. productive appliances), streamlining operations (e.g. maintenance supported by a call center), and reducing connection costs. In August 2015, it completed a series A equity financing round led by Acumen Fund, together with HERi Africa, Impact Assets Emerging Markets, Persistent Energy Capital, and OPES Fund. DFID committed grant funding via AECF, GSMA and EEP.

Sources: site visit in December 2016; interviews with Fabio De Pascale (CEO), Gianluca Cescon (COO), and management; www.devergy.com; company documents

Exchange Rate: 1 USD = 2000 TZS

Contact: Public Relations, media@devergy.com

HUSK
Powering Possibilitie

www.huskpowersystems.com

Husk operates 75 solar and biomass AC minigrids and 450 solar DC microgrids, in India and East Africa, since 2008

Organization

Husk started to operate minigrids in Bihar in 2008, with the vision to sustainably provide clean and affordable energy to rural households and businesses around the world.

It initially developed a biomass gasification technology using rice husk to power 200-300 households with AC power. Between 2008 and 2011, Husk scaled to 70 minigrids in India, and expanded to Tanzania and Uganda. In 2011, the company started to explore the potential of solar energy, by building DC microgrids, with a capacity of 250W and the ability to power 6-8 households each. Since then, it has built 450 of micro-networks in India.

Since 2014, Husk has developed a new hybrid technology, combining solar and biomass, which can generate 24/7 power for households and businesses. This technology, along with continuous improvements in the operational model, can reach commercial viability. Husk aims to build 50 new hybrid plants by 2018, while progressively retrofitting its older plants.

Husk also experienced different ownership models to expand its network. Today, it has both fully-owned plants (which it builds, operates and maintains) and franchised plants (which are owned and operated by partner organizations). Husk has tested and discontinued a third model, where plants were operated by local entrepreneurs, and progressively transferred to them. The management of entrepreneurs was creating too much additional complexities.

Value proposition

The uniqueness in Husk value proposition is to provide 24/7 power with high reliability. It has developed tiered tariff plans for families and businesses, ranging from small shops to community infrastructures (e.g. hospitals), agribusinesses (e.g. mills), or small industrial setups (e.g. reverse osmosis plants).

Customers pay a small connection fee. The basic energy plan for families start at $2.50 per month for 35W load (2 lights and phone charging, replacing a $3-4 kerosene expense). Large businesses can require >1kW. The tariffs per unit decrease for larger clients, who generate >30% savings on alternatives (e.g. diesel generators).

All plans are prepaid on a monthly basis, and capped in voltage and supply. The meters automatically shut off when all prepaid energy has been used. Customers pay in cash to Husk local staff, at their doorstep or at the plant. Husk is now exploring mobile payments, both in Tanzania (well established) and in India (developing quickly).

Customers are responsible for cabling and installation inside their home/businesses. They also purchase appliances on their own. Since mid-2016 Husk is exploring the distribution of appliances (e.g. TVs, fans) on credit, with support of the Rockefeller Foundation, to help customers move up the ladder while increasing the minigrid revenues.

Operations

Husk has corporate offices in Patna (India), Dar es Salaam (Tanzania), and in the US. Field operations are organized in clusters of 5-8 plants, located in a 20-25km radius. Husk also has a warehouse and maintenance center in Bihar.

The company selects areas among high density with no or poor grid service (most Husk Indian villages have poor grid, while most East African villages are not connected at all). After agreeing with village officials on a land for the plant, Husk sends 5-6 technicians to build the full infrastructure, which takes 4-6 weeks on average.

The new hybrid minigrids include a biomass plant (32kW, mostly used in the evening time), 200 solar

panels (20kW, for the daytime), and batteries (for the nighttime), allowing strong efficiency gains. Wires are expended within 2-3km around the plant, to connect 250-300 customers. Each customer has a smart (Spark) meter, located on the nearest pole, which can be monitored remotely. In order to avoid thefts, Husk increases the voltage from 220V to 300V along the grid, and scales it down at customer level.

A central sales team works with local staff to engage customers. In new areas, the first 30-50 customers typically join within the first month, and it takes another 3-4 months to convince 150-200 additional customers. The sales team then keeps interacting with customers to promote new appliances.

Each minigrid employs 4-5 full-time staff, including one site engineer, in charge of overall operations and customer service, one operator and one husk loader who operate the biomass plant, one electrician who maintains the grid and collects money, and one guard who stays at the plant.

On the side of its minigrid business, Husk employs local women to manufacture incense sticks from rice husk char (the waste from biomass plants).

Scale, impact & sustainability

Scale: Husk has installed 75 solar and biomass minigrids and 450 solar DC microgrids, serving a total 15,200 customers across India and Africa. About 40% of customers are businesses or villagers with productive uses. Husk plans to expand to 225,000 households by 2021, mainly through hybrid minigrids.

Impact: Husk enables low-income households to save on kerosene expenses while reducing indoor air pollution, and replaces diesel generators for businesses. It estimates that it has saved 95,000 tons of CO_2 and $500,000 in kerosene and diesel expenses. It also enables villagers to extend their productive activities, with reliable high voltage power.

Sustainability: After testing different business models, Husk is prioritizing hybrid solar and biomass plants. With monthly revenue that are heading towards $2,000, the plants are expected to payback in 5-7 years. The promotion of productive uses and home appliances will be a key driver of sustainability. Husk received funds from numerous investors, in grant, debt and equity, including the Shell Foundation, Acumen, Bamboo Finance.

Sources: Interview with Manoj Sinha, co-founder and CEO, August 2015, Company documents and company website.

Contact: Manoj Sinha, co-founder, sinha@huskpowersystems.com

www.meragaopower.com

Since 2010, Mera Gao Power has developed a low-cost and modular DC microgrid model for basic needs (lighting, charging), targeting small rural villages (20-40 households) and enabling a payback of capex in 3 years only. It has quickly expanded to 20,000 connected households in India.

Organization

Co-founded in 2010 by American and Indian entrepreneurs, Mera Gao Power ("MGP") launched its first grid in 2011. The company now manages 122 people in 10 districts in Uttar Pradesh.

MGP developed its own DC grid and smart meter technology, as well as a number of smartphone apps for data and payment collection.

As they learned from operations, they constantly improved their systems in all dimensions:

- Over dimension battery packs for longer life (current packs are scheduled to hold for ten years),
- Move to steel casings and entrust battery unit to one household to prevent tampering and improve security,
- Increase distribution voltage to 24V to increase reachable distance and enable brighter lights and increase generation voltage to 48V to improve MPPT charge controller performance during adverse weather,
- Enable one month subscription default and reconnection for a reduced fee (60c).

They are now improving their technical monitoring systems, introducing GSM-equipped system monitoring devices in battery cabinets to better assess system performance (as a complement to the current subscriber survey system), as well as meters ($10 target cost) for remote control as well as to more precisely evaluate household consumption and enable bonus "top ups" for selected households (referrers, under consumers).

As they reached their intermediary 20,000 customer households target (from 25 in end 2011), MGP is in the process of raising a second round of $2.5 million to resume their growth. This is already being put in place and the targeted customer recruitment rate is 2,000 new customers per month by September 2017.

Value Proposition

MGP builds and operates solar DC micro-grids in Uttar Pradesh, India. The technology was developed in-house, allowing MGP to set up small grids (with as few as 10 initial households) in remote villages (50 households or less).

Officially, 260 million people in India live on less than Rs. 32 per day. More than 30% of the rural population of Uttar Pradesh falls below the poverty line (BPL) of Rs. 27 per day as defined in 2011, with a greater proportion of this BPL population in hamlets. According to the Arjun Sengupta Committee Report on Unorganized Sector Workers, about 77% of people in the country subsist on under Rs. 20 per day. According to MGP's surveys, the typical household income in hamlets, as reported by customers to MGP, is between Rs. 16 and Rs. 30 per person per day depending on the season. The numbers may vary, but regardless of the data source, the conclusion is clear - providing services at very low price points is critical for capturing a high percentage of the off-grid market.

Customers primarily use kerosene. In North India, experience shows that households consume a minimum of three liters of kerosene per month to produce three hours of low quality nighttime lighting. Subsidized kerosene, of which below the poverty line households may receive up to two liters per month, sells for Rs. 18 per liter while open-market kerosene prices vary between Rs. 40-90 per liter. In addition, mobile phone charging is a primary energy need for which households pay a minimum of Rs. 60 per month and often more. MGP provides two high-luminosity light points and a mobile phone charger operating seven hours per night for Rs. 120 per month. By providing a superior product at a comparable, if not

lower, cost, MGP does not believe competition or insufficient demand to be significant risks.

	MGP	Kerosene / local phone charging
Monthly price	Rs. 120	Rs. 80+ for kerosene Rs. 60+ for phone charging Travel costs to purchase both
Hours per night of light	7	3
Light point	2	1
Lumens per light	75	1 to 6 lumens

It offers 7 hours per day of lighting per household with 2 LED lights and phone charging for $0.45 a week (can be upgraded to 4 LED lights on demand). The 7 hours are usually split 5 hours in the evening and 2 hours before sunrise.

