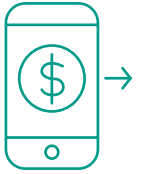


Digital Payments



→ Part of the report: **Energy Access, Data and Digital Solutions**



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THIS DOCUMENT IS PART OF THE REPORT “ENERGY ACCESS, DATA AND DIGITAL SOLUTIONS”.

The report shows that the large-scale and often realtime collection, analysis and use of all kinds of datasets, enabled by the rapid, global technology shift called “digitalization,” is in the process of transforming the energy access industry. Companies across the energy access spectrum use digital solutions to enable their businesses and as the industry matures, there is a growing number of specialized digital solution providers.

The full report can be downloaded here ([link](#)).

DIGITAL PAYMENTS

KEY POINTS

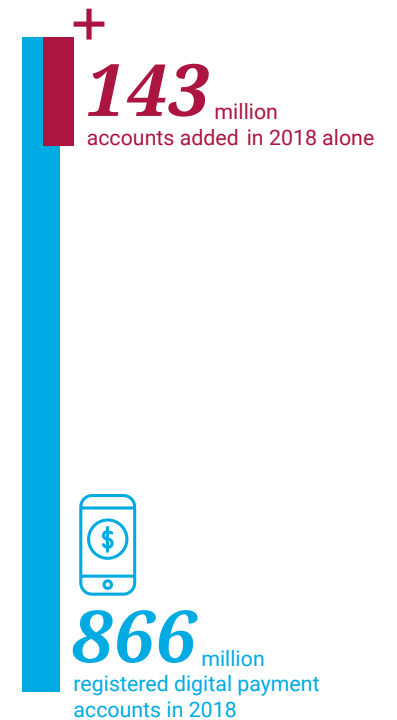
- Digital payments, and mobile money in particular, have had the largest single impact of all digital solutions on the energy access market and are directly associated with the rapid growth of the OGS sector.
- With supportive policy, adoption from mobile network operators (MNOs) and the business case proven in many markets, mobile money is spreading quickly.
- Historically, digital payment platforms have been proprietary solutions. Now, a number of third-party solutions are available, such as PaygOPS and Paygee. This lowers the market entry barrier for new OGS and mini-grid companies.
- The evolution of digital payments has not plateaued. There is ongoing and promising research and development in the core technology, as well as on the data analysis around it.

Digital payments are all non-cash payments, in which the payer initiates the payment electronically. One type of digital payment is mobile money. This disruptive technology has emerged as a leading payment platform in many developing countries with over 866 million registered accounts (143 million were added in 2018 alone) and transactions worth \$1.3 billion conducted every day.⁴¹ Energy access operators have rapidly integrated mobile money into their business models, because it dramatically reduces their operating costs and risks associated with handling cash. Often, it is the only payment method they

offer to customers. In the countries where mobile money is not widely available (for instance, in much of franco-phone West Africa, in Nigeria or in Ethiopia), it severely hampers the growth of electrification businesses.

—
» *We only accept payments through mobile money. PAYGO solar is a technology enabled business model.*«

... ALESSANDRO
... PIETROBON,
... ZOLA Electric⁴²



41 – GSMA, 2017 State of the Industry Report on Mobile Money, 2018 ([link](#)) and 2019 ([link](#))
42 – TFE Energy, Case study interview, Alessandro Pietrobon, ZOLA Electric

1 THE DEVELOPMENT OF DIGITAL PAYMENTS

Digital payments have been used by energy access companies – especially OGS companies – for more than a decade and have become ever more important, as the OGS market transitions towards selling larger, more expensive products that offer higher tier energy access.⁴³ Most energy access customers do not have enough money to buy a product outright. The PAYGO model, a payment in installments, solves this problem but raises another one, albeit for the vendor: the need for regular payment collection. If cash is used as the payment method, the customer needs to regularly interact with a physical vendor agent. This would be straightforward in an urban setting, but OGS customers are typically scattered and located in remote, rural areas: enter digital payments. These have become the main payment method for PAYGO. The centrality of digital payments to the OGS business model is reflected in investment trends between 2012 and 2017, when PAYGO companies received 85% of the funding in the OGS market – a total of \$773 million.⁴⁴

