

Pay-As-You-Go: Unlocking Access to Energy Services in Sub-Saharan Africa¹

A Disruptive Business Model Leveraging Mobile Technology to Finance Energy Services for the Bottom of the Pyramid

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Abstract

Liquefied Petroleum Gas (LPG) for cooking and home solar systems for electricity are not exactly new technologies in sub-Saharan Africa. However, their usage remains a privilege for just a few, since their cost is prohibitive for a huge part of the low-income population.

With this challenge in mind, many companies see a great opportunity to change the energy landscape. By harnessing the extended use of mobile phones and mobile money, they offer clean cooking systems, small off-grid solar panels or water service systems in a Pay-As-You-Go scheme, where customers make small daily or weekly prepayments for usage of the system.

Designed to serve the lowest income populations in the world, this model seems to be on its way to becoming one of the most successful in generating business at the base of the pyramid as companies are proving that it is possible to alleviate poverty by providing goods and services for poor communities in an affordable way.

In the past five years, the PAYG model has grown impressively in the sub-Saharan African energy sector and attracted huge investments, as an increasingly large community of foreign investors has become interested in it.

What are the drivers of this growth? Is PAYG the game changer that will finally push Africa to climb up the energy ladder? What are the hidden pitfalls for the players and what is awaiting this promising sector? Industry experts help us answer these questions by sharing their views in this paper.

Keywords: Pay-As-You-Go; Energy; Sub-Saharan-Africa; Solar; Lpg; Financing; Mobile-money

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1. Introduction

On his way home from school, Chicke jumps around and sings joyfully; he thinks this is going to be a great day. Today, he and his mom won't have to travel all the way to the marketplace in Dar Es Salaam to walk among the labyrinth of bags stacked in dusty piles to get their provision of charcoal, nor will they have to spend all evening cooking beans in the sickening smoke that makes him cough. Now they have the "revolutionary cook stove." That's what his dad calls their new two-burner gas cooker, delivered together with a butane cylinder. This cleaner fuel will allow his mom to prepare dinner much faster and she'll finally be able to sit with him and read, as he had been hoping she would for so long.

Liquefied Petroleum Gas (LPG) and other flammable gases such as butane, propane or natural gas are not exactly a new cooking technology. They have been used as a clean fuel source for cooking since the 19th century and are mainstream in most developed nations. However, in several countries in sub-Saharan Africa, their usage remains a privilege for just a few, since their cost is prohibitive for a huge part of the low-income population. In fact, two-thirds of the population of the region still relies on dangerous and inefficient fuels like firewood, charcoal and kerosene for cooking. These fuels are often burned in open fires or in rudimentary stoves, causing dangerous indoor air pollution, which kills around 600,000 Africans every year and is especially fatal for women and children.²

Electricity consumption in Nigeria is 0.14 MWh/capita, compared to 7.04 MWh/capita in France and 12.83 MWh/capita in the US

Having an indoor cooking fire is equivalent to being exposed to 400 cigarettes per hour

Ethiopia (94 million people) consumes one-third the electricity of Washington DC (600,000 people)

In a village in northern Nigeria, a family spends on average 70 times more than a resident of New York City for each unit of light

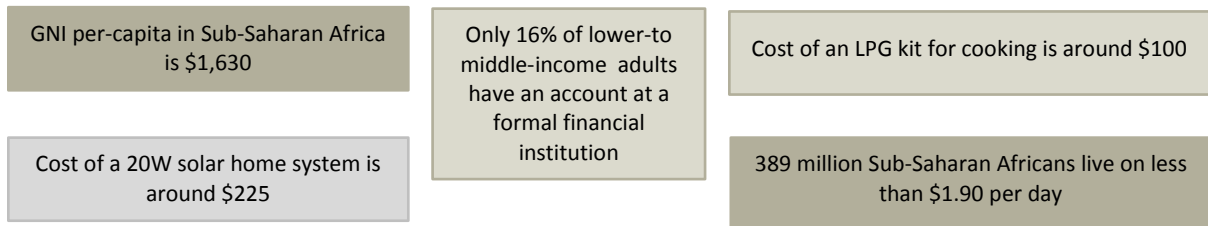
600,000 Africans are killed every year by air pollution caused by the use of firewood and charcoal for cooking

Source: Developed by the authors based on Africa Progress Panel. 2015. *Power, People, Planet – Africa's Energy and Climate Opportunities*. Africa Progress Report 2015. Africa Progress Panel, Geneva. ISBN 978-2-9700821-6-3 and on data from International Energy Agency, *Statistics* © OECD/IEA 2018 [Online]. [Last accessed May 29, 2018]. Available from <https://www.iea.org/statistics/statisticssearch> (for electricity consumption).

Similarly, nearly 620 million people in sub-Saharan Africa – equivalent to nearly twice the U.S. population – still lack access to electricity. Solar panels have been present on the sub-Saharan African market for years and their prices have been decreasing constantly over the past 10 years. Solar photovoltaic module prices have fallen by 80% from 2009 to 2016³ (IRENA, 2016). However, despite becoming cheaper and more readily available, they have never had the desired impact of addressing energy deficiencies across sub-Saharan African countries, as they still remain too expensive for most of the population.