Customers pay an initial connection fee of $1.50. MGP trains its Collection Officers in-house (90% are local unskilled people from MGP's customer base) to collect weekly payments from customers organized in joint liability groups.

Customers are informed of their credit balance via SMS.

MGP provides 24/7 customer support from its branch offices that serve as after sales service points, communicating with customers, allowing repairs, full warranty of service, within 48 hours max (usually next day). Repair Officers, on motorbikes are selected within the communities and trained in-house. Beyond generation maintenance, MGP replaces lights gone out, and grid damage, in what amounts to a fully comprehensive, just switch on, service.

MGP progressively increases the size of its system as more and more villagers join in. Half system is for 10 to 15 customers and includes one 120W panels and two 40 Ah, a ¾ system sees a second panel for 16 to 22 customers, a full system new 75 Ah batteries for 23 or more customers. A full system (240W) costs less than $1,000 (all included) and pays back in approximately 3 years.

Operations

Mera Gao took inspiration from the MFI practices to build an operations-driven, risk and costs minimizing approach.

Potential villages are first visited for awareness, with showcase from sales and flyers left behind. A community meeting is then organised to assess potentially interested parties and explain that a minimum of 10 customers is required to start a micro grid.

Potential customers are then invited to a Compulsory Group Training where Sales Officers explain the terms and conditions and the collective commitment. They are also surveyed for eligibility.

Confirmed parties are then invited to a Group Recognition Training ("GRT"), where members or the group can discuss the commitment with others and the Branch Manager, who is in a position to re assess eligibility of the members of the Group. Detailed rules (e.g. max availability of power, breakers on tampering or overcharge, eligibility) and services (hotline, technician availabilities) governing the contracts are detailed before sign up.

Confirmed parties then pay their connection fee prior to installation (within two weeks after GRT), where the weekly collection schedule is put in place.

Collection officers are equipped with tablets through which they directly update the credit status of each customer.

Growth strategy is to replicate branches serving clusters of 150+ villages and up to 30,000 customers. Villages are attributed by groups of 30 to 40 to collections officers on motorbikes who cover a radius of 10-15 km. Collections are brought back to the branch office every night and deposited by the branch manager the next morning at the bank. Repair Officers are organized similarly, with around 40 villages per technician, with additional requirement on mobility if one specific areas requires intensive support. Customer care (hotline) is located at the branch.

Hubs, covering 3 or 4 branches are focused on delinquencies and business development (target villages, new branches)

Hubs are regrouped in three areas who define the coverage strategy and manage operations. Headquarters in Lucknow is essentially responsible for infrastructure (sales support tools, IT, product development) and finance.

All employees are on fixed salary + Provident fund + health insurance. This is way above local conditions resulting to very low employee turnover. MGP are introducing variable compensation at branch manager level.

Scale, impact & sustainability

Scale: In this build up model, Mera Gao Power serves over 20,000 customer households and 120,000 people in 1,500 villages in 10 districts in Uttar Pradesh. It is one of the largest players in the mini grid sector. MGP aims to pass the 35,000 customer mark by the end of 2017 and profitability by mid 2018.

Social Impact: MGP is replacing kerosene in the villages it equips, giving access to electricity, freeing resources dedicated to the purchase of combustible (although some areas are using the kerosene for cooking purposes). Households save $0.45-0.55 per month on kerosene and phone charging (kerosene costs $1.50 per month and phone charging another $1 per month, while MGP charges $2 per month).

Sustainability: MGP is built from the onset on a no subsidy basis. Villages so far have been extremely faithful, and competition is not addressing these small communities. EBITDA breakeven is at 35,000 households and profitability at 50,000 households. MGP can aims to finance growth through profit by 2019.

Sources: Interview with Brian Shaad, co-founder, March 2016; Interview with Sandeep Pandey and field visit in February 2017

Contact: Nikhil Jaisinghani

Exchange Rate: 1 USD 1 = INR 67

www.omcpower.com

OMC Power builds, owns, operates, and maintains 70 solar minigrids in rural India, using telecom towers as anchor loads

Organization

OMC Power (OMC) was founded in 2011 by three executives from the telecom industry who realized that most of the 450,000 telecom towers in India had poor (if any) grid connection and were using expensive diesel generators. OMC wanted to provide them with cleaner, more efficient energy, and use excess power to serve the rural communities around.

OMC set up its first solar power plant in Hardoi (Uttar Pradesh) in 2012. Between 2012 and 2014, it scaled up to 20 plants, serving 35 telecom towers. At this time, OMC powered the communities around the plant by renting them lanterns and batteries, charged daily at the plant and delivered at households' doorstep. While they reached almost 10,000 households with this model, it wasn't able to serve larger productive loads or meet household's aspirations for round-the clock power supply beyond basic appliances.

Instead, since 2015, OMC has been extending minigrids around solar plants, to power both domestic and business customers. It has now become one of the largest minigrid operators in India, with 70 operational plants and 8,000 active connections.

OMC has partnered with most of the major Indian telecom infrastructure companies, which own 130-150,000 towers across the country. It plans to expand to 250 plants by 2018, with loans from leading Indian banks, DFIs, and foundations.

Value proposition

OMC serves three categories of clients, under an ABC model (Anchor, Business, Community), and has designed competitive value propositions for each category.

Telecom tower companies pay a tariff per unit about 20% lower than what they used to pay with diesel. A majority of towers are also connected to the government grid, which is still highly unreliable (6-12 hours of supply per day). OMC guarantees a 24/7 power service.

OMC has extended AC grids within a 1-3 km radius around the plant, connecting businesses and communities and providing them with a range of energy plans. For households and small shops, OMC offers prepaid packages, starting at $2 per month for a 7W LED light and mobile phone charging (six hours per day). Customers can upgrade according to their needs (e.g. an additional light bulb costs an additional $0.75 per month). The connection fees are minimal (less than $1). So far customers have paid in cash to an OMC sales agent, who visits them once or twice per month, but are increasingly switching to mobile payments, which is finally taking off in India where regulations have been lagging behind East Africa.

Larger businesses (e.g. petrol stations, hospitals, schools, agribusinesses, etc.) and households who want 24/7 power (e.g. for TVs, fridges) can get post-paid plans. The connection costs are higher, as OMC installs individual meters (above $10 depending on loads). These customers pay on a bi-monthly basis.

Lastly, OMC is exploring the sales of appliances, and interventions to promote productive loads. It is currently running a series of pilots with support from the Rockefeller foundation, including television sets with satellite dishes, cold storage facilities for agricultural produce, e-rickshaw charging, agricultural pumps and garment manufacturing units.

Operations

The company is organized geographically, with five area business heads each overseeing about three cluster business heads, who in turn oversee about five plants each. All are in charge of all functions, supported by specialized teams who operate across the fleet. Each plant counts 2-3 employees: one sales

agent, responsible for customer acquisition and money collection; one technician, who mostly stays at the plant for basic maintenance; and one lineman. Since 2015, OMC is reducing its staff per plant, and linemen functions have been transferred to technicians and area staff.

In order to select plant locations, OMC does pre-screening of telecom tower areas via satellite mapping, and runs detailed field surveys in shortlisted villages. The village selection is followed by 2-3 months of negotiations with the local committee (e.g. to agree on the land where to build the plant), during which OMC starts engaging communities.

The marketing efforts, which include village events and door-to-door, allow OMC to identify the highest potential areas where to build the first kilometer of line. OMC would typically connect 20-30 customers in the first month, and an additional 40-50 customers 2-3 months later.

According to OMC staff, there is a strong demand for new connections which the company has not been tapping into yet, to avoid maxing out its capacity of its solar plants. Indeed, this would mean using back-up diesel generators which are very costly. OMC has been dealing with this issue by increasing the capacity of its solar plants (from 27kW in 2014 to 40kW and above in 2016), and by capping the loads of metered plans, hence improving their predictability.

Scale, impact & sustainability

Scale: By end 2016, OMC has built 70 plants in Uttar Pradesh, with a total capacity of about 2.5MW, and over 100km of grid. It serves approximately 6,000 households and 2,000 businesses.

Impact: OMC provides sources of energy to over 30,000 people. The energy pricing matches kerosene expenses, but provide brighter and cleaner solutions. OMC is also saving CO_2 by replacing diesel generators of telecom towers with solar solutions. OMC's impacts are being evaluated by third party experts through random sampling.

Sustainability: Today, OMC generates over 70% of its revenue through anchor clients. While the latter bring immediate and reliable cash flow, the margins are relatively low. The minigrid expansion, and in particular business customers, will hence be a key driver of profitability. OMC has raised debt from Rockefeller Foundation, the Indian bank RBL, and DFIs. It also leveraged loan guarantees from USAID. Some of OMC plants lastly benefit from ex-post solar minigrid subsidies from the central government.

Sources: site visit in January 2016; interviews with Sarraju Narasinga Rao, Chief Technology and Information Officer, Andreas Dahl-Jørgensen, Head of Corporate Finance; company documents and company website.