The combination of extensive mobile communication service coverage, high mobile device ownership rates and widespread mobile money adoption in Sub-Saharan Africa has meant that the region had become the ideal market for implementing mobile money based PAYGO technology. Kenya, in particular, is a pioneer since the

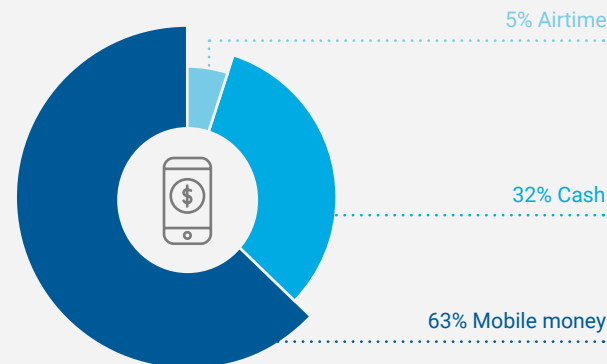
establishment of the M-Pesa platform. Many of the current OGS and mini-grid market leaders use Kenya as a testbed for new innovations.⁴⁵

In 2018, 68% of PAYGO companies were vertically integrated, with more than half developing their own digital payment platforms at costs of \$1-10 million.⁴⁶ Today, digital specialists such as Solaris Offgrid, Mobisol (Paygee) and Angaza offer digital payment solutions off-the-shelf.

» Kenya has been a showcase market for us. I think that it has everything going for it: good connectivity, access to mobile money and a reasonable regulatory framework. It is a great testbed for the sector.«

CHRISTOPHER
BAKER-BRIAN,
Bboxx⁴⁷

Figure 11 – The use of mobile money by OGS PAYGO companies⁴⁸



Mobile money is the dominant form of payment for PAYGO operators.

The distribution of mobile money is not uniform across geographies. East Africa has a much larger share of mobile money payments than other geographies. As the market continues to mature, mobile money will likely grow its share globally. This is, however, contingent on major markets such as India and Nigeria adopting enabling policy.

43 – World Bank and GOGLA, Off-Grid Solar Market Trends Report 2018, 2018 ([link](#))

44 – World Bank and GOGLA, Off-Grid Solar Market Trends Report 2018, 2018 ([link](#))

45 – TFE Energy, Kenya: The World's Microgrid Lab, 2017 ([link](#))

46 – World Bank and GOGLA, Off-Grid Solar Market Trends Report 2018, 2018 ([link](#))

47 – TFE Energy, Case study interview, Christopher Baker-Brian, Bboxx

48 – World Bank and GOGLA, Off-Grid Solar Market Trends Report 2018, 2018 ([link](#))

Smart metering companies, such as SparkMeter and SteamaCo, have integrated mobile money payments into their systems to allow mini-grid operators to leverage digital payments. There are also partnerships emerging between off-grid energy access companies and mobile network operators (MNOs). The latter can offer the former a channel to reach customers, while the energy access companies can help MNOs grow their customer base and

» An important part of our collection method was our physical presence in the village. We maintained regular face to face contact with our customers which helped ensure they came to payment meetings and paid on time.«