² Africa Progress Panel. 2017. *Lights, Power, Action – Electrifying Africa*. Africa Progress Panel, Geneva.

³ International Renewable Energy Agency (IRENA). 2016. *Solar PV in Africa: Costs and Markets*. ©IRENA. ISBN 978-92-95111-48-6. [Online]. [Last accessed July 30, 2017]. Downloadable from <http://www.irena.org/publications/2016/Sep/Solar-PV-in-Africa-Costs-and-Markets>.



Source: Developed by the authors based on data from World Bank. 2018. *Poverty and Equity Data Portal*. [Online]. [Last accessed July 2017]. Available from <http://povertydata.worldbank.org/poverty/home> (for GNI per capita, financial inclusion and poverty headcount ratio).

The up-front payment required to buy a solar panel, a cylinder of LPG and a stove, or even to get access to the electricity grid is one of the main constraints that prevent a huge part of the population from switching to cleaner and more efficient sources.

With this challenge in mind, companies like KopaGas, Arnergy, Ignite Power, CityTaps, PEG Africa, Solaris, Village Power and many others see a great opportunity to change the energy landscape. By harnessing the extended use of mobile phones and mobile money, which allows customers to make payments through their mobile phones, they offer products – clean cooking systems, small off-grid solar panels or water service systems – in a Pay-As-You-Go (PAYG) scheme where customers make small daily or weekly pre-payments for usage of the system.

Designed to serve the lowest income populations in the world, this PAYG model seems to be on its way to become one of the most successful in generating business at the base of the pyramid as companies are proving that it is possible to alleviate poverty by providing goods and services for poor communities in an affordable way.

In the past five years, the PAYG model has grown impressively in the sub-Saharan African energy sector, both in terms of the number of new companies employing it, and in the number of customers using PAYG services. Some form of PAYG energy service is already available in 14 African countries,⁴ with the most advanced market in East Africa. It is estimated that the number of households using a solar home system purchased with a PAYG scheme has grown from 200,000 at the beginning of 2015 to around 800,000 by November 2016, with around 40,000 new systems being installed monthly.⁵ From 2012 to 2017, PAYG companies attracted approximately \$780 million in investments⁶ and there is a large community of foreign investors interested in PAYG.

⁴ Orlandi, I., Tyabji, N., Chase. 2016. *Off-Grid solar market trends report 2016*. Published by Bloomberg New Energy Finance and Lighting Global, an innovation of the World Bank Group in cooperation with Global Off-Grid Lighting Association (GOGLA) [Online]. [Last accessed July 2017]. Downloadable from https://data.bloomberglp.com/bnef/sites/4/2016/03/20160303_BNEF_WorldBankIFC_Off-GridSolarReport_.pdf

⁵ Estimate from Orlandi, I., Tyabji, N., Chase. 2016. *Off-Grid solar market trends report 2016*. Published by Bloomberg New Energy Finance and Lighting Global, an innovation of the World Bank Group in cooperation with Global Off-Grid Lighting Association (GOGLA) [Online]. [Accessed July 2017]. Downloadable from https://data.bloomberglp.com/bnef/sites/4/2016/03/20160303_BNEF_WorldBankIFC_Off-GridSolarReport_.pdf and GSMA. 2017. *Mobile for Development Utilities, Lessons from the use of mobile in utility pay-as-you-go models*. [Online]. [Accessed July 2017]. Downloadable from www.gsma.com.

⁶ Orlandi, I., Tyabji, N., Chase, J., Wilshire, M., & Vickers, B. 2018. *GOGLA. Lighting Global: Off-grid Solar Market Trends Report 2018*. 1–86 [Online]. [Accessed July 2017]. Downloadable from <https://www.lightingglobal.org/2018-global-off-grid-solar-market-trends-report>.



What are the drivers of this growth? Is PAYG the game changer that will finally push Africa to climb up the energy ladder? What are the hidden pitfalls for the players and what is awaiting this promising sector? Seeking answers to these questions, we talked with the CEOs and founders of several PAYG companies that recently entered the sub-Saharan African energy market.

2. How It Works

Taking a closer look at this model, and using a solar home system – the most popular electricity product sold under the PAYG model – as an example, the process can be summarized in three steps:

1. The customer makes an initial payment, normally 10% or 20% of the total cost, and has a kit installed at home. For the basic solar home system, the initial payment is around \$30 and generally consists of a 10-20W photovoltaic panel, a battery, two or three light bulbs, a radio and a phone charger.
2. The customer makes small regular payments in advance to use the service. For the solar system, the payment is generally about \$0.30-\$0.50 per day and is usually made by mobile money. Once the payment has been received, the system is enabled for operation, either by remote instructions received via the GSM chip incorporated in the system itself or through a code received by SMS and entered by the customer. Depending on the company, customers can make scheduled regular payments or top up their account at any time. When the account runs out of credit, the company can disable the system, which will not work until the customer tops up again.
3. In the “rent-to-own” model, after one or two years of PAYG payments, the customer will own the kit. In the “perpetual lease,” model they will keep making payments for the service.

