



# Mobile for Development Utilities

## Lessons from the use of mobile in utility pay-as-you-go models



The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with almost 300 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai and the Mobile 360 Series conferences.

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## Mobile for Development Utilities

The Mobile for Development (M4D) Utilities programme promotes the use of mobile technology and infrastructure to improve or increase access to basic utility services for the underserved. Our programme focuses on any energy, water or sanitation services which include a mobile component such as mobile services (voice, data, SMS, USSD), mobile money, machine-to-machine (M2M) communication, or leverage a mobile operator's brand, marketing or infrastructure (distribution and agent networks, tower infrastructure). The programme receives support from the UK Government.

Cover photo: Fenix International

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### The Innovation Fund

The Mobile for Development Utilities Innovation Fund was launched in June 2013 to test and scale the use of mobile to improve or increase access to energy, water and sanitation services. In two phases of funding, grants were competitively awarded to 34 organisations across the globe. Seed grants were awarded for early stage trials, Market Validation grants for scaling or replication of business models, and Utility Partnership grants to foster partnerships between utility companies and innovators.

The specific objective of the Innovation Fund is to extract insights from the trial and scaling of these innovative models to inform three key questions for growing the sector:

- How can mobile support utility services?
- For a mobile-enabled solution to be adopted at scale, what building blocks are needed?
- What are the social and commercial impacts of delivering community services to underserved mobile subscribers?

These insights, as well as grant-specific learning objectives, are included in individual case studies, as well as thematic reports published throughout 2015 and 2016.




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# Introduction

Mobile technologies and services are disrupting emerging economies and unlocking inclusive new business models directly targeting the poor. In the off-grid energy sector, the “mobile-enabled solar pay-as-you-go model”, or *PAYG solar*, has been enabling access to financed clean energy solutions since the early 2010s. Using the rails of the more mature East African mobile money deployments, pioneers proved the concept, refined their models and secured partnerships with Mobile Network Operators (MNOs) for mobile money integration, and in some cases branding, marketing and distribution.

With up to 800,000 solar home systems available on a PAYG basis,<sup>1</sup> and close to 40,000 new systems being installed on a monthly basis,<sup>2</sup> the model has proved its solid technology foundations, high demand and low income customers’ ability to pay for clean energy. It has also led the off-grid energy sector to attract an unprecedented amount of funding – in the past 4 years, more than USD 360 million have been invested in PAYG solar ventures.<sup>3</sup> Since repayment time for systems is in general one year or more and up-front investments are high, unlocking more capital will be critical to cement this early success story and sustain current growth, enable expansion to new geographies and support new entrants. Steadily growing in East Africa, PAYG solar sales are also making good progress in West Africa and South Asia.

The PAYG solar model is also a perfect example of the “second wave of inclusive digital innovation”<sup>4</sup> impacting lives around the globe. Emerging from the convergence of innovations around the Internet of Things, cloud computing and mobile financial services, these new service delivery models provide flexible payment terms while collecting intelligence on users and the systems they are using: creating a credit history through mobile payments for customers

with no formal financial history; enabling predictive maintenance through Machine to Machine (M2M) connectivity and better understanding of customer power consumption profiles. Beyond solar home systems, such mobile innovations are increasingly harnessed in other solar infrastructure, i.e. mini-grids and other solar products such as lanterns, and to a lesser extent for water and sanitation, i.e. water kiosks, hand-pumps, and latrines.

Fundamentally, mobile-enabled PAYG providers are good partners for mobile operators looking to expand and stimulate their customer base in underserved and rural locations, improve Average Revenue per User (ARPU) and reduce churn. For example, PAYG solar providers operating in Sub-Saharan Africa are becoming some of the largest mobile money bill pay recipients: Fenix International was the third in Uganda bill pay customers to mobile operators, while PEG in Ghana has become the biggest business for MTN bill pay services, outside of key government services and urban utilities.<sup>5</sup> With an estimated 1.6 million mobile money transactions generated per month (September 2016), PAYG solar can also generate significant revenues in transaction fees for mobile operators operating in low ARPU markets. There are early signs of increased financial inclusion with new customers signing up to mobile money services to access PAYG solar services. Even in markets where mobile money is not an option for payment collection, using airtime instead can generate new revenues as well as reduce churn for mobile operators.

Thanks to its partnership with UK Department for International Development (DFID) since 2013, the GSMA M4D Utilities programme has provided funding to 34 organisations in 24 countries, a majority of them looking to test and scale mobile-enabled PAYG models (see Appendix 1). Using the learnings from six case studies already published on the PAYG solar

1. As of November 2016

2. Ibid

3. Bloomberg BNEF, October 2016, “How can PAYG solar be financed?”

4. From Wim van der Beek, Goodwell Investments, at the Sankalp Africa Summit 2016

5. Based on data collected at the end of 2015

model,<sup>6</sup> combined with general industry trends in the energy, water and sanitation sectors, this report focuses on how mobile can further support the emergence and sustainability of innovative utility models delivering services at the Bottom of the

Pyramid (BoP). We also outline how partnerships with mobile operators can facilitate deployments, and what recommendations for both service providers and operators would result in further growth.

## Definition of pay-as-you-go (PAYG)<sup>7</sup>

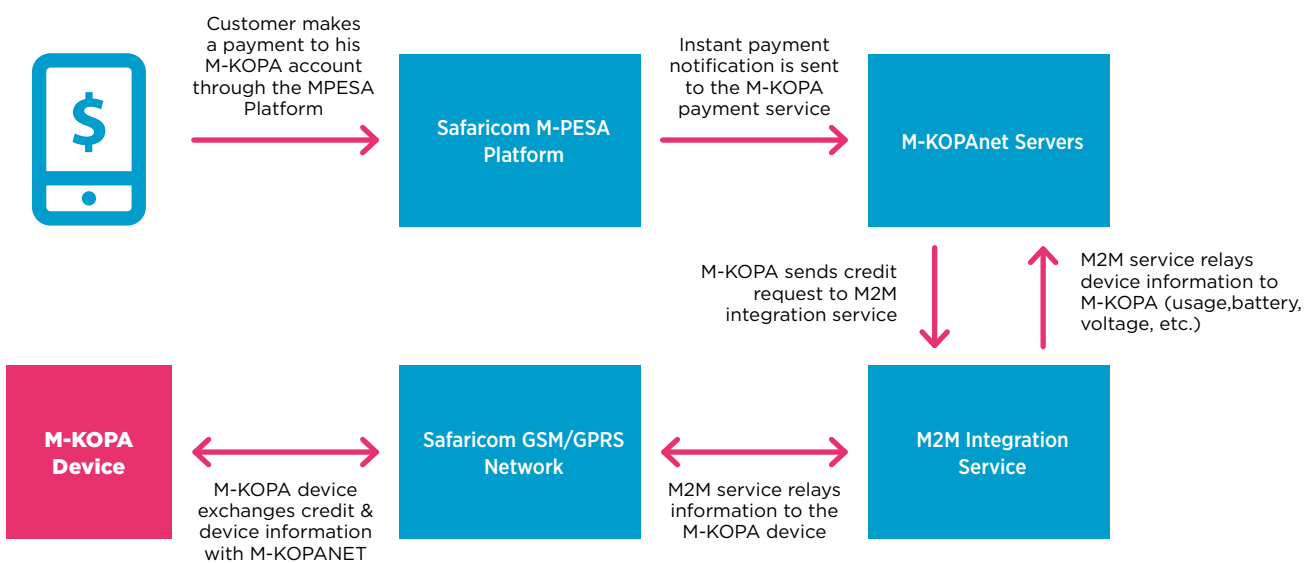
Mobile technologies (or channels) underpin the PAYG model in three main ways (see Figure 1 for the PAYG solar model): they enable payment collection through mobile money or other forms of mobile payment; they update and control PAYG-enabled assets or services through M2M (long range technology such as GSM, or shorter range, such as Zigbee) or keypad; and they enable communication between service providers, customers and local agents through mobile devices and services such as SMS or mobile apps.