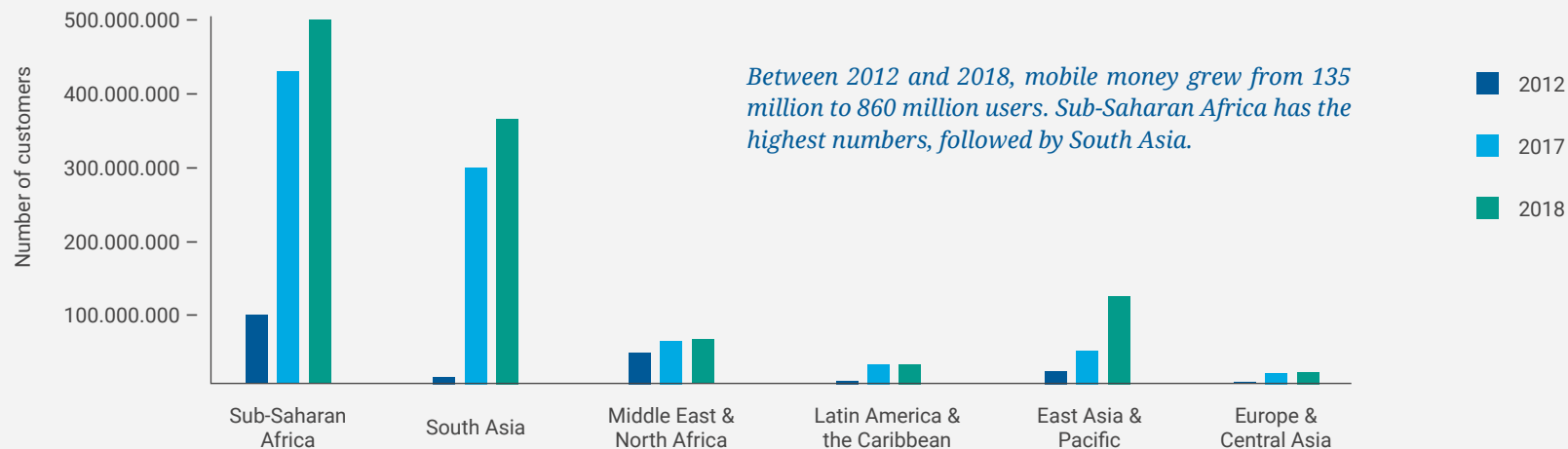
NIKHIL JAISINGHANI,
former executive director and
co-founder of Mera Gao Power⁵¹

increase sales with existing customers. The mini-grid company Deveryg and the mobile money provider Tigo have formed such a partnership in Tanzania.⁵⁰

» Mobisol would like to utilize small, “mom and pop” shops as distributors. This is currently not possible due to the high entry cost tied to mobile money integration. Reducing the cost of mobile money can change the way the market operates.«

STEFAN ZELAZNY,
Mobisol⁵²

Figure 12 – Mobile money users by region⁴⁹



49 – World Bank and GOGLA, Off-Grid Solar Market Trends Report 2018, 2018 ([link](#))

50 – GSMA, Deveryg: Leveraging a mobile services bonus to encourage the use of mobile money wallets for smart solar mini-grids in Mbeya, Tanzania, 2018 ([link](#)); another interesting example is the collaboration between Lumos and MTN in Nigeria ([link](#))

51 – TFE Energy, Market expert interview, Nikhil Jaisinghani, former executive director and co-founder of Mera Gao Power

52 – TFE Energy, Case study interview, Stefan Zelazny, Engie Mobisol

2 HOW DIGITAL PAYMENTS WORK

PAYGO technologies use similar models. Often, the customer must initiate a payment to unlock an energy product or service. This is done remotely and automatically. In other instances, the device is unlocked by default, and only becomes locked when an account is in arrears. The unlocking or locking of the device is an example of combining digital payments and digital operations. The speed at which this happens depends on whether or not instant payment notifications are in place. Regardless of the payment method used, PAYGO business models all leverage a digital component. Even in the case of cash, an