There are essentially three main characteristics of this model:

- The payments are in small installments, paced with the usage of the service rather than the entire cost of the system itself to make it affordable to low-income customers. Usually, the daily fee is strategically set to match the cost of its substitute fuel, namely kerosene for lighting and charcoal for cooking.
- The model uses mobile phones and mobile money platforms for payments, without the need for a smartphone or internet access.
- The ability to remotely turn off the systems if payments stop is made possible through a remote-control mechanism incorporated into the system. The introduction of a strong incentive for customers to keep up with payments considerably diminishes the insolvency risk assumed by the PAYG companies (although many companies prefer to not use this mechanism).

M-KOPA - The Pioneers

Coming from the mobile payment industry (M-Pesa), the founders of M-Kopa had already seen the mobile-money technology revolutionize the telecom industry and they were convinced that it could do the same in the off-grid energy sector. The idea was simple: they took the upfront cost of purchasing a solar panel, divided it into micro-installments and made those amounts payable by the customer through their mobile phones (using the M-Pesa platform) on a daily basis over a period of two years. Their success is evident: as of May 2017, M-KOPA has connected over 500,000 homes to solar power and it is one of the main players in the sector.



3. Bridging the Credit Gap Through Mobile Money

The PAYG model, employed in telecom companies since the 1990s, allows the customer to use the service until running out of credit, at which point they can top up and continue using the service.

While the innovation here is the application of the model to make the energy services affordable and accessible to a low-income and remotely located population, the underlying disruption is that households traditionally out of the reach of financial institutions are getting access not only to electricity, water or cooking fuels, but also to a formal source of financing. With the PAYG model, energy companies have established a small-loan delivery channel, allowing their customers to access credit without needing a bank account!

In fact, only people who are “formally salaried” have bank accounts and, therefore, the chance to access consumer credit. This is a major limitation in a region where only 19% of the labor force is in wage employment, whereas 74% is in agricultural or non-farm self-employment.⁷ These conditions exclude the majority of the population from the banking sector, as they are too risky to justify the high costs of managing credit. With no access to any form of credit, even an up-front cost of a few dollars can pose an insurmountable barrier for a cash-constrained buyer.

Where the lack of access to credit posed a constraint to customers, it was also a barrier to the companies trying to sell solar solutions for these potential clients. Thomas Huth, co-founder of Village Power, a solar company operating in Uganda, Zambia and Mozambique, explains, “When we founded Village Power we carried out a pilot test in collaboration with the government and micro-finance institutions. But the process of approving ‘normal’ loans for our customers was too slow, consequently slowing down the company’s growth. That’s why we decided to go PAYG.”

4. PAYG Through the Eyes of Customers: Affordability, Flexibility, Convenience and Productivity

Does PAYG mean that energy has suddenly become cheap for Africans? Probably not, but it is certainly more affordable than the current alternatives. Nowadays, it is estimated that most of the families living without an electricity connection in Africa spend over \$140 per year in candles, kerosene and battery-powered torches for lighting, and another \$34 to charge mobile phones at kiosks.⁸ Meanwhile, a basic solar-powered home system – financed through a PAYG rent-to-own scheme – that provides for lighting, charging a mobile phone and a radio costs approximately \$106 per year.⁹ This is a considerable savings, and it is even more significant when

⁷ Bhorat, H., Naidoo, K., & Pillay, K. 2015. *Growth, Poverty and Inequality Interactions in Africa: An Overview of Key Issues*, No. 2016-02, UNDP Africa Policy Notes, United Nations Development Programme, Regional Bureau for Africa. [Online]. [Last accessed July 2017]. Downloadable from <https://econpapers.repec.org/paper/racwpaper/2016-02.htm>.

⁸ Africa Progress Panel. 2017. *Lights, Power, Action – Electrifying Africa*. Africa Progress Panel, Geneva.

⁹ Annual costs vary depending on providers and products. Our estimate is based on:

- A 10W solar system (10W Ready Pay Home Plus from Fenix International to Z) that allows for lighting (with 3 LED bulbs), charging a mobile phone and a radio, financed through a PAYG rent-to-own scheme: initial payment of \$16 and installments of \$0.27 per day for 24 months, after which the solar system becomes client’s property. Consulted on <https://www.fenixintl.com/wp-content/uploads/2018/03/English-Flyer-March-2018-1.pdf> on April 16, 2018, using an exchange rate of UGX 3672 per USD.

- A 8W solar system (M-KOPA 5 Solar Home System to Kenya) that allows for lighting (with 4 LED bulbs 1.2 W each), charging a mobile phone and a radio, financed through a PAYG rent-to-own scheme: initial payment of \$30 and installments of \$0.50 per day for 12 months, after which the solar system becomes client’s property. Consulted on <http://www.m-kopa.com/products/> on April 16, 2018, using an exchange rate of KES 100 per USD.



taking into account that the payments take place over the course of two years, after which the solar system becomes the client's property. Nevertheless, solar modules can still be too expensive for low-income households, as their cost represents at least 15% of the income of that 41%¹⁰ of the population of the region living under the poverty line.