Exchange Rate: 1 USD = 68 INR

Contact: Sarraju Narasinga Rao, sarraju.n.rao@omcpower.com

PowerGen RENEWABLE ENERGY

www.powergen-renewable-energy.com

PowerGen is the largest owner-operator of microgrids in East Africa, with over 40 sites

Organization

PowerGen was founded in Kenya in 2011 by Sam Slaughter (current CEO), Alastair Smith (current Sr Director of Installations), and Mark Wopicho (current Sr Director of Engineering). The company was initially started as an engineering and installation business, for kW-scale off-grid solar and wind power systems. Over the course of 5 years, PowerGen has installed hundreds of renewable energy systems across 7 countries in Africa, and built a team of more than 60 full-time professionals.

But PowerGen also realised that many off-grid people wouldn't benefit from its energy systems without innovative financing solutions. The company decided to extend its activities to microgrids, and built the first operational site in 2013 in Zambia. PowerGen microgrids involve smart metering, pay-as-you-go, distributed storage, and interconnections. It is now working on a new "grid extension" model, to build smart, grid-connected microgrids in unserved near-grid areas.

Since 2011, the company has built power systems across Zambia, Uganda, Rwanda, Mozambique, and Somaliland, and the current micro-grid developments are focused on Tanzania and Kenya. In Kenya, PowerGen has applied for a license to become a Small Power Distributor (SPD), which provides off-take and feed-in agreements with the main operator.

Following a successful Series A equity round of $4.5 million in 2016, PowerGen will continue to scale its activities with the view to reach a critical size for commercial sustainability.

Value proposition

PowerGen see themselves as a distributed utility, which undertakes all activities related to the development, construction, and operation of microgrids. It is hence helping communities benefit from grid standard AC power, which can support most domestic and commercial appliances.

They develop fully financed projects on a build, own, and operate model. This approach enables them to select their clients, focusing on small businesses and households, with addition of an anchor client when the opportunity arises.

The connection fee, which is at most 40,000 TZS or 2,000 KES (around $20) and is significantly lower than the connection fees of grid operators in Kenya ($350) or Tanzania (starting at $100). The initial installation includes basic in-home wiring, lights, switches, and power outlets. Customers can add any widely available AC appliance.

PowerGen offers fully prepaid model to its clients, paid via mobile money. The entry-level tariffs mimic telco companies' structure for data bundles. Larger payments lead to lower effective unit rates. In Tanzania, PowerGen uses "time of use" tariffs, but is regularly examining new structures that maximize value for the customer.

Operations

PowerGen has its management, development, O&M, and customer service teams located in both Kenya and Tanzania. This gives PowerGen flexibility and verticality that other players may not have. Its operations are organized in two parts: 'grid execution', responsible for everything up to installation, and 'grid operations', in charge of O&M and demand activation.

The development team is responsible for site acquisition, i.e. assessing customer potential and technical feasibility, and obtaining all permits at the local and national levels. Its strategy relies on the identification of clusters of grids per area. It conducts surveys 6 months prior to installation, to identify potential customers. Approximately 50% of those surveyed eventually apply for a connection. Sites are typically between 50-200 connections.

Once the sites are identified, an engineering team designs the reticulation. An in-house installation team builds the solar generation plant and the grid within a 500m radius (which PowerGen is now looking to extend further, thanks to innovative meters). All systems are designed and manufactured in Kenya, using components from leading international suppliers.

For O&M, all microgrid parameters (inverters, controllers, meters) are remotely controlled. This enables PowerGen to limit local involvement and prevent theft or fraud. Lastly, demand activation has been reinforced recently with a new team dedicated to customer engagement.

Scale, impact & sustainability

Scale: With more than 15 of its own and operated sites in East Africa and 30+ built for partners, PowerGen has equipped approximately 2,000 households and businesses (i.e. around 10,000 people and ultimate beneficiaries).

Impact: Grid installation reduces kerosene and diesel consumptions for households and businesses. They deliver maintenance-free, reliable power, which can support productivity improving appliances.

Sustainability: PowerGen did ~ $1 million in revenues, and it plans for the recent $4.5 million equity round, led by DOB equity and AHL Venture Partners to accelerate and help attain critical size. While financing has been mostly on equity so far, it is currently exploring special purpose vehicles, which would require "bundles of 20-50 projects and at least $5 million".

Sources: Interviews with management (Aaron Cheng, Penelope Smith, Eve Meyer, Ben Cornell), website, reports, site visit

Contact: Johannes Holst, Director of Business Development

www.powerhive.com

Powerhive builds and operates minigrids in East Africa since 2011, and plans to leverage smart techno and infrastructure for rapid scale up

Organization

Powerhive, headquartered in Berkeley with regional offices in Nairobi, was founded in 2011 by a team of industry experts from the renewable energy, utility and telecom sectors.

The company has developed a proprietary AC minigrid hardware and software technology, and was the second company in the history of Kenya to obtain a license to distribute electricity. It has been piloting its technology, marketing and operation approach in four sites Kenya with 400 connections and 80kW total capacity, between 2013 and 2015.

In 2015, Powerhive announced the launch of a large project, "Cloverfield", to build and operate smart minigrids in 100 villages in Kenya – servicing 90,000 people, small businesses, schools and healthcare facilities. Powerhive started to roll out this project and counts around 4,000 customers by January 2017.

Powerhive is both a B2C operator that builds, operates and maintains minigrid sites, and a B2B service provider to utilities or developers. Its growth strategy is based on a highly scalable technology. Powerhive lastly started piloting operations in India in June 2015.

Value proposition

Powerhive minigrids target both residential and commercial customers. The sites, which range between 10 and 50kW in generation capacity, can power a range of equipment from home appliances (e.g. lamps, TVs) to productive uses (e.g. hatcheries, mills, or hairs salons). Residential customers pay a connection fee of about 25-30 USD to get connected. The connection comes with a ready board and a few lights. Then, they prepay for electricity. The tariffs include both a fix and a variable part, starting at a few dollars per month.

While a majority of customers would start with only lighting and phone charging, Powerhive helps them move up the energy ladder with business activation programs. The pilots in Kenya has focused on understanding consumer behaviors, motivations for sign up, and strategies for increasing energy usage. In the future, Powerhive plans on leveraging customer data for credit scoring and sales of appliances on credit.

As a B2B service provider, Powerhive provides technology (smart meters, performance monitoring platform, etc.) and technical assistance services (e.g. feasibility study, site identification, procurement management, customer acquisition support, etc.).

Operations

Powerhive's technology has been designed to make minigrid monitoring as automatized and scalable as possible: it relies both on smart "Asali" meters and the "Honeycomb" platform. Powerhive has also designed a software to remotely analyze sites based on financial, technical, and geospatial data. This is completed with on-site feasibility studies.

Powerhive generation relies mainly on solar but may also be equipped with back up diesel generators to ensure full reliability, in particular for larger business uses and anchor clients. Distribution lines are extended within 1-2km radius around generation.

The Asali meters, installed at each customer, remotely communicate customer data to the Honeycomb platform, hence allowing remote monitoring of activation, changes in parameters, load balancing, performance measurement, etc. For instance, customers top up their accounts using mobile money and power is immediately activated. Powerhive sends sms alerts when balance gets close to zero, and electricity deactivates if no credit is added.

In the future, Powerhive plans to partner with community-based organizations for market activation programs. It is also envisioning different ownership models for minigrids, including community ownership.

Scale, impact & sustainability

Scale: After pilots in four sites between 2012 and 2014, Powerhive started to roll out a large-scale project targeting 100 villages and 90,000 people – it counts around 4,000 customers by January 2017

Impact: For residential customers, Powerhive is replacing polluting and low-quality energy sources like kerosene with clean power on tap, at competitive prices. Business customers can access new appliances and machinery hence increasing their revenue substantially

Sustainability: Powerhive targets a payback of 5-7 years with average revenue per user of $10 per month and costs of $500-600 per connection. Powerhive has raised over $30 million in 2015 (Prelude Ventures and Enel Green Power), to support its expansion in Africa and Asia. In February 2016, Total acquired 15% of the company.

Sources: Interview with Rik Wuts, Co-founder & VP Business Development and Chris Hornor, CEO and founder, company documents and company website.

Contact: Chris Hornor, chris@powerhive.com

www.rafikipower.com

Since 2013, Rafiki Power, an initiative of E.ON, operates AC minigrids in Tanzania around solar-powered kiosks

Organization

Rafiki Power (Rafiki), or 'friendly power' in Swahili, was started in 2013 as a start-up incubated by E.ON SE, a large German energy company, to set up and operate hybrid energy AC mini-grids in villages of Tanzania and potentially in other countries. After one year of market assessment and business model development, Rafiki started a pilot in December 2014 with a 7.5kW grid (~30kWh/day) in Komolo, an off-grid village of 1,500 people. The company scaled up to 8 sites as of early 2017, and has another thirty sites under development and plans various grid-extensions at existing sites.

Rafiki serves remote villages with min. 200 potential connections, by installing Solar PV & Battery mini-grid networks and offering value added services such as product sales and financing. The most recent sites have a larger capacity and can better capture latent demand from households, who are progressively getting equipped with appliances (consumer goods, productive-use) by Rafiki.

Future plans for Rafiki include replicating internationally and expanding services in order to become a global energy & access platform.