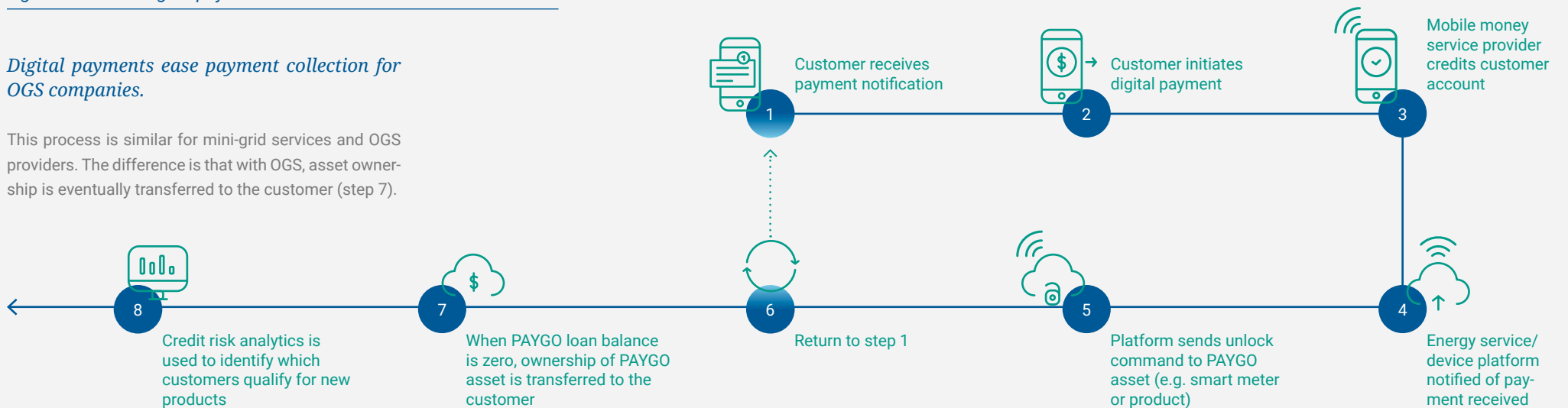
agent will accept the cash payment and then activate the OGS product digitally, through either a cable, Bluetooth or a manually entered SMS code.

In Africa, 90% of mobile money transactions are made over the Unstructured Supplementary Service Data (USSD) layer.⁵³ This fundamental protocol is available on the most basic mobile devices and is even more robust than SMS in areas with poor mobile coverage.

Figure 13 – How digital payments in the PAYGO business model work^{54, 55}

Digital payments ease payment collection for OGS companies.

This process is similar for mini-grid services and OGS providers. The difference is that with OGS, asset ownership is eventually transferred to the customer (step 7).



53 – GSMA, 2018 State of the Industry Report on Mobile Money, 2019 ([link](#))

54 – Adapted from Mastercard, Pay-As-You-Go and the Internet of Things: Driving a New Wave of Financial Inclusion in the Developing World, 2018 ([link](#))

55 – GSMA, State of the Industry Report on Mobile Money, 2019 ([link](#))

3 HOW DIGITAL PAYMENTS ADDRESS THE MAIN CHALLENGES OF ENERGY ACCESS

Digital payments have so far been the most impactful digital solution in the energy access market and are a key driver for the growth for many market leading companies.⁵⁶

3.1 IMPACT ON SCALE

Digital payments enable scale directly, by significantly reducing the complexity of operating an energy access business. The effect can be seen in the growth of the OGS market as a whole. Moreover, energy access companies that use mobile money have been able to attract significantly more investment than those that use cash payments.⁵⁷

Globally, the sales volume of PAYGO products grew by 30% last year with revenues growing even faster at 50% driven by customers upgrading to solar home systems beyond basic products like solar lanterns. According to the global off-grid solar market report, PAYGO companies represented just 24% of the sales volume in the last six months in 2018 but accounted for 62% of revenues.⁵⁸

3.2 IMPACT ON COST

As digital payments reduce the need for agent networks and ease payment collection, they have the potential to significantly reduce operational costs. However, they also come at a cost: for building or buying the solution and for the hardware to enable it. In addition, MNOs charge transaction fees for their mobile money networks that can make up as much as 25% of the total cost of an OGS system over the course of the repayment period.⁵⁹

Digital payments, therefore, only have a cost benefit beyond a minimum operational size and product value. According to case study companies interviewed for this report, the threshold value is around 100 OGS products sold per month. Strategically, however, any energy access company with growth aspirations that operates in regions with network coverage, should integrate digital payment solutions.

3.3 IMPACT ON RISK

Digital payments reduce risk in different ways. Firstly, a business based on cash transactions carries the risk of theft and straightforward fraud. By comparison, a digital payment involves an auditable third-party (in this case the MNO) and is thus more transparent and secure. This increases the confidence of the end-user buying the services, as well as of the investor investing into the service provider.

Secondly, digital payment information can be used to build a credit history and identify opportunities for low-risk customer up-selling. Customers who pay installments on time and repay loans on schedule can be targeted for upgrade products.