The advantages of PAYG go beyond the savings. Flexibility and cost control are other very valuable advantages brought by PAYG. The option to skip payments for a few days in hard times or to purchase several weeks in advance after a good harvest is a key element in countries where the informal economy is predominant and there is no such a thing as a fixed monthly wage. "With a traditional connection to the electricity grid comes the bill to pay at the end of every month, and people dislike bills. It's cultural," says Siten Mandalia, CEO of Solaris Offgrid. "They don't know how much they are consuming and how much they'll end up paying. And even if they don't consume, there is still a fixed cost to be paid."

Moreover, in not owning the system for the first years, the customer carries no risk of failure of the solar-powered system. This is a compelling advantage for customers who may not yet be confident in this new technology and would thus be unlikely to risk buying it if they had to bear the cost of maintenance. Instead, with the PAYG structure, this risk is left with the operator, who has a strong incentive to keep the system working if it wants to see incoming payments.

Another remarkable advantage is the gain in productivity and life conditions. With new household energy systems, the time and money previously spent on the procurement of fuels or travelling hours to charge a mobile phone can be redirected towards other activities, like working and studying, which are also facilitated by higher quality sources of light. Many households also find ways to monetize their solar-powered systems – the most popular being to launch a small phone-charging business to serve the neighbors. The creative ideas also include small hair-cutting businesses and basic cinemas where movies are shown on a TV.

Perhaps the two main benefits are those less taken into account by customers when deciding to switch to a solar-powered home system or to a cleaner cooking fuel: health and security improvements.¹¹ The elimination of toxic smoke released by kerosene lamps and charcoal stoves, which causes life threatening respiratory infections and eye irritations, is one of the main benefits of the cleaner alternatives. However, as the CEO of KopaGas explains, users often only see this advantage in the middle and long term, as there is a lack of awareness about this issue. Many clients have become used to the conventional sources and accept its problems, so the change needs to be compelling from an economic perspective first.

Further, having water, gas and electricity delivered at home, instead of having to walk on poorly lit roads to procure them, drastically improves people's security, especially for women and children who are typically responsible for procuring water and energy sources. Gregoire Landel, founder of CityTaps, a company operating smart and PAYG water meters in Niger says, "Because women usually fetch water early in the morning, when it's still dark outside, the risk of sexual assault is a concern. With our smart and prepaid water meters, we help water operators expand their networks so they can bring running water at home to more people, making a huge difference in the lives of women and girls."

¹⁰ World Bank. 2018. *Atlas of Sustainable Development Goals*. [Online]. [Last accessed April 15, 2017]. Available from <http://datatopics.worldbank.org/sdgateatlas/SDG-01-no-poverty.html>.

¹¹ A.A. Rahnema, F. Sánchez, P. Giordano, "Alternative Cooking Fuels in Kenya: How can household decision-making be impacted?" IESE, WP-1177-E, May 2017.



5. The Drivers for Growth

The customer advantages of choosing PAYG solutions helps to explain the growth in sales, but we are also keen to understand why more and more companies are entering this market and why they look at sub-Saharan Africa as a fertile ground to demonstrate their innovations. Why is this region so appealing for PAYG businesses?

- A region where two-thirds of the population still lacks access to electricity certainly represents a huge potential market! The global market volume for lighting products and energy services is estimated at approximately US\$30 billion and US\$17 billion in sub-Saharan Africa alone, making for a very appealing environment, especially when combined with low competition.

Sebastian Rodriguez, CEO of KopaGas says, “One of the reasons why we chose Tanzania is that only 5% of its population uses LPG, while the other 95% still relies on charcoal or biomass. And although the country has natural gas among its natural resources, that doesn’t represent a threat to us, since building distribution pipelines that could reach the households is still too expensive, and thus it’s not yet an option.”

- The high penetration of mobile phones and the developed mobile money ecosystem found in several countries in sub-Saharan Africa are key enablers to scale up the model – which leverages digital payment platforms – according to most of the companies interviewed. In fact, the rate of subscription to mobile phones passed from 12% in 2005 to 76% in 2015. Mobile money accounts surpass bank accounts in 18 sub-Saharan African countries, such as Kenya (58% have mobile money accounts vs. 23% who have bank accounts), and 16% of the adult population in the region actively uses a mobile money product, against a 2% global average.

What Is Mobile Money?

Mobile money is an electronic payment system that enables users to make and receive payments through an electronic account that can be accessed via a mobile phone. Each customer’s account is linked to their mobile phone number by means of an in-built SIM-card application. Since it doesn’t need to be connected with a bank account, mobile money can extend the reach of financial services to those who have traditionally been unbanked, such as low-income or remote households.