Value proposition

Rafiki installs mini-grids in villages of >1,500 inhabitants to serve at least 150-300 households, typically smallholder farmers earning around $100 per month and spending 10% of their budget on energy. At the moment, customers pay between $1-2 per kWh on average, although Rafiki is still trying different tariffs and service bundles (e.g. premium for night & day tariffs). When subscribing, households have to top up their account with a credit of ~$10 and are then equipped with a smart meter POU Box including a light bulb and various plugs. Using Rafiki Powers digital services they can monitor their consumption, remaining balance and contact customer service at any time. Rafiki sends a technician on site in case of malfunction.

Since Rafiki offers 230V AC power 24/7, households are able to plug in all regular available appliances. The company also started to sell and finance efficient home appliances to households (e.g. light bulbs, refrigerators, TVs, radios, washing machines) via PAYG financing plans of 1 to 6 months. Furthermore Rafiki is now offering small-scale productive-use appliances (e.g. oil presses, grinders/mills or drillers) to small businesses (e.g. carpentry stores, repair workshops or hair saloons) to develop local economic activity and increase load. In the future, this retail business should be taken over by a partner NGO or local retail organisation. Rafiki actively encourages development partners as for example Energy for Impact to come to their villages as NGOs profit from availability of Data, Power and Financing and Rafiki from increased growth in the region.

Lastly, the solar panels are located on the roof of a kiosk (made from a recycled container) which, in addition to storing batteries, serves as a small retail stores or business location (e.g. hair salon, restaurant) run by a local villager.

Operations

Rafiki is headquartered in Düsseldorf, Germany with a local office in Arusha, Tanzania. When developing a new site, Rafiki first runs a sophisticated GIS analysis based on satellite data. Afterwards, a site surveying team is send out to the short-listed villages to inspect local conditions, take drone footages and meet with village leaders to explain the service offering. Upon approval, Rafiki sales agents organize events to pitch the project to villagers and engage early adopters, collecting all relevant information (e.g. age, income, GPS location) and payment commitments. Technicians design an optimized grid layout via the collected data (e.g. number of households, distance between houses, economic activity).

Rafiki procures globally and assembles panels, batteries, and all other power and communication electronics in Tanzania, and packs it in a 20ft

recycled container for transportation and build up. The container is installed in the middle of the village. Installation takes 2-4 days and is done by local contractors, who (i) set solar panels on a frame above the container, (ii) connect them to the battery storage system inside, (iii) deploy turrets along the main village axis to distribute 1 or 3-phase power to nearby houses, (iv) dig a few kilometres of trenches (underground reticulation) or build overhead reticulation for wiring, and (v) install the point of use box inside every customer's house. All is done under close supervision of Rafiki.

After installation, Rafiki works with village-level electricians for maintenance, while the kiosk is operated independently by a local entrepreneur. The smart metering and mobile money payment systems allow remotely managing the grid and controlling power thefts. In case of default payment (<3%), after various warning-sms to the customer, the smart meter shuts off the system until the customer has uploaded new credit.

Scale, impact & sustainability

Scale: Rafiki has set up 9 mini-grids as of early 2017, serving more than 750 households (3,000 people electrified), and targets 15,000 households by 2020. Total capacity installed amounts to 100kW. Rafiki has sold 300 appliances to date (mostly light bulbs, TVs, Radios).

Impact: Rafiki brings clean and affordable energy to off-grid villages and enables its customers to develop (economically and socially) in the future.

Sustainability: Rafiki's first project in Komolo in 2014 was financed in-house. Rafiki is now working on increasing the average revenue per user and bringing down its current $1,000+ cost per connection to $800, in order to allow for sustainable scaling. Most sites are now already managing to cover their OPEX. Rafiki has raised more than $5 million in equity since inception and has successfully received various development grants from EEP and GIZ.

Sources: Interview with Daniel Becker, Managing Director and Gerrit Wiezoreck, Head of Strategy & Business Development, December 2016

Company documents

Contact: info@rafikipower.com

SOLAR IRRIGATION PUMPS

Credit: Claro Energy

CLARO®
Sustainable Cleantech Solutions

http://claroenergy.in/

Claro is a leading project developer and system integrator for solar pumps, with a park of close to 6,000 pumps in India

Organization

Founded in the 2010 in Delhi, Claro is a leading project developer and system integrator for solar pumps in India, providing purchase, financing, and sourcing, installation and maintenance of solar pumps and related equipment for a wide range of needs and applications. While they initially invested into R&D (e.g. they engineered an AC converter), they then passed their innovations to manufacturers for industrialization.

Present in 15 Indian states, Claro also played a leading role in supporting and advising the government in launching subsidies' schemes to promote solar irrigation, the first one being Bihar back in 2011. They currently capture up to 15% of the total existing market in India (up to 80% in Bihar), positioning them likely as the 2nd or 3rd largest solar pump player in India.

Claro focuses solely on solar pumps (vs. most other players who are diversified into several solar verticals or equipment manufacturing). As a result, it turned into one of largest downstream player offering high quality distributed installation, maintenance, and warranty service for solar pumps to rural regions of India. The company's core value proposition is around service provision (vs. equipment provision). As a result, they quickly diversified from selling pumps through government bids to co-bidding with manufacturers, or to maintaining existing pump parks installed by others. As a result, large government contracts represent today only 60% of their business (down from 95% some six years ago).

One exciting development is Claro's piloting an 'irrigation as a service' scheme in Bihar, thanks to USAID funding. It is currently refining various versions of a connected mobile trolley transporting a solar pump that can be connected to small farmers' boreholes against a fee that should hover around half the price of rental for diesel pumps. The plan is to roll out 100 of them by end 2017. Farmers will use pre-paid e-cards to activate the pump. The business model to commercialize this equipment (capex payback estimated at five years through PAYG, or seasonal leasing) will also be refined in the coming months. Claro will also test larger fixed pumps to be shared between 5-10 farmers. This will make solar pumps available to smaller farmers, for whom it may not be economical to invest into own solar irrigation infrastructure.

Value proposition

Claro has 14 products in their portfolio, including solar water pumps for drinking and irrigation applications (1, 2, 3, 5, 7.5, 10 HP both AC and DC) but 60% of their business is 2-5HP pumps priced at ~$5,000 in average, including installation and five-year guarantee.

Claro sources the components from various specialized manufacturers, e.g. submersible pumps from Shakti pumps, Rotosol, Grundfos and Lorenz; PV panels from PV PowerTech, Gautam Solar, Waaree Solar; converters from Schneider, ABB, Delta etc.).

A sales team of about 25 is deployed either in government tenders requiring to identify beneficiary farmers in remote rural regions, or to identify individual, larger farmers with tailored needs. In addition, to increase its customer acquisition ability in the various states it operates in, Claro is developing a network of referral sales agents working on commission (referred to as Claro Mitras). It also collaborates with large banks and agro companies to leverage their in-field presence to identify and access potential farmer clients. Furthermore, Claro runs live demonstrations for the prospective customers ('seeing is believing'), and has also started investing into ATL marketing (online and offline), to increase its visibility and brand presence among potential customers.

In addition, Claro currently deploys close to 75 field staff, in charge of site surveys, installation and after-sales maintenance (scheduled and unscheduled).

Given that the technology is not 'plug and play' (a lot of issues are related to the farmers' mishandling of the equipment), after-sales is crucial. It also set up a dedicated toll free number, which gets about 300 complaints a month, out of which about 200 are closed within the same month. An estimated 40-50% of new installations require a visit per year (ratio increases over time).

The large majority of Claro sales is made through state government programs (with subsidies ranging from 60 to 95%), or companies that work under similar programs. The size of the farmers actually supported through these schemes varies enormously from state to state. In addition, they sold about 100 pumps to larger farmers thanks to the 'NABARD scheme' which makes 40% subsidies available to farmers who take a loan with participating banks, in addition to the 20% down-payment. Two additional tiny, yet fast growing customer segments are contracts with NGOs, donors and CSR programs who pay for small numbers of pumps, as well as larger agro companies (e.g. wineries).

Payment and money collection schemes vary considerably. In the (still tiny) NABARD scheme, banks concentrate all the process (down-payment, subsidy, loan provision) and pay 100% to Claro. In the large state government schemes, Claro might be required to ensure farmers' down-payment, and the actual payment by the public entity is linked to milestones (over a period of five years). While payments may get delayed, default is very rare.

Scale, impact & sustainability

Scale: Until end 2016, Claro directly sold and installed 2,600 solar pumps for irrigation, and installed/maintained 2,700 pumps sold by other companies. They also sold a few hundred drinking water pumps (1-2 HP). Solar appliances (SHS, solar fencing) are also offered to larger clients which have more individualized needs, but this is a marginal activity. Sales (in value terms) have been increasing rapidly over the past years (+26% in 2016).

Impact: Claro mostly focuses on the technical requirements of farmers – more thoroughly for NABARD scheme (where farmers will be offered tailored solutions), and more superficially for state government programs (where farmers are eligible or not).