the customer side, it is affordable and convenient for those with irregular incomes. PAYG expands addressable markets significantly and, in some cases, builds consumer trust by offering a low-risk, low commitment trial. This is especially important in areas where low-quality solar products may have damaged user perceptions and opinions of the service. For service providers, PAYG allows more accurate awareness and control of systems performance, efficient and secure payment collection and gives customers an incentive to pay regularly since the service is suspended if they default (although service providers usually offer a grace period).

Across sectors, mobile-enabled PAYG meets important needs for both customers and service providers. On

**FIGURE 1** Source: M-KOPA

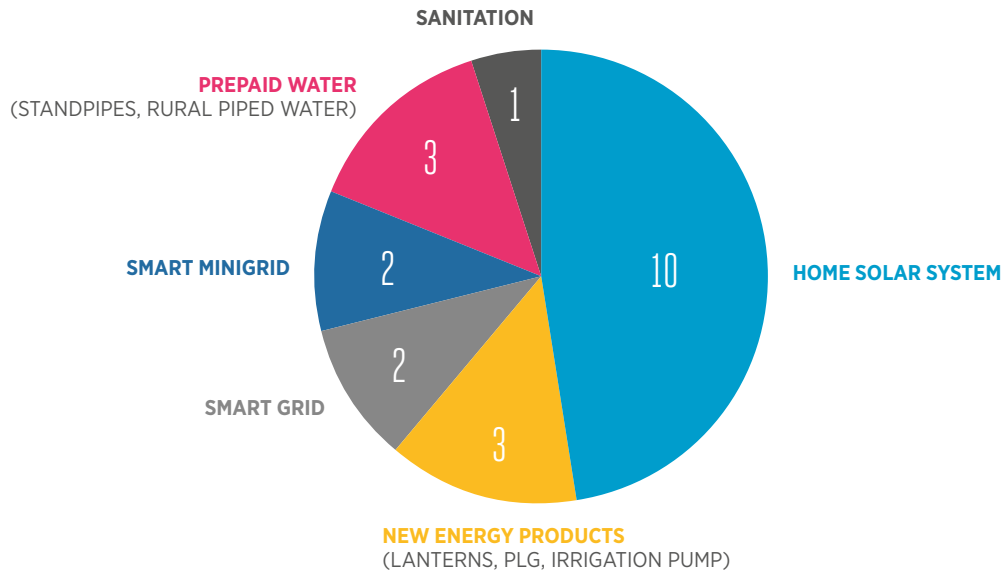
### Using mobile money and M2M communications in the PAYG solar model (M-KOPA in Kenya)



6. Phase 1 Case Studies are available on the GSMA website - [GSMA M4D Utilities Resources](http://www.gsma.com/m4dutilities/resources)  
 7. GSMA Mobile for Development Utilities, 2016, "Unlocking access to utility services: the transformational value of mobile", <http://www.gsma.com/mobilefordevelopment/programmes/m4dutilities/annual-report>

# GSMA M4D Utilities grants provided to PAYG pilots

In the programme's Phase 1 (2013-2014) and current Phase 2 (2015-2017), 21 grants were awarded to energy, water and sanitation organisations piloting mobile PAYG solutions:



## M4D Utilities grantees and partners



# Solar pay-as-you-go market – state of play

As an indicator of the growth of the mobile-enabled utility sector, we are focusing of the PAYG solar model, which has already impacted millions and attracted the majority of investments so far. However, smart

minigrids and smart water systems (kiosks, water pumps and irrigation pumps) are also getting traction, impacting thousands of lives and growing.

## FOCUS ON THE PAYG STATE OF PLAY



PAYG SALES OF

**800k** units

A CAGR OF 140%  
IN THE LAST 4 YEARS  
(NOV 2016)

MORE THAN

**40k**

UNITS SOLD ON A  
MONTHLY BASIS  
(NOV 2016)

FORECASTED

**7** million  
units

CUMULATIVE SALES IN 2020



INVESTMENT IN MOBILE-ENABLED PAYG  
PROVIDERS MORE THAN

**USD 360m**

IN THE LAST 4 YEARS  
(SOURCE BLOOMBERG NEF)



PAYG PROVIDERS EXTENDING  
LOANS UP TO

**USD 10m**

PER MONTH TO INSTALL NEW  
SYSTEMS (SEP 2016)



**5** PROVIDERS ARE  
RESPONSIBLE  
FOR MORE THAN

**90%**

OF THE SALES (SEP 2016)