With the automatic collection of payments through mobile money, the PAYG companies avoid collecting cash, a process that not only involves security concerns but, most importantly, erodes almost all of the companies’ profits and strongly impacts the scalability of the business. “In Tanzania, it is very important to go cashless,” explains Sebastian Rodriguez, from KopaGas, “but this is not an issue for our company, since in Tanzania mobile money penetration is very high. Being backed by a healthy and competitive mobile telecommunication industry translates for us into transaction costs as low as 1% of the total distribution cost. It is very important to have a good partnership with a telecom company.”

- Another important condition is the absence of regulatory barriers for the PAYG models. In fact, in general providers of PAYG solar, cooking and water systems in sub-Saharan Africa operate on the margin of the regulation designed for the utilities/grid operators and IPPs, which otherwise would prevent them from making good use of their technologies. “When we tried to deploy our innovative gas smart meter in countries with



more mature energy systems, such as Mexico” says Sebastian Rodriguez “we couldn’t fully exploit its potential: we were not allowed to switch off the supply to a customer who ran out of credit, a critical condition for our model to work.” Some countries in the region even play a supportive role, with low or zero value added tax for solar technology (Kenya and Ethiopia), as well as tax increases on charcoal or cuts to kerosene subsidies (Tanzania).

- The support of an international community of investors – ranging from foundations to development banks and donors – prepared to identify quality innovative companies is another factor contributing to the spread of PAYG initiatives in sub-Saharan Africa. These investors have a strong interest in investing in the growth of the sector at varying stages (nascent stage, impact funds, venture capital and large companies) and this is especially true in the solar sector, since it is better understood and more easily accepted than the LPG/cooking innovations.

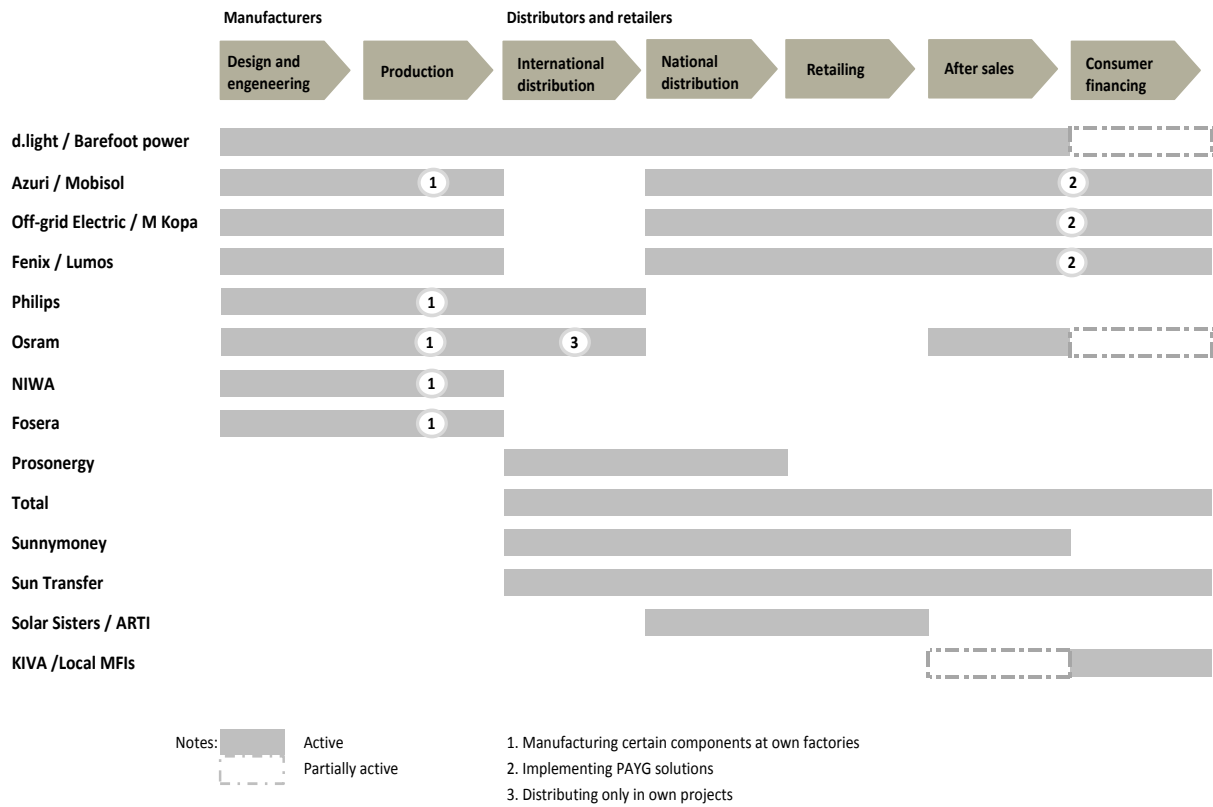
6. Finding the Right Strategy Through The Value Chain...

Although we all know that finding fertile ground is a key requirement for a company to flourish, we also know that it is not an exhaustive condition. Where does a company need to focus to fully take advantage of these opportunities and become successful in the sector?