Thirdly, digital payments can be linked with digital operations to reduce operating risks. For example, Mobisol has



Image provided by Sam Duby, TFE Energy

56 – TFE Energy, Case study and market expert interviews

57 – World Bank and GOGLA, Off-Grid Solar Market Trends Report, 2018 ([link](#)), Wood Mackenzie, Strategic investments in energy access, 2019 ([link](#))

58 – World Bank and GOGLA, Off-Grid Solar Market Trends Report, 2018 ([link](#)); see also: Quarz, Solar Power in Africa and the Mobile Money Advantage ([link](#)); IFC Lighting Global, PAYGO Market Attractiveness Index ([link](#))

59 – Lighting Global, Off-grid Power and Connectivity: Pay-as-you-go Financing and Digital Supply Chains for Pico-Solar, 2015 ([link](#)); for an assessment of how MTN and Fenix worked to reduce the fees, see a GSMA case study ([link](#))

determined that there is a strong correlation between late payments and default rate. The quicker they are able to address the reasons why a customer is late in paying their monthly installment, for instance a faulty battery (which is easy to detect via digital operations) causing a loss in service, the less likely the customer will default.

Real-time, transactional data can also be used to detect and counter fraudulent payment behavior. Fraud detection is enabled by a combination of data analytics and manual verification. Data analytics can flag potentially fraudulent behavior. Then, a trained person must verify

» *The later the interaction with a customer who is late on a payment, the higher the chance that they will default. Time is of the essence here and the digital platform gives us the opportunity to react almost in real-time.*«

STEFAN ZELAZNY,
Mobisol⁶⁰

whether fraud has actually occurred. As an example, Mobisol is able to detect collusion between customers and agents.

4 CHALLENGES TO DEPLOYMENT

The main barrier to increased use of digital payments is regulations. Some countries, such as Ethiopia, do not currently allow mobile money transactions. This deters PAYGO companies who use mobile money from entering the market. More often, however, the question of how conducive regulations are is a matter of detail, touching on issues of taxation, know-your-customer (KYC) requirements, cross-border payments (especially remittances), national financial inclusion strategies and data protection.⁶¹

Another challenge to deployment is the reach of fundamental enabling factors like GSM network coverage. Energy access companies naturally operate in off-grid and remote areas, where networks are often weak. One reason for weak networks is the challenge of supplying

mobile network masts with stable energy. This can, of course, also turn into a symbiotic relationship with mini-grid companies looking for anchor loads.

Entering a new market can be slow for PAYGO operators, as integration with mobile money networks can take up to six months to complete.⁶³ The largest PAYGO operators are often integrated with more than a dozen MNOs to cover different geographies. Often, each of these integrations uses a different method.

» *We cannot operate in markets where there is no cellphone signal.*«

ALESSANDRO PIETROBON,
Zola Electric⁶²

60 – TFE Energy, Case study interview, Stefan Zelazny, Engie Mobisol

61 – GSMA, 2018 State of the Industry Report on Mobile Money, 2019 ([link](#))

62 – TFE Energy, Case study interview, Zola Electric

63 – GSMA, Mobile for Development Utilities Annual Report: Intelligent Utilities for All, 2019 ([link](#))

5 LOOKING AHEAD

There are a number of key developments in digital payments that are highly relevant for the energy access market. These include innovations in telecom technology, such as the rise of new application programming interface (API) standards, the adoption of 4G, the increased availability of digital payments, as well as the application of data analysis to analyze customer data for commercial insights.

5.1 MAKING DIGITAL PAYMENTS MORE WIDELY AVAILABLE

One approach to making digital payments more widely available is by improving the integration of PAYGO operators with MNOs. The Instant Payment Notification (IPN) Hub, developed by the Global System Mobile Association (GSMA), addresses this by providing a single point of connection between provider of mobile money and those of PAYGO utility services. This minimizes the integration bottleneck and allows companies to more easily scale in new geographies. Specialist digital payment companies, such as PaygOPS or Paygee, will likely benefit the most, because they are designed to scale internationally. Our case study companies, and market experts flagged the potential importance of the IPN Hub, although membership is currently still limited. As of February 2019, seven mobile providers were integrated. The Hub's success depends on higher levels of adoption from both OGS companies and mobile money providers.