RAPID GROWTH

**3%**<sup>2016</sup>

**10%+**<sup>2020</sup>

PROPORTION OF PAYG SOLAR SALES BASED  
ON LICENSING ARRANGEMENTS

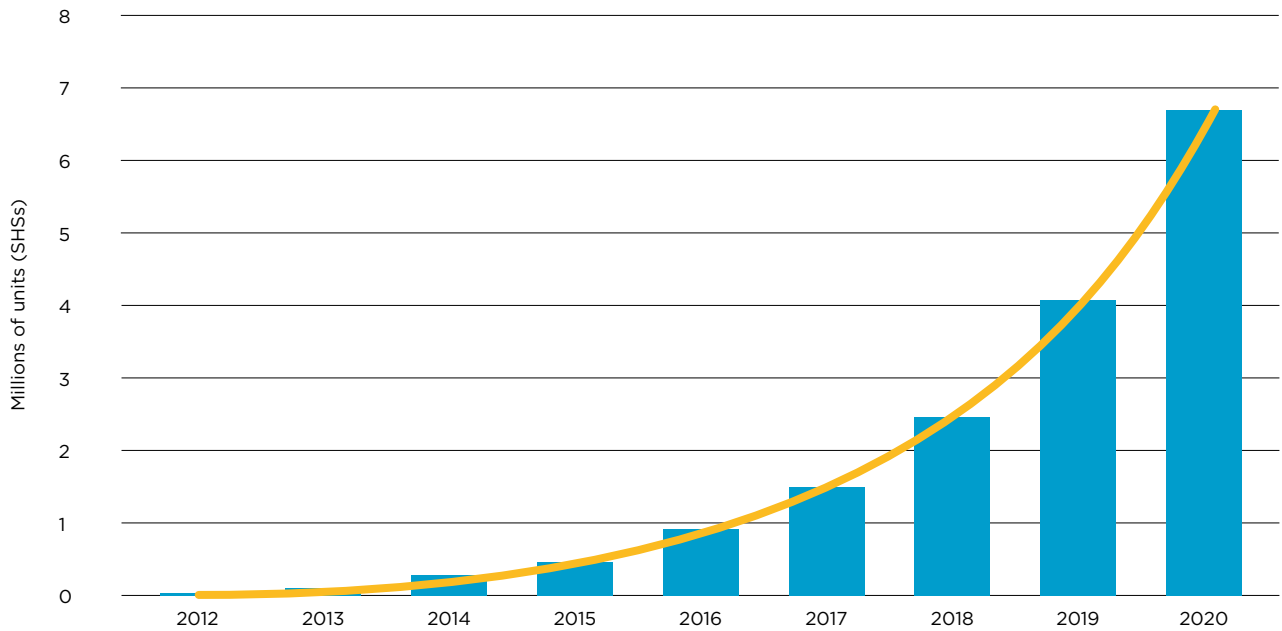
## From East Africa to new markets

The volume of solar home systems sold on a PAYG basis, including systems from 4W to 200W+ (either under a lease-to-own and solar-as-a-service model), has reached approximately 800,000 units

in November 2016 (Figure 2), with an annual growth rate of ~140% in the last 5 years. Based on the current growth trend, PAYG solar unit sales are forecasted to reach up to 7 million units in 2020.<sup>8</sup>

**FIGURE 2** Source: GSMA M4D Utilities

### Cumulative sales of PAYG solar systems (2012-2020)



While four East African markets (Kenya, Tanzania, Uganda and Rwanda) are making up the majority of the sales (>95%), more than 50,000 systems have been deployed in West Africa and South Asia (Figure 3): in Ghana, PEG has over 15,000 customers and plans

expansion to neighbouring Ivory Coast; In India, Simpa Networks solar has installed its solar products in more than 20,000 households, with nearly 30% of these homes in areas not connected to a power grid.<sup>9</sup>

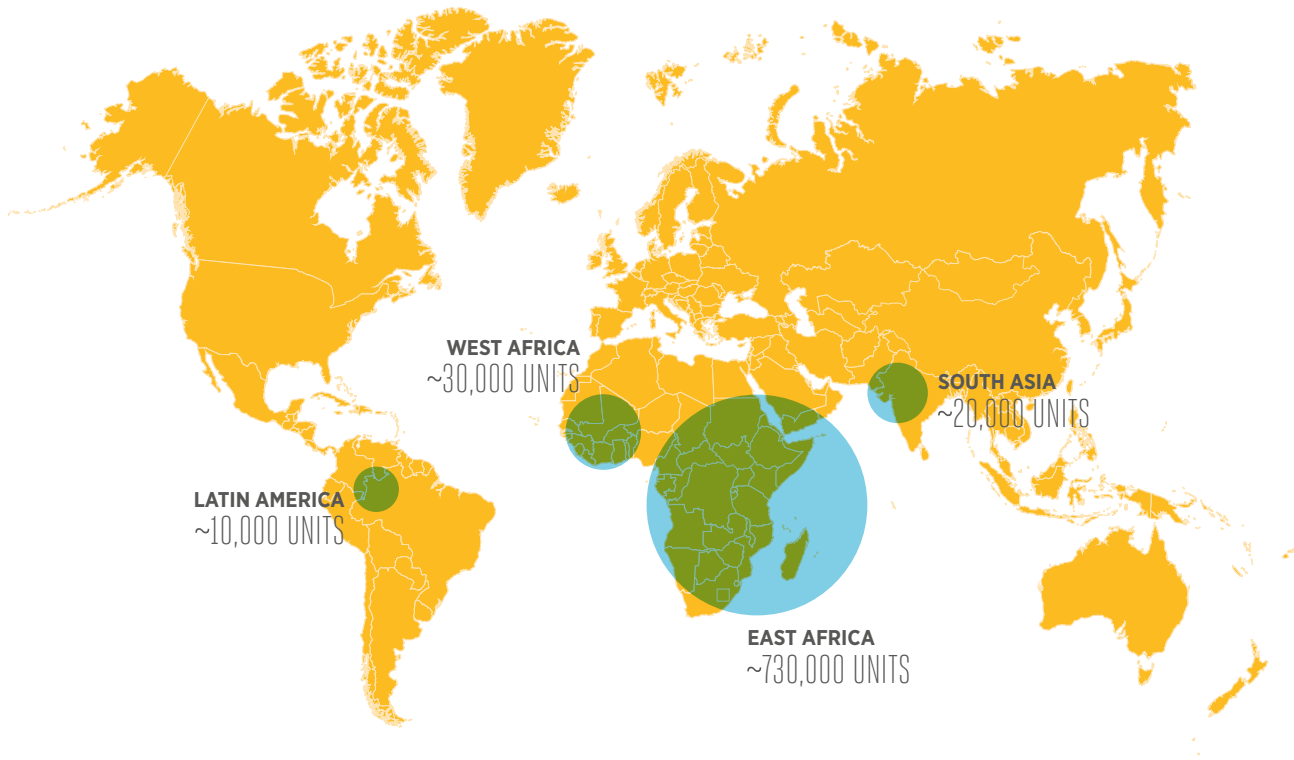
<sup>8</sup> Based on current sales growth rate

<sup>9</sup> MG Arun, India Today, Movers and Makers <http://indiatoday.intoday.in/story/make-in-india-awards-indian-entrepreneurs/1/709392.html>



FIGURE 3

## Sales by geography of PAYG solar systems



Growth is coming from existing and new markets. We have estimated addressable market sizes based on the numbers of customers covered by mobile networks and without access to electricity.<sup>10</sup> Globally, close to two-thirds of the 1.2 billion off-grid population is covered by mobile networks<sup>11</sup> and could theoretically directly benefit from mobile-enabled utility services. The ten countries with the largest energy addressable markets are India, Nigeria, Bangladesh, Indonesia, Kenya, Uganda, Tanzania, Pakistan, Philippines and Democratic Republic of Congo.