Ignite Power and Rwanda’s National Electrification Strategy

Although most of the companies are comfortable operating in a market with little or no governmental interference, others advocate for stronger government engagement, with centralized planning and public-private partnerships to unlock the full potential of the sector creating economies of scale. This is the case of Ignite Power, a company providing nation-scale off-grid solutions in Rwanda, where they collaborated in the creation of a national program with the support of government and utilities companies, aiming to connect 250,000 homes by 2018. This centralized electrification strategy is allowing them to deploy the solutions faster, at lower costs and with more guarantees for entrepreneurs and users. Ignite’s top-down approach leverages the proactive governments, which wants to increase access to energy.

Some years ago, companies had to work through the whole value chain, creating their own solutions in product design and engineering, software, distribution, financing and customer support. Although some companies still operate in this way, as the market has matured, most firms have been encouraged to specialize. As a result, the strategies adopted by different companies and their positioning on the energy service and product value chain vary significantly, as we see in the graph below:



Source: Technical Assistance Facility -Sustainable Energy for ALL – Western and Central Africa. 2016. *Sustainable Energy Handbook - Module 5.4 Off-grid Rural Electrification - Standalone PV Systems, 2016*, [Online]. [Accessed 28 March 2018]. Downloadable from <https://europa.eu/capacity4dev/public-energy/document/sustainable-energy-handbook-module-54-grid-rural-electrification-standalone-pv-systems>.

Based on our interviews with a group of startups, we identified three areas receiving more attention that have driven the competition.

6.1. Technology Provider

While the hardware behind the solar PAYG model (namely the photovoltaic and battery technologies) has already become a commodity, with most of the solar product commercialized in Africa imported from China, there is still an opportunity for innovation in both product design and software.

In terms of software, some companies have focused their strategy on developing technology to support the payment system or the use of data collected from customer interactions, or they have developed the remote control technology or credit analysis tools, offering them as software-as-a-service for other PAYG companies or for their own usage. Although some players believe that even software will end up becoming a commodity as well, with a few winners distributing their solution to other operators, other companies see an opportunity to gain a competitive advantage or to become a successful provider of such technologies.

Solaris Offgrid is one of the B2B companies specialized in designing a PAYG platform through an integrated approach (hardware, software and consulting) and distributing their technology to other companies focused on the downstream operations. To do that, Solaris uses its own



operating branch in Mwanza (Solaris Tanzania) as a means to develop its PAYG systems and management platform in the field, through direct feedback and a faster reiteration of the technology, and as a demonstration for other operators on how to scale faster while making the best use of the technology they provide.

6.2. Logistics Expert

KopaGas and CityTaps provide technological solutions for LPG and water operators respectively, in addition to developing their own smart meters. The development of smart, prepaid meters in conjunction with software is crucial to optimizing utility operations. Both companies use their own PAYG technology to achieve a leaner utility supply chain.

As Sebastian Rodriguez from KopaGas states, “Distribution revealed to be the most important part of our business and an excellent opportunity to exploit and build a competitive advantage.” In fact, poor infrastructure in sub-Saharan Africa makes the last mile to the customer’s household really challenging for a company, especially for those operating in the LPG business, which requires constant refills. Furthermore, the provision of energy gets very expensive as you move towards the rural areas. However, by tracking consumers’ behavior and getting to know their consumption patterns, KopaGas became more and more efficient in their logistics. “If initially four reserve cylinders for each household were needed in different parts of the supply chain to speed up the refilling operations, now only two are needed,” Sebastian proudly says. By leveraging the advantages offered by their smart meter, the company was able to monitor the level of gas in the customer cylinders, and as a result it was better able to predict the demand, reduce the number of reserve cylinders in the system and offer lower prices to its customers.

6.3. Focusing on Presence on the Ground

Others, like Village Popwer and PEG, focused efforts on building a strong and engaged relationship with customers. As Thomas Huth from Village Power says, “We shifted our focus from a technological control of customers, through the classic switch off of the system in case of non-payment, to a more personal control. To do so, we employ around 100 sales and customer service representatives and train them to select customers and to inform them appropriately of the importance of keeping up with payments. With this strategy, we managed to reduce significantly our default rate.” Similarly, Hugh Whalan, CEO and co-founder of PEG, which was the first in the industry to license hardware and software from partners so that it could focus on customer acquisition, financing and branding, explains that, “In the future, margins will shrink and there will be rapidly diminishing returns on the technology itself, both hardware and software. Value has to be put on customer service, brand and presence on the ground.” He explains that at PEG they invested in their own network of prepared agents who carry out a careful customer selection. “We want to do our own diligence, in the same way as banks do before delivering a loan. They would never allow someone else to do the diligence,” he says. Furthermore, he adds, “the direct and constant contact with the final client should serve to know our clients better and better to provide them with the services they need. For example, after noticing that payments were often stopping as a consequence of medical expenses, we recently decided to add hospitalization insurance as a benefit that comes with the product.”