Since 2017, all solar pump providers are required to set-up remote monitoring systems that will include farmers' details, GPS coordinates, details about the pump, as well as track power and water dispensed and functioning of the pump. With the solar trolleys scheme however, Claro will collect even more information (land, crops, expenses, sources of water, energy requirements, etc.) to be able to develop a B2C business.

Anecdotal evidence suggests that benefits to farmers can be significant: estimated 30% increase in yield for farmers dependent on diesel and unable to cultivate, irrigate sufficiently or irrigate higher-value crops in summer when evaporation is high; decrease in costs (fuel expenses can amount to $1,000/year for smaller farmers). For farmers reliant on electricity, higher yields is also the main draw, as irregular or insufficient power supply often limit their cultivation potential. In addition, larger farmers estimate that they can cut 75% of their electricity bill (which may not represent significant amounts given the highly subsidized price of electrical power).

Sustainability: Claro is profitable since its first year of operation. However, access to working capital debt is a significant bottleneck to growth, and it is only as they got a sizable loan in 2015 that they could start growing more aggressively.

Sources: visit of Head office in New Delhi on 21-22/12 and interviews with Soumitra Mishra (Management), Kartik Wahi (Management), Pravin Tiwari (customer service and maintenance), Gaurav Chaudhary (customer service and maintenance), Akshay Aggarwal (system design engineer), Praveen Sinha (engineering and technology), Anirban Banerjee (Marketing). Field visit of Claro solar installations (under NABARD scheme).

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Jain Irrigation Systems Ltd.

www.jains.com

Jain Irrigation Systems is the largest solar pumping system provider in India, with an installed park of more than 20,000 pumps. It offers R&D, manufacturing, installation and after sales

Organization

Jain is an agro conglomerate with turnover in excess of one billion dollars, with a broad offering of products, solutions and services to improve the productivity and livelihoods of more than 5.5 million farmers (e.g. irrigation systems, tissue culture, produce processing).

One of the divisions is Jain Green (Renewable) Energy Jain started working on solar in 1994 with selling solar water heating systems, adding solar lanterns, solar home lighting, solar power packs and street lighting in 2003. In 2007, when the price of PV came down, it started developing and manufacturing solar DC pumps (as there was no reliable supplier able or willing to create one, and as DC motors are up to 93% efficient vs. 65% for traditional AC motors). The pump is also compatible with drip irrigation and suitable for small landholdings. They also invested into PV in-house assembly, development and manufacturing of DC controllers, remote monitoring system as well as embedded software solutions. They started installing pumps for the Rajasthan state program in 2009, followed by Chattisgarh, Orissa, UP, MP and 10 other states. Today, over 80% of the sales of the division comes from solar pumps.

Jain is the leading solar pump player in India with 50% of the total existing market. Over 95% of its solar pump business comes from state government tenders that offer subsidies ranging from 60 to 95% to farmers. The rest is sold through a program combining loans and subsidies for larger farmers (NABARD scheme) and direct retail sales direct.

In addition, Jain has run two interesting projects: a) For the Punjab Government, it combined solar pumping with micro-irrigation for 1,200 small farmers in Talwara, where only 2.5% of the surface was irrigated due to the difficult and hilly terrain. As a result farmers have recorded up to 100% increase in productivity; b) A pilot community pump project in Uttar Pradesh where 14 solar pumping systems of 12.5 to 25 HP were installed. They are now bidding for an additional 2,000 community pumps (12.5 to 40 HP AC, 100% subsidized for communities of 100+ farmers). Such collective models could make solar pumps more easily available to smaller farmers.

Value proposition

Jain offers complete DC solar pumping solutions, including pumps with highly efficient BLDC submersible motor in stainless steel for extra durability, controller, PV panels, tracker, remote monitoring system/data logger, and any other required equipment. It is also a total solution provider with quality service provision, thanks to large technical field teams. Jain also stands as a brand for quality and reliability, and has a reputation of caring for farmers. As Anil Jain (Jain's MD) puts it: 'Nobody cares about the farmers the way JAIN does. It is not only about the product, it is about giving farmers solutions to all of their productivity problems over the entire crop cycle'.

Jain's product portfolio includes solar water pumping (surface and submersible) for drinking and irrigation applications (1, 2, 3, 5, 7.5 and more HP AC outsourced, and 2, 3 and 5 HP DC manufactured by Jain), along with other products of the renewable energy division. 60% of their business is their own DC pumps, mostly 5HP and 3HP pumps, respectively priced at ~$7,300 and $4,800 (DC pumps are typically 7-19% more expensive than AC for 5 and 3HP respectively), including installation and five-year comprehensive maintenance & warrantee. For 5-7% more, farmers get the sun tracking device (for times of day and seasons), allowing to get 25-30 % more output. None of the pumps come with a battery, given they can run from sunrise to sunset (also when overcast), while a battery is costly, maintenance is high and needs frequent replacement. Jain is also currently field testing a 1HP DC pump for drinking water, and prototyping an AC submersible type pump specifically suitable for solar.

When not explicitly required in the state tender (e.g. like in Rajasthan), Jain does try to convince farmers to add drip irrigation, as solar is adapted for it (less HP required). But the majority of small farmers are reluctant to invest further.

Operations

Jain manufactures DC pumps in-house and outsources AC pumps. The PV panels manufacturing facility, and on-site quality control facility has a 55 Mw production capacity, is fully automated and can assemble panels ranging from 10w to 310w.

In the Maharashtra scheme, each district has a team leader, coupled with engineer and technicians. These teams are on the move, visiting farmers, assessing technical feasibility among farmers pre-identified by the implementing agency (in Maharashtra, up to 25% of referred farmers are actually not vetted by Jain due to site condition). In some states, Jain is mandated to identify potential candidates, which requires more proactive field work.

For all other solar products and schemes (e.g. NABARD), a regional sales team works directly with larger farmers (e.g. identified among farmers constructing greenhouses, through fairs, demo vans and meetings at successful farmers' sites). They also support the other team with commercial and paper work. In total about 40 managers oversee 130 field staff.

The district teams are in charge of both scheduled and unscheduled maintenance (after-sales conditions differ in each tender, but five years warrantee is systematically offered). While the pumps are durable and efficient, farmers can still 'create problems': e.g. letting the pump sit in sand or mud, not running the pump 5-10 minutes a day, not cleaning panels regularly, tamper with the wiring or 'reprogram' the controller etc. Maintenance will be facilitated by the remote monitoring device that will be installed on pumps since 2016 (legal requirement).

Payment and money collection schemes vary considerably. In the (still tiny) NABARD scheme, banks manage the entire process (down-payment, subsidy, loan provision) and pay 100% to Jain. In the state government schemes, payments are typical conditional to a number of milestones (over a period of five years), and can be significantly delayed.

The profile of the ~20,000 farmers in the state programs won by Jain vary from state to state. Farmers who own a diesel pump are ready to switch given the rising fuel prices and subsidies lowering the cost to that of a diesel pump. The ~450 larger farmers in the NABARD program (40% subsidies, combined with 40% loan and 20% down-payment) are typically connected to the grid, but want to switch to a more durable and dependable source of energy.

Scale, impact & sustainability

Scale: Until end 2016, Jain sold and installed more than 20,000 solar pumps for irrigation. The solar division has been growing 7% in 2016. There have been fluctuations over the years, given growth is linked to government programs.

Impact: Since 2016, all solar pump providers are required to set-up remote monitoring systems that will include farmers' details, GPS coordinates, details about the pump as well as panel power and water dispensed. Jain's system also tracks functioning of the pump (fault logging, up/off time) and indicates the possible source of the problem.