In Kenya, where PAYG solar sales total between 450,000 to 500,000 units, we estimate that the current installed base still represents a fraction (<8%) of the country addressable market (~32 million people).<sup>12</sup> In new markets, beyond the actual addressable population, other indicators to consider when launching operations are the ease of doing business, population density and the maturity of mobile payment infrastructure.

10. See Appendix 2 for complete addressable market list

11. Out of the 1.2 Billion off grid population, up to 772 million are covered by mobile networks

12. Based on estimates of 5 persons per household

## A growing mobile money footprint<sup>13</sup>

Since 2012, the growth of mobile money has increased substantially, and by the end of 2015, 17 services surpassed one million active accounts on a 30-day basis. In 2015, 19 markets had more mobile money accounts than bank accounts: Chad, Ghana and Liberia joined the list from 2014, which also includes Burundi, Cameroon, Democratic Republic of the Congo, Gabon, Guinea, Kenya, Lesotho, Madagascar, Paraguay, Rwanda, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe. With a 31% increase in 2015, the number of registered mobile money accounts grew at nearly the same pace as in 2014 (33%), reaching a total of 411 million globally. South Asia and Sub-Saharan Africa showed the strongest growth in adoption, accounting for 85% of all new accounts opened in 2015. In Sub-Saharan Africa, the majority of growth came from outside the mature mobile money markets of East Africa - 63% of all accounts opened in Sub-Saharan Africa in 2015 were in Middle, West, and Southern Africa. The most impressive growth occurred in West Africa, where the percentage of mobile connections linked to a mobile money account increased by nearly 6% in 2015 to reach 19.6%.

Overall, around 30 organisations have deployed PAYG solar, either commercially or as pilots, in most regions: Sub-Saharan Africa, South Asia, East Asia and Latin America. Two main types of providers coexist in this growing space:

- Under their brand name, PAYG solar market leaders are expanding their activities in existing and new markets in order to broaden their growing

customer base, sometimes in partnership with mobile operators and/or energy utilities.

- Off-grid solar providers (old and new) are now adding the PAYG functionality to their current portfolio to offer larger and affordable systems, either under a licensing agreement or by developing their own technology;

## Signs of growth for smart minigrid players

In combination with solar home systems, minigrids will play an important part in bridging the current global energy gap. While they are not new solutions, the integration of mobile technologies in smart minigrids (ranging from several hundred watts to several kilowatts per site) has been contributing to the emergence of more scalable business models, showing early signs of commercial and social impact. Cloud based metering and software platforms to remotely monitor and manage energy production, operations and consumption, added to digitized payment collection, are now offered by several providers, such as PowerHive, PowerGen in partnership with Steamaco, and Devery, in West and East Africa. Similarly to PAYG solar, minigrids could capitalise upon their access to customers to offer additional products and services, from the productive use of energy with machinery to support entrepreneurial activities to education loans and insurance. As recently reported by Vulcan and Steamaco in Kenya,<sup>14</sup> “demand for minigrid electricity is strong and growing, [...] customers cited economic growth, increased security and health benefits.”

13. GSMA, 2016, “State of the Mobile Money Industry”

14. Vulcan Impact Investing, 2016, “Powering productivity, early insights into minigrid operations in rural Kenya”

## Prevalence of the lease-to-own model vs solar-as-a-service

PAYG solar providers can either offer their customers a lease-to-own or energy-as-a-service model. In the lease-to-own model, customer payments go towards paying off the system and customers eventually become the owner of its home solar system. They can also complete their payments ahead of the collection schedule. In the energy-as-a-service model, customers pay for access to a reliable service (similar to a utility) and there is no incentive for customers to complete their payments in advance. As most PAYG players delivering energy-as-a-service also do not operate as a utility (sometimes due to regulatory restrictions), they must enter into time-bound agreements with their customers where ownership of the home solar system is eventually transferred

to their customers. In the case of Lumos in Nigeria, customers enter into a 5-year agreement and commit to a minimum of 1500 days' worth of payments.

Overall, the lease-to-own model remains more prevalent than perpetual service, customers valuing asset ownership for long term engagements. However, the two models could be complementary when approaching new customers. In Cambodia, Kamworks customers used perpetual rental as a low-risk, low-commitment way to test their home solar system before deciding to buy it. Of the customers who signed up for rental, 48% transitioned to lease-to-own or repaid their systems fully on a 24-month loan term.



Kamworks, Cambodia.

## Partnering with mobile operators to fast track deployments

In the PAYG solar space, Mobile Network Operators (MNOs) have been partners and enablers. Their assets include sales network, logistics support, warehousing, after sales support and marketing (ATL, BTL, co-branding). A recent study found that 9 out of 30 energy companies interviewed are cooperating with MNOs for distribution,<sup>15</sup> in Sub Saharan Africa, South and East Asian markets. The far-reaching distribution and sales networks of MNOs, combined with their recognisable and trusted brands, give utility providers the opportunity to leverage these assets to reach underserved customers.

For example in Nigeria, the Lumos solution is marketed, distributed and sold by MTN Nigeria as the MTN mobile electricity service. In Benin, SNV is currently trialling a business model for the distribution of PAYG pico-solar lanterns through an existing network of 100 MTN agents.<sup>16</sup> MTN agents are being trained to sell the PAYG lamps to customers by explaining their functionality, how to charge them, and how they can be used.

### Lumos & MTN Nigeria marketing and distribution partnership

In Nigeria, MTN is co-branding the service with Lumos and helps build the customer facing relationship. The overall benefits of the partnership allow MTN to support distribution, sales and after-sales support. Since the first day of joint sales of the product, thanks to the MTN partnership, Lumos obtained access to MTN's nationwide logistics, warehousing, inventory management, retail stores and call centre services, keeping the cost of service to a minimum. MTN's understanding of the local market was instrumental to better address and communicate with customers while their existing customer base of 60 million subscribers offers a head start and fast access to the Nigerian Market.

### Fenix International & MTN Uganda co-branding

Co-branding and marketing of the Fenix systems with MTN proved critical in establishing customer trust and creating pull in unproven market conditions. Before Fenix launched ReadyPay Solar in 2014, solar was often viewed suspiciously in Uganda due to sub-par quality products and unethical practices by other vendors. In addition to partnering with MTN Uganda for marketing and distribution, co-branding the ReadyPay systems with both MTN and Fenix's logos and matching the plastic casing with MTN's brand colour were instrumental to create early growth.