7. ...With the Right Team

Positioned between the energy and financial sectors, with a strong technological component, and operating between Africa and Europe or the United States, the companies we met are run by multi-disciplinary teams with both local and foreign employees – a necessary condition to handle the complexities of their operations. Behind the different positioning and strategic approaches, we found young – but experienced – teams. In general, at least one of the founders is foreign and the other founder or other senior members are African. This combination facilitates access to international investors and technological partners, while assuring the capacity to understand and deal with the local market and develop ad hoc commercial and operational strategies. Usually, teams are started in countries other than where they primarily implement their solutions.

8. The Challenges of a Rising Model

Optimistic and passionate about the future of a sector that is already impacting the lives of many, the experts we interviewed share the view that, although PAYG has grown fast, it is a young industry with many challenges to overcome and plenty of room to evolve. As an industry in the early stages of development, many startups are still below break-even and dependent on external funding to grow. Further, there are several market issues creeping in and some major challenges still to overcome including:

8.1. Mobile Penetration Does not Mean Digital Education

Most of the companies aim to have 100% of their customers pay by mobile phone. However, even in countries with a high mobile penetration rate, not all customers are familiar with mobile money payments. This means that PAYG companies have to introduce and educate their potential clients.

8.2. Difficulty of Scaling Up in a Fragmented Market

As Kunle Odeunmi, co-founder of Arnergy, a solar company operating in Nigeria remarks, “In sub-Saharan Africa there’s never such a thing as a copy-and-paste business model, and not just at a regional level, but also at an in-country level. The solution that works perfectly in one part of the country might not work in the next one. Customers’ behavior varies a lot in the range of a few miles: different crops cultivated, for example, generate different cash flows, and different households’ composition determines different needs of energy.” To scale up a solution/model is not such an easy task in reality. For Arnergy, “To be aware of these differences and to be able to adapt the product to people’s needs fast is the only way to scale up.” For this reason the company, which was at first looking for a technology ready to be purchased and distributed extensively on the market, reversed its course and decided to design its own technology in a modular format, so it could be ready to adapt more quickly and more easily.

8.3. Government Policies Changing Along the Way

Although governments and their policies are in general not a barrier, entrepreneurs should be prepared to face changes in the governmental approach along the way. For example, Arnergy reports that when they began operations in Nigeria, there was a renewable energy policy in



place to exempt solar products from value added taxation. This is no longer the case, and the company is responsible for value added taxes as a result. As the sector grows, it should receive more attention from the public sector, which could translate into technical requirements of the product to satisfy minimum quality standards. Furthermore, as off-grid solutions are becoming more affordable and reliable and are starting to become the least expensive alternative to electrification in some remote areas, some governments have started incorporating these technologies into their rural electrification strategies. Should this trend progress as expected, mini-grids and stand-alone systems will become a natural part of the centralized electrification planning processes, which could create friction points with the private companies operating using the PAYG model. How policies or national programs could impact the sector and how they could benefit the off-grid population will depend on the approach taken by each country, but some companies remain skeptical about the outcomes of any government intervention, afraid that it could compromise fair play, create distortions in prices, benefit just a few players and leave space for corruption.

8.4. And What About the Electricity Grid?

What will happen to PAYG when the grid arrives? Surprisingly, the grid and the potential competition that it entails do not seem to be a concern yet. It covers a limited percentage of the territories and it is still a long way off for rural areas. But even in the areas where the grid is available, it is not necessarily the default option, either because the upfront costs are too high or because it provides poor service – just three hours of service per day in some areas of Nigeria – or simply because clients' needs are already satisfied by the off-grid system. It seems as though off-grid solutions could remain a long-lasting alternative to connecting to the grid, especially as more powerful and sophisticated products come onto the market.

9. Financing Working Capital

Last but not least, the biggest challenge, reported unanimously by all of the companies we interviewed is how to finance growth.

While many of the technical barriers in this market are already falling, the access to capital to sustain rapid growth still represents a major challenge. Up to now, companies have been very successful in raising capital both in grants, for the innovation and pilot stage, and in equity, for the developing stage. More recently, debt investment is also increasing as an option among the community of international investors, a signal of the increased confidence in the PAYG model.

However, with sales growing at a faster pace than the operational cash flow allows, for most of the PAYG companies *finding credit providers to finance their working capital remains the biggest challenge*. In this highly capital-intensive model, at each sale, the model requires an initial outlay to pay for the solar kit (or for the LPG full cylinder, in the case of the solution for cooking) plus the operation and commercial expenses, which will be paid back by the customer in a period of between one and two years.

Securitization,¹² sometimes used by larger PAYG companies to finance their working capital, is not an option for many early stage companies that do not yet have the necessary volumes.

¹² Securitization refers to the practice of selling to investors the future cash flow originated by the contracts already in place with customers.



Moreover, whether it is in the form of grants, equity or debt, funding almost always comes from international sources, with a *very limited presence of local investors*.

Although it is effective, sourcing capital on the international market presents some challenges for the PAYG companies:

1. First, they need to put in place *complex structures* to raise capital, which entails high transaction costs.
2. Second, they expose themselves to *currency risk* by borrowing in foreign currencies (typically in U.S. dollars or euros) and financing their customers in local currencies.