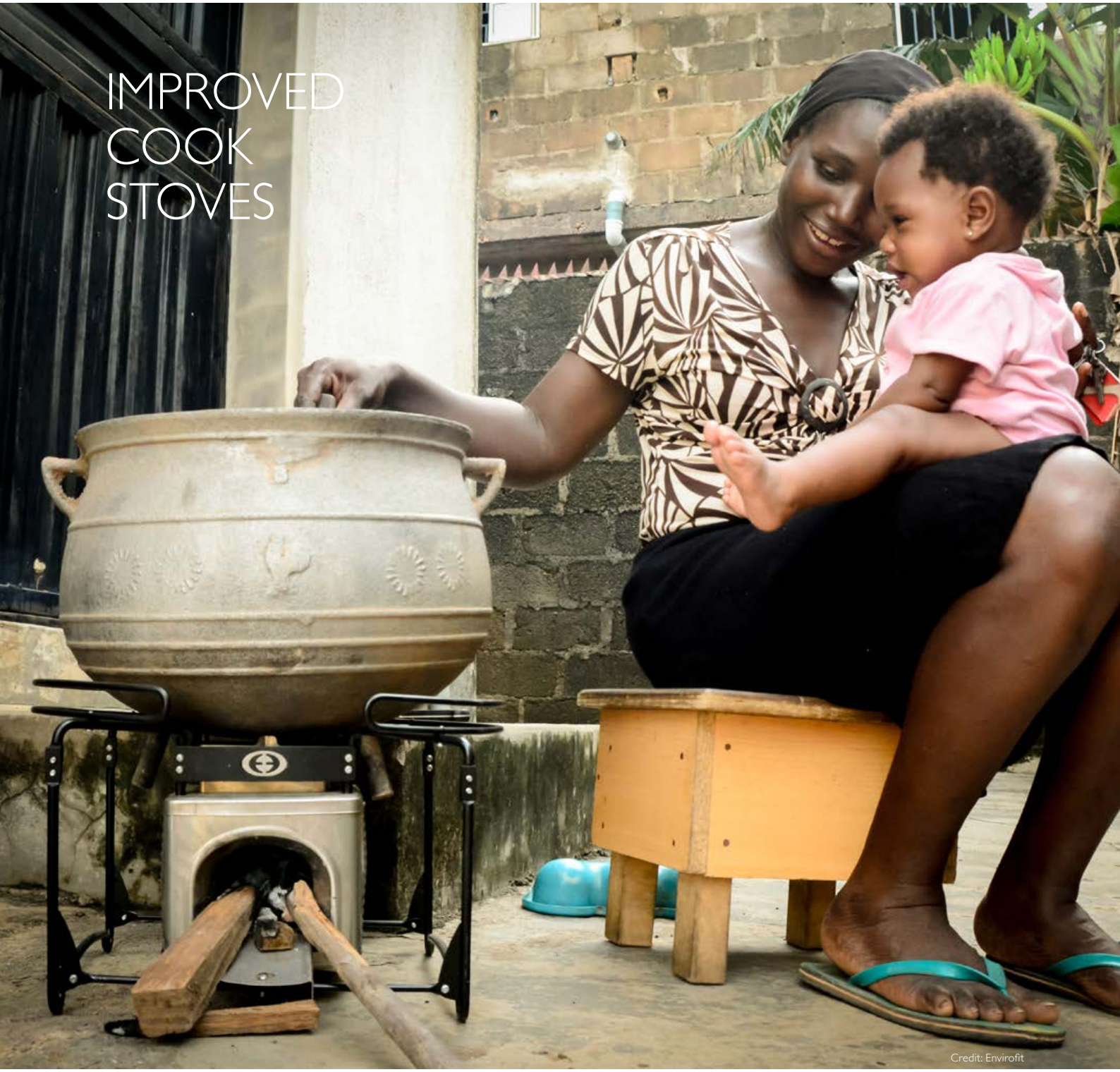
That said, benefits to farmers can be significant: an estimated up to -60% increase in yield/income for farmers dependent on diesel and who were unable to cultivate, irrigate sufficiently or irrigate higher-value crops in summer, and decrease in fuel costs (about $1,500/year for smaller farmers). For farmers reliant on electricity, increased yields is the main draw, as irregular or insufficient power supply often limits their cultures. In addition, larger farmers estimate that they can cut 75% of their electricity bill (which may not represent significant amounts given the highly subsidized price of electrical power).

Sustainability: The EBITDA margin of the solar division ranges from 3 to 10%. Profitability will improve as COGS go down and pumps are monitored remotely (about 50-60% of the end price is the PV, 20-25% the solar pump and converter, and 20-25% other equipment and servicing).

Sources: visit of Head office in Jalgaon on 19/12. Interviews with Anil Jain (Vice Chairman and MD), Sanjeev Phadnis (Executive Senior Manager) and Anupkumar Agiwal (Area Sales Manager). Field visit of Jain solar installations (under NABARD scheme).

Contact: Sanjeev Phadnis, Executive Senior Manager Jain Green (Renewable) Energy, phadnis.sanjeev@jains.com

IMPROVED COOK STOVES



Credit: Envirofit

BioLite

www.bioliteenergy.com

BioLite has manufactured and distributed over 20,000 advanced cook stoves powering small electrical appliances in India and East Africa

Organization

Two American designers, Jonathan Cedar and Alec Drummond, founded BioLite in New York City in 2009 and launched their first high-efficient stove for the US recreational camping market in 2012. The CampStove is a wood burning stove equipped with a thermoelectric generator that powers a fan, creating a smokeless fire, and simultaneously charging small electrical appliances via USB (e.g. phone chargers and LED lights).

In parallel with the development of the CampStove, BioLite applied the same core combustion technology and developed the HomeStove for daily cooking by off-grid households in emerging countries. While BioLite has used its revenue from the recreational camping market to test a number of distribution strategies over the last 3 years in India and East Africa, the company is on track to become financially sustainable in its emerging markets business.

Beyond its flagship stove, BioLite has developed over 20 products across cooking, charging (e.g. portable solar panels), and lighting (e.g. solar lanterns, multi-room lighting systems) for its recreational camping market. The team is currently expanding its emerging markets product portfolio across these same categories of energy.

BioLite has also been playing a leading role in advocating for lower VAT and tariffs in East Africa. In Kenya, BioLite led an effort to achieve a 16% VAT exemption on all cook stoves. Across East Africa, BioLite secured a duty reduction from 25% to 10% for the importation of cook stoves in the region.

Value proposition

BioLite has a unique stove model, the HomeStove, for both Indian and East African markets, which reduces smoke and CO_2 emissions by 94% and 91%, respectively, and burns 50% less fuel than a conventional three-stone fire. The HomeStove also generates 2W of electricity from the surplus heat of the fire, enabling households to save up to $200 a year on fuel, lighting, or charging. It has a 3 to 5 year lifetime and comes with a 1-year warranty. Customers can buy the stove in cash for $50 – $70, depending on the market, and 95% of their customers pay on credit through consumer finance provided by MFIs, banks, or cooperatives (typically 20% interest rate for a 12-month credit). Most BioLite customers earn between $4 and $20 per day. Wood users save $7.6 per month in India and $13 in Uganda. Former charcoal users who switched to wood generate even higher savings. For fuel purchasers the stove pays for itself in six or fewer months.

An aspirational design, tangible benefits and regular after sales follow-ups (phone calls or technician visit) ensure the BioLite HomeStove has very high adoption and satisfaction rates. 94% of customers in India and 96% in Uganda still use the stove 3 years after purchase.

BioLite has designed the second-generation of the HomeStove, launched early 2017.

Operations

BioLite designs its products in the US and manufactures them in East Asia before shipping to distribution partners in India and East Africa. These partners include MFIs, banks, telecommunication companies' retail stores and rural credit cooperatives.

Initially, BioLite sold HomeStoves exclusively through cash-based distribution channels in India and East Africa. For instance, In India, BioLite sold 5,000 stoves through Greenlight Planet in Orissa, without consumer finance. Each BioLite sales agent worked with around 250 Greenlight Village Level Entrepreneurs, leveraging them as local referrals. Sales agents were responsible for stove delivery and user training. However, as

BioLite learned that consumer finance was catalytic to higher uptake, it has more recently focused on credit channels. BioLite supports these channels by developing a full-time mobile salesforce on payroll to reach remote areas and provide distribution partners with marketing and training support.

Scale, impact & sustainability

Scale: BioLite has sold over 20,000 stoves in India, Kenya and Uganda (and many hundreds of thousands in developed markets) since inception, including 8,500 in 2016. BioLite has nearly 100 staff across the US, India and East Africa.

Impact: BioLite estimates that it has reached 100,000 people, generated 51m Wh of electricity, and offset 60,000 tons of CO_2.

Sustainability: Since 2012, BioLite has raised a $2 million Series A round led by Disruptive Innovation Fund, and also received debt and grant funding from Deutsche Bank and USAID, respectively. In 2015, BioLite raised $3 million Series B equity round led by Acumen Fund with investments from White Road Investments, RRE Ventures. In 2016, BioLite signed an $8 million long-term purchase agreement for carbon credit with the Norwegian government, and also started generating its own carbon credits.

Sources: Interviews with Ethan Kay, Managing Director Emerging Markets, and Jan de Graaf, East Africa Program Manager, November 2016; company website.

Exchange Rate: 1 USD = 104 KES

Contact: Ethan Kay, ethan@bioliteenergy.com

www.burnstoves.com

BURN has manufactured and distributed over 260,000 charcoal and wood improved cook stoves in East Africa

Organization

BURN Manufacturing Co. is an affiliate of BURN Design Lab, a stove design company based in Washington State, USA, since 2010. In 2011, BURN Design Lab's CEO Peter Scott and his partners decided to expand upon design to manufacture and distribute its products. The company now has a factory in Kenya where it produces energy-efficient and almost smokeless charcoal-based cookstoves, the Jikokoas, targeting urban low-income households.

By the end of 2016, thanks to efficient partnerships with local distributors, BURN had sold over 240,000 Jikokoas, mostly in Nairobi and medium Kenyan towns. A little under 20,000 stoves were already sold at export; and BURN plans to expand first in Tanzania and then in Uganda in 2017.

BURN is also working on developing its own distribution channel, moving from a strictly B2B to a partly B2C model.

Value proposition

BURN's Jikokoa - or 'saving stove' in Swahili - sells for $35[1] in Kenya and pays for itself in 2 to 3 months by cutting fuel consumption by around 50%[2]. 85% urban households in East Africa usually buy traditional $4 stoves and spend up to $500/year on charcoal: buying a Jikokoa typically saves $150-250/year. In Kenya, 25% of the population are such charcoal users.