15. Bloomberg New Energy Finance, 2016, "Off-grid solar market trends report"

16. SNV in Benin is a current recipient of a GSMA M4D Utilities grant, in partnership with GreenLight Planet and Angaza Design

## Licensing PAYG technology to reach new markets

The inherent value of the PAYG business approach is the focus on distribution, financing and branding of the solar products. Selling a solar home system under a PAYG model is the start of a relationship with a customer, which will last at least the length of the payback period and most probably beyond, as customers might adopt new products, larger systems and/or appliances. As a result, the approach to launching operations is unique to each market and replicating the PAYG model in “new territories” requires time and investment to build the foundations of an efficient value chain.

For new entrants without the technical expertise (hardware and software) to develop their own PAYG technology, licensing existing solutions is a good choice to quickly launch operations; however, this can lead to reduced margins due to licensing fees. PAYG hardware

and software building blocks are becoming increasingly available as the sector matures. d.Light, Angaza Design, Bboxx, M-KOPA, Lumeter or Kingo Energy are now licensing their technology including payment systems, customer support and inventory management tools.

As of September 2016, we estimate that the proportion of deployments based on licensing arrangements constitutes 2% to 3% of overall PAYG solar sales.<sup>17</sup> This proportion should grow rapidly to the double digit range by 2020 as more providers are looking to license PAYG for new markets and licensors have more capacity to support new deployments. However, as outlined below, the multiplication of new licensing agreements should not come at the expense of high quality of service and support.

### Learnings from PEG Ghana licensing agreements

Licensing does not come without its challenges and given the nascent state of the mobile-enabled energy sector, replication requires a more hands-on approach from the licensor to transfer knowledge and technical support, and build local business operations. Licensing must be approached as part of licensors' own growth strategy and their experience will dictate the level of investment required. In the case of PEG Ghana licensing the M-KOPA solution, the technology has been made more adaptive to this new context (such as flexibility in the backend customer management system) and more robust, while M-KOPA was able to anticipate the right level of training and support for PEG agents.

17. Based on deployments in Sub Saharan Africa, South Asia and Latin America

# Mobile money is enabling PAYG deployments at scale

As mentioned earlier, mobile money has been a key element to support the deployments of PAYG solar solutions and represent the most integrated way to enable customers to pay for their instalments or utility bills. We're looking in this section at why mobile

money is an important element in the PAYG model, some of its challenges and how alternative payment solutions such as airtime credit can enable PAYG to be launched in markets where mobile money is not readily available.

## PAYG supports mobile money services growth

For mobile money operators, there are multiple benefits in partnering with PAYG providers: scale agent network to rural and off grid areas, acquire new customers, facilitate digital financial literacy and generate frequent account activities.

### **Scale agent network to rural and off-grid locations**

The expansion of mobile money into non-urban areas has tended to be a gradual diffusion of services beyond urban centres, rather than a strategic effort by mobile operators to tailor services to meet the needs of rural customers.<sup>18</sup> Even in the more mature mobile money markets, the need for customer registration, education and support to conduct their first and/or following mobile transactions is a sign of the complexity of the service and is an indication that there is still room for growth. Despite the potential size and loyalty of the rural market, evidence suggests

most mobile money service providers still have to expand their services beyond urban centres.

Evidence has shown that agents play an especially important role in the uptake and use of mobile money in rural areas.<sup>19</sup> For example, 22% of rural MTN Uganda users began using mobile money because an agent recommended the services to them.<sup>20</sup> In Pakistan, 68% of EcoEnergy customers reported that the nearest mobile money agent was at least 5km away: this sparse presence of mobile money agents in EcoEnergy's sales area required staff to be involved in payment collection and dampened its potential to scale. By operating in peri-urban and rural locations, PAYG solar agents can improve the feasibility and business case for mobile money agent networks. If these agents are also conducting Over-The-Counter (OTC) transactions for their customers, such agents receive liquidity, improving float, essential for stable mobile money operations.

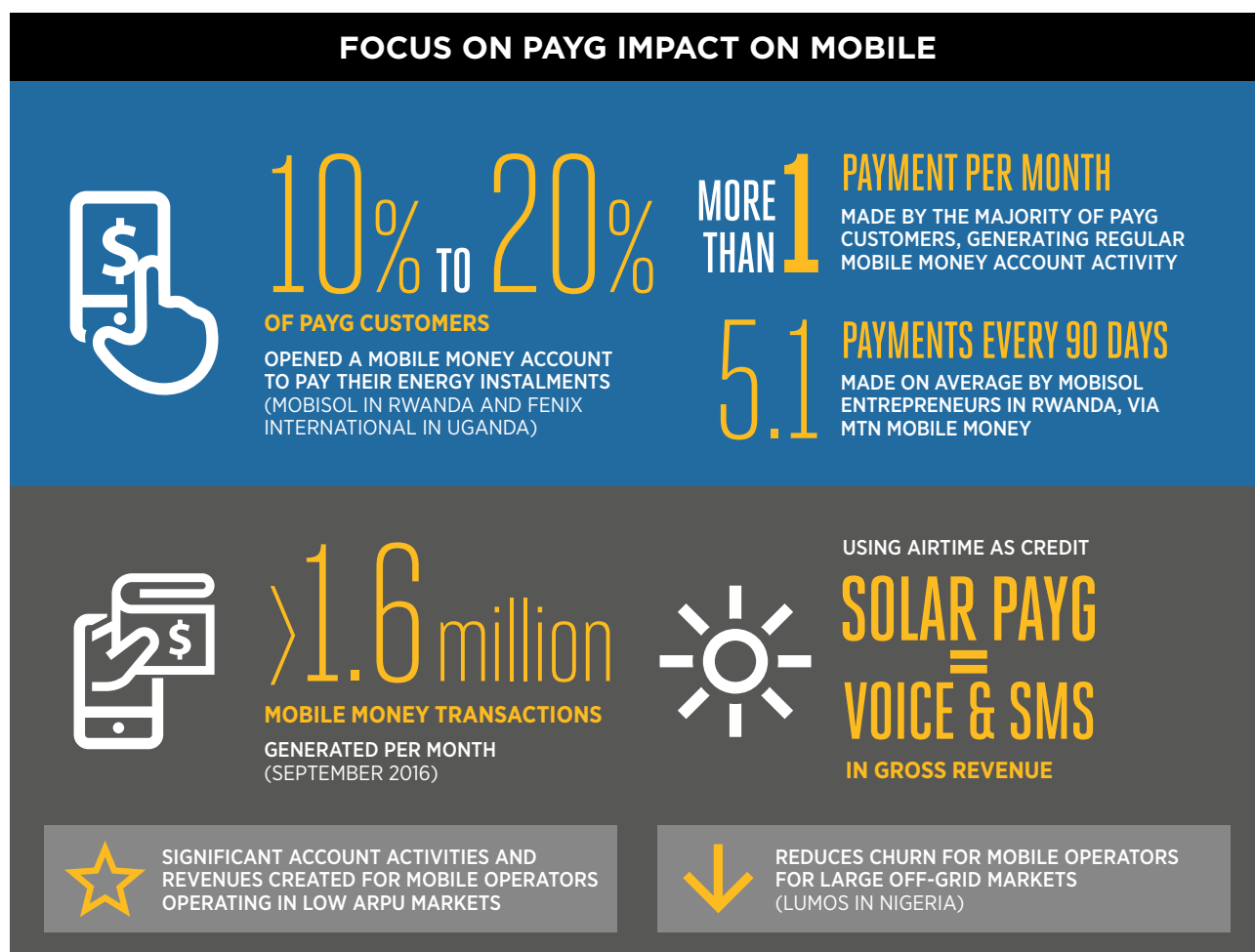
18. GSMA, October 2014, "Extending reach: mobile money in rural areas"