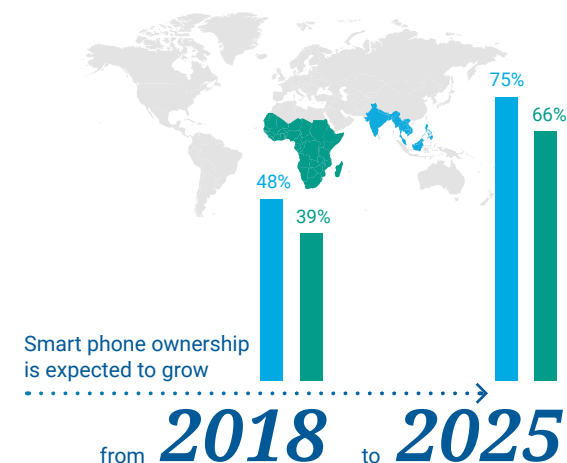
There are also first attempts at using blockchain technology. Okra Solar, for example, works with Bitspark to pilot a blockchain-based payment system in South East Asia. In Africa, there are also encouraging use cases, such that by the South African startup Wala, operating in East Africa.

However, many interviewees, both market experts and case study companies, still expressed skepticism about blockchain, wondering if and when the technology will be able to replace other, more established means of enabling payments.

» *Our team headed to Palawan, a remote island west of the Philippines. Until now, there wasn't an easy way for these communities to pay for commercial services such as power. By simply giving them a way to pay cash for their power bill, communities in Palawan can now pay for their Okra electricity bill remotely using Bitspark.*«

All the more sophisticated payment functionalities, including blockchain, rely on better mobile network service (3G rather than GSM 2G) and more advanced mobile devices, like smart phones. In South Asia, smart phone ownership is expected to grow from 48% penetration in 2018 to 75% by 2025. In Sub-Saharan Africa, penetration could rise from 39% in 2018 to 66% by 2025.⁶⁵ There will likely be a lag until this development reaches the off-grid energy access customer base. Until then, most payment services will continue to rely on more basic protocols like USSD.

» *USSD is not a great mechanism for making payments. It is time sensitive; you can get timed out of a session easily. It requires a degree of literacy; the user has to memorize long strings of numbers and multiple numbers. The buttons and text are small; many older people do not want to engage with it. There are a lot of ways that it can go wrong, but it is still better than the alternative, which for non-smartphone users is cash.*«



Bitspark⁶⁴

DANIEL WALDRON,
CGAP⁶⁶

64 – Bitspark, Bitspark Roadmap Update - The Month of Milestones, 2019 ([link](#))

65 – GSMA, State of the Industry Report on Mobile Money, 2019 ([link](#))

66 – TFE Energy, Market expert interview, Daniel Waldron, CGAP

5.2 USING DIGITAL PAYMENTS FOR CREDIT SCORING

Many rural off-grid energy customers are unbanked. This means that customer data collected by mini-grid operators or OGS suppliers is often their first digital trail. Data on payment patterns and product usage can help create simple creditworthiness profiles. As an example, Bboxx uses this kind of data to identify customer trends, perform credit checks and determine which customers may have the capacity for an upgrade.⁶⁷

» The credit side gets much easier as you get to a higher-margin item because you can afford to do more thorough assessments, you can call references, you can actually visit the borrower's home if you are talking about something in the \$800 or above range.«

DANIEL
WALDRON,
CGAP⁶⁸

5.3 ADVANCED DATA ANALYSIS

Companies are investing into advanced data analysis and are applying new technologies such as machine learning. Some have integrated credit risk assessments and default forecasts into their workflows. There are still some questions around the effectiveness of credit scoring, especially for new markets, and it is important to keep in mind that

many insights and quick wins can be obtained through simpler, big data-based models.⁶⁹ Nevertheless, companies are gaining first insights and experiences that they can then test and improve upon. For example, Fenix has found a correlation between customers who are late on

» We do not currently understand customer behavior well enough to predict who is going to be a good or bad customer or what the payment patterns are going to look like. That is a big challenge in the sector.«