The Jikokoa is easy to use: its ashtray system allows the user to control the temperature of the stove and keep it clean over time. BURN provides a 2-year guarantee to consumers through SMS registration (as of Feb 2016, 75,000 clients have voluntarily registered).

In Nov-Dec 2016, thanks to the support of the Enhancing Livelihoods Investment Initiative (ELII) created by Acumen and Unilever, and after 18 months of market research and product design, BURN started selling its second product, targeting the 75% of Kenyans who use wood to cook and particularly the 25% who actually pay for their wood: the Kunikoa, a wood-fired cookstove meant to reduce particulate pollution by 67%[3].

Operations

BURN set up its R&D lab in the US and its manufacturing plant in Kenya, where it produces 850-900 stoves per day. In 2016, BURN moved its design team to Kenya.

BURN aims at reaching sustainability through market-based sales, without relying on donor programs. As of February 2016, 40% of BURN's stoves are distributed through supermarkets (Naivas, Tuskys, etc.). 50% are distributed through various partnerships: MFIs (e.g. Kenyan Women Finance Trust, MicroEnergy Credits and the Equity Bank Clean Energy program - the Jikokoa being one of the best-selling products of the two latter); PAYG partners (e.g. M-KOPA, Mobisol); local agent networks (e.g. not-for-profit social enterprise LivelyHoods that runs door-to-door campaigns with Kenyan youth from slums, or farmers' organizations such as KTDA which gathers over 500,000 tea farmers). Finally, 10% of the stoves are exported. BURN is extending its distribution network in Kenya to reach more wood-buyers for its new wood stove and is working on setting up its own distribution agents to sell directly to women's groups.

BURN supports its distributors with both traditional marketing efforts (village demonstrations and door-to-door prospection) and above-the-line marketing

1 The price was initially $40 but The Clean Cookstove Alliance of Kenya lobbied to remove VAT in the summer of 2016.

2 56% fuel reduction in lab - BURN data

3 Study conducted by the University of Washington, Seattle

campaigns. TV and radio commercials, as well as product placement in popular TV shows, enabled BURN to move from 3-4,000 monthly unit sales to 8-12,000. This mass marketing strategy fitted with the Jikokoa's positioning as its key target market was urban consumers (more likely to watch TV). When asked what led them to buy the cookstove, 30% of BURN clients cite the TV campaign, 30% radio, 30% word of mouth and 10% on the ground activities. Similarly, BURN will set up marketing offices in Tanzania and Uganda to select and support its local distributors' networks.

For the Kunikoa stove, of which target users live in peri-urban areas or in small cities, the marketing mix will be different, with no TV and billboard campaigns and a strong focus on radio and below-the-line marketing.

BURN provides direct customer care to its clients, through its Kenyan factory that includes a customer service department to repair damaged products, as well as through 48 guarantee stations in Kenya, one in Tanzania and one in Uganda. All customers can reach a unique call centre for usage or quality questions.

Scale, impact & sustainability

Scale: By early 2017, BURN had sold 265,000 stoves, including over 100,000 in 2016 alone, with a sustained 8-12,000 stoves sold per month since mid-2016.

BURN currently only uses a third of its Kenyan production capacity and aims at producing and selling 3.7 million clean biomass cookstoves in East Africa in the next 10 years, for charcoal and wood users. It aims at creating over 200 sustainable design, manufacturing, and sales jobs in Kenya (added to the already existing 400 jobs).

Impact: The Jikokoa stove emits 65% less PM 2.5 (particulate matter) and 63% less carbon monoxide than regular cookstoves. To date, households using Jikokoa save 3.9t of wood per year and an estimated $42 million in fuel. According to BURN's impact studies, people use their stove on average 2.4 times a day (still using gas for tea or quicker cooking purposes).

Sustainability: BURN had $2.5 million of revenues in 2015 and $2.9 million in 2016. Its Kenyan business had its first breakeven month in August 2015. It expects to be fully profitable by October 2017.

It received $1.9 million in equity from Acumen and other investors; $4 million in debt from OPIC and General Electric; and $3.5 million grants from GACC and the Energy and Environment Partnership Programme (EEP) for capex and R&D. BURN is currently looking for a further $600,000 in equity.

BURN is also leveraging carbon credits: it has received $40,000 as of end 2016 and plans to issue $300,000 worth of credits in 2017, hoping to get $2-4/ton.

Sources: Interviews with Boston Nyer, co-founder and General Manager of East Africa Operations, April 2016 + February 2017; Acumen.org; cleancookstoves.org; company website.

Exchange Rate: USD 1 = KES 103

Contact: Boston Nyer, boston@burndesignlab.org

ENVIROFIT
SMARTER LIVING

www.envirofit.org

Envirofit serves over 5 million people, with over a dozen user-designed smart energy products and services, notably clean cook stoves, in East Africa, West Africa, Asia, and Latin America.

Organization

Envirofit was founded in 2003 in Colorado (USA), and has become the largest player in the clean cook stoves industry globally, with manufacturing and production facilities in China, India, Kenya, Nigeria, Ghana, Peru, Honduras and Mexico, and a total production capacity of 100,000 units per month. It has sold 1.2 million units and keeps growing.

The company has evolved its business model since its inception from B-C to B-B to a hybrid of the two. It started experimenting with a direct sales force in India to gather consumer insights. This experience also showed the complexity of building a distribution network from scratch. In order to scale up more rapidly, Envirofit decided to focus on manufacturing, and to sell stoves through distribution partners. It is now back to investing in field operations, by piloting direct sales models in Kenya and India, and by setting up consumer care services across Latin America and East Africa. It wants in particular to ensure that customers use the stoves properly and are satisfied with it.

Envirofit has invested continuously into R&D (both on improving design and technology as well as business model). These efforts were supported by over $20 million in grant funding, from the Shell Foundation.

Value proposition

Envirofit produces a dozen clean cook stoves, which are adapted to different fuel uses, cooking habits, and capacity needs. The retail prices of domestic stoves range between $25-50 (with accessories up to $100), while larger commercial stoves for restaurants are sold between $200-1000.

Envirofit started with "premium" stoves selling for $40-50. In order to reach a larger consumer group, Envirofit designed an "economy" range of stoves, selling for $20-30, which account for about 20% of sales volume.

To maintain economies of scale, Envirofit has designed stoves with standard features that can accommodate optional accessories, such as pots and pot-skirts, and double pot attachments.

Envirofit's stoves generally cook at least 50% faster than traditional cooking methods, reduce smoke and toxic emissions by up to 80%, are up to 60% more efficient in fuel use, and are more durable thanks to Envirofit patented metal combustion chamber. Where traditional metal and clay stoves last for a few months, Envirofit's stoves come with a one-year warranty and have an estimated life span of 3-5 years.

Operations

Envirofit has three manufacturing and distribution models, which adapt to sales volume per country: (i) if the market is new with low sales volumes, stoves are imported; (ii) as the market increases, once sales reach a few thousands per month, Envirofit invests in local assembly facilities to reduce the burden of import tariffs and reduce costs; (iii) in countries where the market is more developed, Envirofit builds full-fledged manufacturing facilities, to reduce lead times and simplify logistics.

The stoves are distributed through the following channels:

- Commercial distributors, including retail chains and local entrepreneurs
- Large scale MFIs, NGOs and development Organizations which leverage their customer/ beneficiary base, and often offer consumer financing
- Large scale government and emergency and aid programs, which distribute stoves for free or at highly subsidized prices for example in emergency or relief contexts
- Envirofit direct sales force

Envirofit supports its distributors with training, marketing materials, and customer care services. For example, in Honduras, Envirofit trains field agents to install the stoves at end-users' home and explain them on how to properly light and maintain them and follows up with each customer to ensure that the family still uses the stove daily and benefits from it.

Scale, impact & sustainability

Scale: Since inception, Envirofit has sold over 1.3 million stoves in 45 countries. It directly employs 400 people. It also produces a line of lighting products and LPG stoves to complement their line of clean biomass cook stoves.

Impact: Envirofit estimates that it has improved 5 million lives, prevented 17 million CO_2 emissions, and saved $138 million in fuel costs for its end-users.

Sustainability: Envirofit is sustainable on a unit economic basis, but is currently prioritizing scale over consolidated profitability. Envirofit has grown its sales revenue from $0.7 million in 2010 to $28 million in 2016. In addition to grant funding from Shell Foundation and others, it has raised debt funding from Calvert Foundation, OPIC and Deutsche Bank and investment capital from Shell Foundation and FMO. Envirofit has also leveraged carbon programs to support its growth.

Sources: interview with Jessica Alderman, Director of Communications, November 2016; www.envirofit.org; Cooking in One Million Kitchen. Lessons Learned in Scaling a Clean Cook stove Business, Envirofit, 2015

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www.geres.eu/en/

GERES aims at supporting value chains for clean and sustainable energy solutions adapted to the BoP. It works with local partners which have distributed 3.6 million cook stoves

Organization

The Group for the Environment, Renewable Energy and Solidarity (GERES) is an NGO founded in 1976, which aims at supporting value chains for clean and sustainable energy solutions adapted to the BoP.