19. CGAP, January 2013, "Rural vs Urban Mobile Money Use: Insights From Demand-Side Data", <https://www.cgap.org/blog/rural-vs-urban-mobile-money-use-insights-demand-side-data>

20. Ibid

In Ghana, PEG Ghana agents can register mobile money customers across all networks. In Mobisol's experience in Rwanda, making their own agents mobile

money agents, rather than the other way around, has proved more effective, and actually helped to expand the MNO's footprint.



### Acquiring new mobile money customers

Cross-industry research suggests that rural customers are traditionally slower to adopt new products. Communicating the value proposition of mobile money products to this market segment is therefore crucial. Rural customers typically require in-depth product education and demonstration, as well as testimonials from peers or local opinion leaders. By coupling the PAYG solar repayments with opening and/or using a mobile money account, customers have a direct incentive to open an account (if they do not already have one). Based on Fenix International and Mobisol GSMA-funded pilot learnings in East Africa, an

important proportion of new solar customers were also new mobile money users:

- For Fenix International in Uganda, 13% of their customers were new to MTN mobile money (facilitated through Fenix signing up customers to MTN mobile money exclusively);
- In Rwanda, 20% of Mobisol's customers using the entrepreneurial kit were new MTN mobile money customers.

In regions where the mobile money footprint is lower than in East Africa, the proportion of new mobile money

customers acquired through new PAYG solar contracts should be even higher. In Haiti, early learnings from a d.light<sup>21</sup> pilot show that many RE-volt customers using d.light systems are new to mobile money. However only 40% of them end up being regular mobile money customers as local agents conduct OTC transactions.

### Improving customer digital financial literacy

Digital literacy is essential to the mobile payment process and to minimize agent input to conduct transactions. As reported by SteamaCo on their minigrad operations in rural Kenya,<sup>22</sup> a user survey indicated that Average Revenue Per User (ARPU) was 2.6 times higher for customers who always read their SMS compared to people who did so sometimes or never. People who do not often use phones or M-PESA, or cannot read, tended to have greater difficulty using the system.

In addition to signing up new customers, PAYG providers can help customers conduct their first transactions, either teaching them in group workshops and/or following up through direct calls. In less mature mobile money markets, such customer support is critical in reducing some of the barriers to usage such as complex USSD interface with many steps to conduct a transaction. In Uganda, Fenix with MTN support has included their payment option directly in the SIM menu thus facilitating the payment process.

Offering OTC transactions also make mobile money services more accessible to communities with lower digital financial literacy. OTC helps address a lack of confidence amongst customers who are hesitant to use mobile money to perform transactions themselves. Such transactions are prevalent in markets such as Pakistan, where mobile money was initially launched with an OTC-centric value proposition, or in Cambodia, where mobile handsets do not support the script for the local language. However, some PAYG solar

providers are also taking steps to ensure users avoid OTC transactions, providing a discount to customers who purchase prepaid energy with their own mobile wallet and offering extra commission to sales agents to promote this habit.<sup>23</sup>

### Generating frequent mobile money account activity

Solar repayment plans vary between providers and between countries, but on average PAYG solar customers make several payments per month to unlock their energy service, which can generate significant new revenues for mobile operators, especially in low ARPU markets:

- In Kenya, M-KOPA reported an average of 35 payments per year to fully repay their balance in 12 to 14 months;<sup>24</sup>
- In Rwanda, Mobisol recorded 5.1 payments every 90 days;<sup>25</sup> in January 2016, Mobisol indicated that it generated USD 0.58 in monthly transaction fee revenues per SHS to MTN Rwanda (for customers with blended ARPUs of ~ USD 2).

Regular account activities are generating large volumes of transactions for mobile operators. We estimate that PAYG solar generate close to 1.6 million transactions on a monthly basis<sup>26</sup> (September 2016), and this number keeps growing based on current sales trend. Even when solar systems have been fully paid off, re-financed assets are renewing payment terms leading to even higher volumes of transactions over time.

Impact on churn reduction for MNOs is also becoming apparent. After a few months of initial data, MTN Nigeria found that the Lumos service reduces churn by half as customers make regular payments for this service with airtime and exclusively through MTN.

21. d.light in Haiti is a current recipient of a GSMA M4D Utilities grant, in partnership with Re-Volt and Digicel Haiti

22. Vulcan impact investing, 2016, "Powering Productivity, early insights into minigrad operations in Rural Kenya"

23. Jacob Winiecki, CGAP, May 2016, "Four Ways Energy Access Can Propel Financial Inclusion", <https://www.cgap.org/blog/four-ways-energy-access-can-propel-financial-inclusion>

24. M-Kopa lightbulb series, 2015, "Affordable clean energy: a pathway to new consumer choices"

25. As reported in the learnings of the GSMA funded pilot

26. Based on monthly transactions either recorded or estimated for the top 5 PAYG solar providers



## Using mobile payment data for credit scoring

Mobile-based credit scoring, based on transactional and/or social data, is gaining traction, enabling customers with no formal financial history to access loans, savings and credit products. For solar PAYG providers, insights generated from customers' transactional behaviour can be used to extend customers' engagement, enable them to climb the energy ladder, and get access to larger systems and appliances.

### More than payment collection, creating customer credit history

Payment collection through mobile money services has proved its efficiency across the utility sector by easing (or facilitating) payments for customers, expanding revenue collection for utilities, and removing opportunities for theft, bribery, and collusion.<sup>27</sup> In the case of PAYG solar, the flexibility of mobile repayments in daily, weekly or monthly instalments, usually on par or below customers' expenditures on energy, facilitate adoption while increasing household savings.