NICHOLAI LIDOW,
LIB Solar⁷¹

their first digital payment and loan defaults. Building on this insight, they have applied advanced analytics to predict which groups are most likely to miss their first payment and are now testing whether a call from the call center can increase the likelihood that this at-risk group will make their payments.⁷⁰

» Credit risk assessments for PAYGO solar home systems (SHS) are really hard, because off-grid, unbanked customers have no history repaying a loan of this size. There were a couple of data firms working with PAYGO firms, trying to create credit scores based on all of the mobile data that they could get through linkups with MNOs such as data records, airtime, mobile money transactions. But it's a different size, term, and type of lending, and those experiments either have not worked or have not worked well enough to justify the cost, yet.«

DANIEL WALDRON,
CGAP⁷²

67 – TFE Energy, Case study interview, Christopher Baker-Brian, Bboxx

68 – TFE Energy, Market expert interview, Daniel Waldron, CGAP

69 – Guilhem Dupuy and Thibault Lesueur, Big Data, Big Opportunity: Is Data Science the Key to Universal Energy Access?, 2019 ([link](#))

70 – Brianna Schuyler, The Interplay of Experimentation and ML to Aid in Repayment of Micro-Loans in Sub-Saharan Africa, 2019 ([link](#))

71 – TFE Energy, Market expert interview, Nikolai Lidow, LIB Solar

72 – TFE Energy, Market expert interview, Daniel Waldron, CGAP

FURTHER READING

GSMA conducts research on mobile money technology and funds pilot projects and studies. GSMA's annual report, *State of the Industry Report on Mobile Money* ([link](#)) provides an up-to-date overview of the mobile money industry. While it does not specifically address the relationship between mobile money and energy access, the annual report, *Mobile for Development Utilities* ([link](#)), describes the linkages between the telecommunications industry as a whole and the energy access industry. Finally, GSMA, through their Mobile for Development Utilities Fund, has produced a number of case studies, highlighting the mobile-related work of several energy access companies, such as *Mobisol*, *Devergy*, *Village Infrastructure Angels* and *ME SOLshare*. A complete list of case studies can be found here ([link](#)).

The Consultative Group to Assist the Poor (CGAP) is a global partnership of development organizations and publishes on PAYGO and mobile money. The primer, *Open APIs – From integration to Innovation: Implementing an Evolving API Strategy*, 2018, ([link](#)), provides a brief overview of how APIs are changing. In a 2015 article titled, *What is USSD & Why Does it Matter for Mobile Financial Services?*, 2015, ([link](#)), CGAP describes USSD in detail.

Bankable Frontier Associates (BFA), has written a report called *Payment APIs: What, Why, and for Whom? An Introduction to Payment Interfaces & the Kenyan*

Market, 2016, ([link](#)). It is one of the best resources for gaining a deeper understanding of the role of APIs in digital finance.

Lighting Global is the World Bank Group's initiative for increasing energy access through OGS. It is a market authority on OGS and publishes many reports on quality standards, policies, technology and markets. The report, *Off-grid Power and Connectivity: Pay-as-you-go Financing and Digital Supply Chains for Pico-Solar*, 2015, ([link](#)), was one of the first to explore the impact of digital solutions on off-grid energy access.

Companies, such as Solaris Offgrid and Angaza, publish *technical articles* on solutions, impact and technology development. Solaris Offgrid's material can be found here ([link](#)) and Angaza's here ([link](#)).

The Future Energy Program, has written a report *Digitalization for Energy Access in Sub-Saharan Africa: Challenges, Opportunities and Potential Business Models*, 2019, ([link](#)). The report provides an in-depth view on the status of the role that PAYGO technology plays in OGS solutions.



Image provided by Sam Duby, TFE Energy

ABOUT TFE ENERGY

TFE is dedicated to achieving universal energy access and to improving investments into remote infrastructure. Our team consists of data technology experts on the one side and village electrification experts on the other. This breadth allows us to continuously test and validate new data technologies in the field and work towards specific solutions – such as Village Data Analytics – that create tangible value to the electrification ecosystem. We are always looking for passionate, talented people to join our teams in Munich/Germany and Cape Town/South Africa (for open positions see [here](#)).

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