After initial projects in West Africa and India in the early 1980s, GERES now works with 4,100 companies and entrepreneurs in 19 countries to pilot the production and distribution of improved cook stoves (among other products and services), and counts 697,000 direct beneficiaries (families, institutions, or project developers).

GERES's ambition is not to expand worldwide, but to test projects in a given context, mature businesses and then bring technical and strategic support to partners willing to replicate most successful models, especially in the cooking sector. GERES also assists them in raising funds to scale up.

To do so, the NGO officially launched in 2014 GERES Expertise (GEX) unit. GEX is in charge of providing strategic and technical assistance to external partners, as well as advising GERES across local teams and projects on energy-related themes (access to energy, climate change and sustainable consumption and production…), training and reporting.

Value proposition

GERES supports access to clean energy by shaping sustainable value chains in Asia and Africa. To do so, it empowers local entrepreneurs producing and selling various innovative products to the BoP[1].

The programme Stove+ provides technical expertise to existing producers, distributors and retailers of cookstoves to help them produce and distribute improved sustainable biomass products. In the same vein, GERES also backs-up local value chains actors producing and selling sustainable charcoal and charbriquettes. Starting in Cambodia, GERES has developed similar models in Africa (Mali, Kenya, Ghana), South-East Asia (Indonesia, Myanmar and Lao PDR) and Morocco.

Last but not least, Stove+ is also supporting governments and international organizations in shaping their clean cookstoves sectors, through standards and labelling schemes and RBF mechanisms development.

Operations

In its Stove+ program, GERES supports 36 local partners in designing sustainable energy supply chains for cook stoves and fuel.

On the production side, GERES selects, trains and follows up existing local producers (specialized in production of cook stoves or charcoal). They can in turn commercialize new clean stoves models or sustainable charcoal, out of which they increase their revenues. In Cambodia, GERES also helps informal local charcoal producers (who lacked a permit from the Forestry Administration to produce charcoal for commercial use) to formalize their activities and to access financing for equipment and to develop their activities.

On the distribution side, GERES leverages existing distribution networks (wholesalers, distributors and retailers), and trains them on selling techniques. GERES focuses on below-the-line marketing to initiate demand.

1 GERES works on improved biomass cookstoves and sustainable charcoal in South East Asia and Africa, hybrid solutions to provide small companies with electricity in Mali and Benin, sustainable hammams in Morocco, biofuels for farmers in various countries of Africa, and energy efficiency in housing in cold countries of Asia (Afghanistan, Mongolia, Tajikistan) and climate change adaptation and mitigation throughout its countries of interventions.

2 "New Lao Stove" is the first cookstove model sold by GERES partners in Cambodia

3 Agence Française de Développement, Fonds Français pour l'Environnement Mondial, Ministère des Affaires Etrangères et du Développement, Union Européenne

In order to improve the efficiency of the whole value chain and to ensure the impact will last beyond its own involvement, GERES contributed to the creation of the association ICOPRODAC in Cambodia (composed of producers, distributors and retailers involved in the improved cook stove value chain). It is in charge of 1) training the producers on management and manufacturing standards, 2) facilitating communication between the different actors and 3) setting a minimum selling price from producers. ICOPRODAC is now totally independent from GERES. The experience will be replicated in Myanmar in 2016, with the creation of a national cook stove alliance.

Scale, impact & sustainability

Scale: GERES has 237 direct employees (39 in France, 198 abroad), contributing to 58 projects in 19 countries. The NGO works with 36 local partners involved in cook stove supply chains, which together distributed 3.6 million cook stoves between 2003 and 2014. Via the same project, GERES has also organized the regeneration of 65,000 km2 of forest and has launched pilots to produce and sell sustainable charcoal in Cambodia (65T sold so far). Through its various projects GERES has benefited close to 700,000 people (though 3.6 million stoves were sold, some beneficiaries have bought several stoves between 2003 and 2014, because of their 18 to 36-month life span).

Impact: In Cambodia, the improved cook stove value chain generates $2 million added value per year (2014 data). Consumers save 20% to 40% of their fuel thanks to the various technologies introduced, equivalent to $38 per year on average. In terms of environment protection in Cambodia, selling the NLS[2] model enabled to reduce carbon emissions by 2.4 million tonnes from 2003 to 2013 and training communities on smart forest management practices enabled to reduce deforestation by 10% in project implementation areas.

Sustainability: Resources mainly come from public funds (60%), of which main donors include AFD, FFEM, MAE, UE[3] and private funds (9%), among which companies, NGOs and individual donors. The remaining 31% comes from sales of expertise and carbon revenues. The NGO maintains low head office costs (fundraising, operating and extraordinary expenses) to 10% of total costs. The NGO experienced a ten-fold growth of its activities ($1.1 million to $11 million budget) from 2002 to 2014. As a consequence, GERES needed to invest massively to restructure its internal organization, which led to a $141,000 deficit in 2013. The restructuration was a success and enabled a surplus of $31k in 2014, a trend followed in 2015.

Sources: Interview with Julien Jacquot, Program Manager; company website.

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Toyola Energy Limited (Toyola) builds local assembly chains for improved ceramic charcoal cook stoves and has sold over 600,000 units via door-to-door and retail in West Africa

Organization

Toyola was started in 2006 by Suraj Wahab and Ernest Kyei who trained local Ghanaians in improved cook stove production and started buying their stoves and organizing their distribution. During 2007, the company was selling double its projections. By June 2009 it had sold 64,000 stoves. In 2010 Toyola received its first revenues from carbon credit sales. In 2011 it opened production centres in Togo, Benin and Nigeria (with parts still made in Ghana).

In 2013, as the price of scrap metal (a key input for the stove) was spiking up, the company started importing metal sheet from China, which has allowed to simplify the production process as the metal component is now standardized. In 2015, it opened a "cook stove plaza" also selling stoves from competitors. By September 2015, it had sold 600,000 stoves.

Value Proposition

Toyola sells high efficiency stoves, priced at $8-12 in Ghana where there is high competition as carbon credits are available, $12-18 in Nigeria and $7-18 in Ivory Coast through agents. Stoves decrease charcoal usage by 40%. Customers can re-coup the cost in a few months from savings in reduced charcoal consumption (annual savings range between $48-72 for an average household income of $800). In addition, the faster cooking time saves an average of 30 minutes a day. The food stays warm for longer thanks to a heat retention liner. Lastly the stove emits less smoke, lowering health risks from indoor air pollution, and is heat insulated, reducing burns by 90%.

Rural clients have the choice to try the stove for free for 4-6 weeks against a slight price increase (~$2-4). Most of them choose this solution, which allows them to verify the fuel savings allowed by the stove. Some salespeople offer them a 'Toyola box' with the stove: a tin box where client store savings made from reduced coal consumption. These types of paperless financial arrangements account for 20-70% of sales (depending on the country).

Toyola also sells solar devices ($20-30) and home systems ($4-10,000) through its wholly owned subsidiary 'Toyola Solar' (with different sales agents).

Operations

The value chain is completely local, except for metal sheets imported from Chinas since 2013. Initially Toyola trained artisans for 1-3 months and helped them specialise in manufacturing specific stove components, which increased productivity by 500%. Each of these artisans would then train others. By 2011, Toyola had 4 centralised production and training centres in Ghana, 3 in Togo and 1 in Benin, and had trained 170 local artisans. Toyola also has mobile production teams assembling stoves directly on site (including exports). The company owns 90% of KT ceramics, which manufactures the ceramic lining.

Distribution is done mostly through retailers in urban Ghana and Nigeria, and with a direct sales force in rural Ghana and Togo. Most retailers pay Toyola in cash. Retail accounted for 80% of sales in Ghana in 2014. In Nigeria, most clients, especially key agents and distributors pay cash, as there is more purchasing power, while in Togo, most sales require financing.

In rural areas, Toyola sales people recruit local "evangelists" who aggregate orders, deliver the stoves to their client doorstep from the delivery point in their village, and collect payments. Evangelists are entirely paid on commission (10%). Toyola works with over 600 selling points across West Africa, including retailers and evangelists. Toyola also has a computerized tracking system to keep record of who assembles, sells and buys each stove.

Scale, impact, and sustainability

Scale: Toyola sold 150,000 stoves in 2014 alone in four West African countries, Ghana, Togo, Benin and Nigeria. By September 2015 it had sold 600,000 stoves total. Toyola solar sold 1.3k lanterns and 840 home systems in 2014. Toyola solar sold 14.3k lanterns to date and 5,500 home systems overall since 2008.

Impact: By 2014 Toyola's stoves were offsetting 200,000 tonnes of CO_2 per year. Stoves are registered for Gold Standard carbon finance in Ghana and CERs in Togo. Each stove generates about $20 in carbon credits over its 5 year lifetime. Toyola stoves save 0.5 kg of charcoal per day.

Sustainability: Toyola is currently profitable. It had over $1 million in revenue in 2014. It has received carbon credit since 2010, but carbon credit sales have been unreliable and are now an insignificant part of the revenues.

Sources: Previous Hystra case studies; Interview with Suraj Wahab Ologburo, Founder and CEO, September 2015; Energy Access Knowledge Base EAKB Case Study Toyola; Ashden Awards Ashden Awards Case Study Toyola

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