Due to these challenges, *local entrepreneurs are restricted from participating in the industry*, or at least they encounter a high barrier to growth, because they often do not have the strength to borrow on international markets and are unable to develop complex financial structures. As a result, most of the known PAYG companies operating in the sub-Saharan market were started by foreigners.

Foreign companies also face the lack of local financing, and this is identified as a *key barrier to scaling up* as it heavily impacts the price of the service offered to their customers and consequently their growth.

Although they face little intra-market competition in most of the countries, PAYG energy companies are still perceived as high risk by local financial institutions. On the one hand, the industry is still in its early stages, and the firms are struggling to provide the track records and collateral required by traditional financial institutions. On the other hand, banks and lending companies have a limited understanding of the technology behind the PAYG model and little to no information about the low-income customers to which their products are addressed.

To change this perception, Y, from X, explains that in Z the PAYG solar companies are cooperating in setting up a *country-wide monitoring system in order to counter the exaggerated risk perceived* by the lending entities. “By collecting our customers’ repayment data on a common database,” he says, “we want to facilitate the financial institutions’ understanding of the cash flow patterns underlying the PAYG model and raise their confidence in the business. By building a benchmark across the industry we want to help them to develop more accurate methods of assessing our companies’ credit worthiness.”

In fact, once companies across Africa adopt new technologies, and most importantly mobile money, it radically changes the way they can be financed. Platforms like Kopo-kopo and Kountable, for example, are already *using technology to provide funds to local startups and to small and medium-sized enterprises*. Leveraging their mobile technology, they can track exactly what loans are used for and how the payback progresses, increasing both the information and transparency regarding the usage of the loan, which reduces the risks and attracts potential lenders/investors. In the case of the PAYG companies, for example, Kopo-kopo and Kountable are able to monitor their cash flows – through the M-Pesa system used by the startups as the main payment method – and to be reimbursed first and directly, before the PAYG company even touches the money. With all these facilities, banks and investors can offer lower interest rates as compared to conventional channels, resulting in a better deal for the companies looking for capital.



10. What's Next? The Future of PAYG

When asked what the future holds for the PAYG sector, in their view, the companies we interviewed outlined a vibrant picture, both in terms of industry development and the products and services offered. Here the main trends noted from these interviews:

Pay-as-you-go will keep spreading across Africa, with new startups entering the market: with a huge market yet to be served (more than 600 million people without electricity and clean cooking fuels in sub-Saharan Africa), there is room for new players, which will benefit from the ecosystem and products created by the market leaders (especially concentrated in East Africa), to become their distributors, focusing on developing efficient logistics and commercial channels. These companies may face challenges to replicate/scale-up as they move towards more complex market environments, with lower solar awareness, an absence or low penetration of mobile money systems, and regulatory barriers.

That said, we also expect *more mergers and acquisitions* in the sector, as the companies will assess these options to expand geographically and internationally, complementing potential gaps in their value chain or simply to gain economies of scale.

Large energy companies will enter the sector: the recent acquisition of Fenix International (PAYG company with its headquarters in the United States and operating in Z and Z) by ENGIE and the partnership between EDF and Off Grid Electric (Tanzania) was a milestone in the PAYG solar home system industry, demonstrating that utilities are recognizing the potential of the sector.

Clients will move up in the solar energy ladder: with the cost of the solar panels and batteries further declining, and more energy-efficient appliances coming on the market at lower prices while families' incomes increase, clients will demand larger solar home systems. The demand for these systems will change from solar lanterns to basic solar home systems (lights, radio and phone charger) to larger systems that power TVs, fans and small fridges. Companies are preparing to offer upgrade plans to their clients by adding more solar modules, batteries and appliances.

The PAYG model and data could unlock the markets for a variety of other products and services that are not energy related: by keeping their balances active and showing a good repayment track record, the customers are building their credit record while providing valuable information to firms interested in microfinancing their products and services to these families, potentially using the PAYG solar platforms to collect payments. Furthermore, a paid-down solar home system could serve as collateral. For Solaris Tanzania, "Soon the sector will be prepared to attend a larger range of clients' needs, from irrigation systems to internet access."

Companies will engage in cross-sectorial partnerships that can bring mutual benefits: PAYG firms are currently being served by mobile network operators and mobile money platforms – key enablers for the sector. As PAYG firms reach more clients not yet served by mobile services, they will become stronger prescribers for telecommunication companies and mobile money platforms. Working together and leveraging their respective commercial channels, these companies can offer better deals for new customers. Furthermore, the repayment history databases built up over the years by the PAYG companies could become a valuable asset for the banking sector, which could open the way to partnerships or acquisitions.



More governments will show interest in incorporating the stand-alone solar home systems and PAYG solutions in their rural electrification strategies: as the market matures and the technology costs decrease, making the benefits of PAYG more evident, we should expect centralized programs and initiatives. Furthermore, governments could require minimum technical standards for the products to protect customer interests.

For the time being, something amazing is already happening. As the good, clean smell of cooked beans permeates the air, Chicke is reading on his mom's lap, the pages of his book illuminated by the bright light of an LED bulb.