Using mobile repayment data, providers are now able to build credit history for mostly unbanked customers. Despite the many regulatory, design and commercial barriers that need to be overcome for next-generation credit systems to work,<sup>28</sup> the data behind customers is key to their empowerment. Using in-house algorithms or working with third party data specialists, PAYG providers can get accurate insights into customers' future ability to repay for other products in their portfolio. Towards the end of their payment term, customers with positive credit ratings have the opportunity to access more products such as smartphones, DC TVs, cookstoves and water pumps. Using the same PAYG model, customers are transferring the financing of their new products to the solar home system they now own, paying back their new loan in fixed-term instalments the same way they paid off their solar home system.

### M-KOPA providing secondary products in Kenya

For their customers who have successfully paid off their solar system or are close to doing so, M-KOPA is now offering more products, in exchange for reopening the account and making payments for another term. This includes fuel-efficient stoves, bicycles, rainwater harvesting tank, and other products. M-KOPA also sells TVs, smartphones and offers loans to pay for school fees. As stated, repayment rates are up to 98% for secondary products and about a quarter of those who pay off their first purchase move on to others.<sup>29</sup> As of June 2016, M-KOPA has provided more than 60,000 new products to their customers with positive credit rating,<sup>30</sup> including more than 20,000 LED DC TVs. The positive social outcome is also, in the case of M-KOPA, the transfer of positive credit reports to local credit bureaus in Kenya (more than 160,000), further enabling previously unbanked customers to have access to institutional loans with low interest rates.

27. University of Oxford, "Mobile money and water services in East Africa", <http://www.water.ox.ac.uk/mobile-money-east-africa/>

28. Daniel Tomlison, Green Tech Media, March 2015, "The future of mobile money: building seamless financing options through clean energy", <http://www.greentechmedia.com/articles/read/the-future-of-mobile-money-financing-that-goes-above-and-beyond-the-grid>

29. Stephan Faris, Bloomberg Business Week, December 2015, "The solar company making profits on poor Africans", <http://www.bloomberg.com/features/2015-mkopa-solar-in-africa/>

30. Marianne de Nazareth, July 2016, "Clean solar energy, brings light to Kenya's villages", <http://www.countercurrents.org/2016/07/15/clean-solar-energy-brings-light-to-kenyas-villages/>

### Towards a universal credit scoring technique?

Just as PAYG service providers are using their customers' payment history to assess creditworthiness, MNOs could also leverage their customers' mobile usage history to derive a credit rating that could be used by PAYG providers.<sup>31</sup> This is already being done for savings or airtime loan products, which are issued based on the age of the subscriber on the network and their recharge history. Using this same principle, an MNO could use usage data, such as average revenue per user (ARPU), mobile transaction history, and geo-location to profile potential customers and better target them for its partners' PAYG services. This type of partnership is already happening in Pakistan, where Telenor "references mobile subscribers GSM activity"<sup>32</sup> and

will provide credit scoring analysis to EcoEnergy to better target their solar customers.

Beyond mobile operators, other players are innovating on credit assessment, either by using mobile operators' data to develop their own credit scorecards or directly by using data from users' smartphones to credit score potential customers and offer them loans. As outlined in a recent GSMA blogpost,<sup>33</sup> building up on current initiatives, "the ability for every individual with a mobile number to provide a financial institution of their choice with access to their credit score, if they wish, would be a novel and empowering one. This credit score could be calculated on alternate data (such as call data records, mobile money transactions and loan repayments) using an open-source algorithm across a number of developing markets."

## The route to mobile money integration is often challenging

Unless there is an exclusive deal with an MNO, providers will usually leverage several mobile money platforms in a

market to cover the majority of the energy addressable population and offer customers multiple choice.

### Fenix International and MTN Uganda upgrade their mobile money platform

An example of Fenix's strengthening partnership with MTN is encapsulated in the way they coordinated their efforts when MTN upgraded its mobile money system. This upgrade required that MTN Mobile Money be brought down for a week and could have disrupted Fenix's sales and payment collection. The partners coordinated closely to ensure minimal impact on customers.

31. GSMA Mobile for Development Utilities, 2016, "Unlocking access to utility services: the transformational value of mobile", <http://www.gsma.com/mobilefordevelopment/programmes/m4dutilities/annual-report>

32. Yahya Khan, World Bank, May 2016, "Telenor: financial inclusion is a good sustainability initiative and business opportunity", <http://blogs.worldbank.org/psd/telenor-financial-inclusion-good-sustainability-initiative-and-business-opportunity>

33. Arunjay Katakam, GSMA M4D, November 2016, "Accelerating mobile credit: could a universal credit score be the answer?", [GSMA M4D Blog - Accelerating Mobile Credit: Could a universal credit be the answer?](#)

Mobile Money integration is nonetheless costly and time intensive for service providers. Each individual integration between a payment instrument provider (such as a mobile money service) and a third party (such as a utility company) can cost anywhere between USD 15,000 to USD 30,000 and take 4-6 months.<sup>34</sup> Even in markets where a robust mobile money ecosystem is in place, implementation challenges can be rife. A survey of 21 PAYG practitioners<sup>35</sup> and other stakeholders revealed that technical challenges (for example related to API integration) were most common, followed closely by awareness and education, and agent networks.

In addition to PAYG technology licensors, local mobile money aggregators can also facilitate the integration process. Aggregators are entities that will allow payment instrument providers (for instance, MNOs offering mobile money services) to integrate with providers that want to send money to or receive money from end customers.<sup>36</sup> At a basic level, they will connect the systems of payment instrument providers to third-party systems, and provide Value-Added-Service (VAS) like notification of successful payments, reconciliation, and receipts.

## GSMA support to facilitate mobile money integration

To facilitate mobile money integration for service providers, the GSMA Mobile for Development is currently working in parallel on two initiatives for short and long term impacts.

### Testing an instant Payment Notification (IPN) hub in Rwanda

The objective of the IPN Hub is to provide a single point of integration for PAYG service providers that would connect them with multiple operators' mobile money platforms. The hub enables real time payment notification to service providers, and also the capability to validate payments to ensure they are from registered customers. The hub is currently being tested in Rwanda and, based on results, should be expanded to more markets.

### Application Programming Interface (API) harmonization

Following a year-long industry engagement, the GSMA Mobile Money team has published a first set of harmonised mobile money APIs.<sup>37</sup> The aim of the harmonised Mobile Money APIs is to, first ensure that best practices from the technology industry in API design, security design, and others are made accessible to the mobile money industry; second, to address the apparent complexity and fragmentation in the fast-growing mobile money industry. The web portal outlines the design principles, objects, behaviours and error handling for the Mobile Money API. Recently tested at a Mobile Money Hackathon in Tanzania,<sup>38</sup> the GSMA is now encouraging its members, and mobile money industry partners to raise the bar by using these APIs to ensure rapid partner on-boarding, offer advanced and secure functionality, and reduce the fragmentation that limits and delays regional partners from leveraging mobile money.

34. CGAP, January 2016, "Aggregators: the secret sauce to digital finance expansion"

35. GSMA Mobile for Development Utilities, 2016, "Unlocking access to utility services: the transformational value of mobile", <http://www.gsma.com/mobilefordevelopment/programmes/m4dutilities/annual-report>

36. CGAP, January 2016 "Aggregators: the secret sauce to digital finance expansion"

37. GSMA, "Mobile Money API", <https://mmapi.gsma.com/>

38. GSMA, "Highlights from the Mobile Money API hackathon: testing harmonized mobile money APIs for the industry", <http://www.gsma.com/mobilefordevelopment/programme/mobile-money/highlights-from-the-mobile-money-api-hackathon-testing-harmonised-mobile-money-apis-for-the-industry>

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## Airtime credit as an alternative solution in immature mobile money markets

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Alternatives to mobile money payments exist to collect user payments and scratch cards for example have been used by providers such as Azuri Technologies in several markets or WakaWaka in Rwanda to launch their PAYG solar operations. However intuitive the scratch card method is to enable PAYG, it also means a complex stock of cards to manage and distribute across agents' network. A more integrated solution is airtime. The learnings collected through the Lumos GSMA funded pilot in Nigeria have been valuable to better understand the viability of airtime credit as a payment mechanism in markets with limited mobile money penetration.

Thanks to their strong partnership with MTN Nigeria, Lumos customers could directly purchase an energy service package with MTN airtime – as customers purchase airtime for their electricity bill, mobile operator transfer it as credit for their PAYG system. During the course of the GSMA grant, Lumos proved that airtime

credit could successfully be used as an alternative means to collect payments for its energy service. On the upside, mobile subscribers' familiarity with airtime reduces the need for customer education. Using airtime is not without challenges, and requires a close partnership between the PAYG provider and the MNO. It should be noted that regulations surrounding the use of airtime to purchase services other than mobile vary across different markets.<sup>39</sup>

To use airtime, a company will be approved by a mobile operator as a Value Added Service (VAS) vendor. The VAS will be offered by the mobile operator directly and customers will pay for the service via premium SMS/ USSD. From a technical perspective, mobile operators need to create a new product and short code for each VAS product so that customers can pay separately for each product or service. Payments, in the form of airtime deductions, are done and recorded by the mobile operator.

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39. GSMA Mobile for Development Utilities, 2016, "Unlocking access to utility services: the transformational value of mobile", <http://www.gsma.com/mobilefordevelopment/programmes/m4dutilities/annual-report>

# Towards the digitization of utility systems and services

Using the Internet of Things technologies to make utility systems and connections smarter and more affordable is at the heart of current PAYG models across the energy, water and sanitation sectors. The ongoing price decline of Machine to Machine modules, cloud computing and data analytics technique now

make it possible to collect and analyse large quantities of data to produce specific insights and intelligence, triggering the right actions. In the coming years, billions of data points will be collected in various utility models, giving governments and institutions the opportunity to make cities and countries smarter.

## Is GSM the right connectivity technology?

This question can be answered in the context of utility infrastructure deployments: is the location covered by GSM networks, what type of utility equipment (home solar system, minigrid, water kiosk or water pump, latrines,...), what is the density of connected

devices, what are the cost constraints and scalability? Each technology has distinct characteristics, including the range of their signal, the extent of their data throughput (or bandwidth) and the power needs of the communications device (or battery life).

Type of Utility model	Decentralised systems	Decentralised clustered systems	Centralised systems
<b>Technology</b>	Wide Area Network (GSM, LPWA)	Wide Area Network (GSM, LPWA) and Personal Area Network	
<b>Details</b>	Individual connections in low density environments are more likely to rely on GSM as backhaul technology to send data directly over long distances to a central server	Connected systems in high density environments use local nodes (e.g., Zigbee) to create a networked architecture while relying on a central GSM gateway to send data over long distances	Connected systems in high density/urban environments are most likely to rely on a combination of RF connectivity solutions and aggregators to transfer data
<b>Types of applications</b>	Solar home systems, handpumps, water kiosks, latrines	Minigrids (smart meters at the production or household levels)	Grid electricity and piped water connections

Although PAYG can be enabled using a combination of shorter range wireless technologies or a keypad (to switch devices on or off and collect data), the majority of the installed base of PAYG solar systems are connected through GSM, enabling data to be transferred over long distances through cellular networks. The standardisation and interoperability of GSM, the ubiquity of its coverage (~90% of the world's population), wide availability of modules and relatively low price (USD 6-8 per module) make it a go to solution for remote connections. However, the use of GSM technology should be weighed in terms of its cost and technical impact against the value of being able to directly communicate with devices. Other considerations include the Total Cost of Ownership of GSM compared to other connectivity solutions, the high power consumption of GSM (up to 10 times that of Low Power Wide Area (LPWA) solutions) and the need for reliable mobile coverage.

Regardless of the chosen technology, connecting solar systems through Wide Area Network technology adds another level of intelligence to utility solutions, beyond the simple ability to remotely lock/unlock units:

- Detecting early signs of malfunctions or theft – real-time monitoring of system activities (e.g. battery charging and power consumption) alerts providers on current or upcoming issues; corrective actions can be taken instantly by either contacting end users (reducing field technician costs) or sending agents on site for more severe problems.
- Getting more granular information about customer usage - power consumption information can also be used to better understand customer consumption patterns and identify sales opportunities;
- Creating new revenue streams by monetising data – the more advanced providers are looking to monetise the data they are collecting

## Adding weather sensors to utility systems

New use cases are emerging to capitalise on the growing reach of mobile-enabled utility systems, such as solar home systems and minigrids. In 2015, M-KOPA in Kenya received a grant from reinsurer company Swiss Re to explore the possibility of using its system to collect weather data from its devices.<sup>40</sup> M-KOPA is experimenting with adding instruments that measure barometric pressure, humidity, temperature and rainfall. This ability to capture solar intensity and other weather and climate-related data could benefit the region's farmers in addition to insurance firms, meteorological planners and environmental agencies.

## From local to global to embedded SIMs

The SIM card provides a secure identity to the systems connected to the mobile network. Increasingly, solar providers are using global SIMs for convenience and flexibility versus local SIMs, as global SIMs can roam on different networks. With local SIMs, providers would have had to use SIMs of a particular MNO depending on the location of the SHS. Global SIMs also release providers from the tasks of managing mobile billing for each SIM. Mobile operators in emerging markets are also often not equipped to provide M2M services

for a small number of systems (less than 10,000 units), which makes the adoption of local SIMs more complex.

In the case of EcoEnergy in Pakistan, it was found that the total cost of ownership for a global SIM was lower than that for a local SIM despite its higher monthly cost. Furthermore, the cost of roaming is expected to become comparable with that of local plans in the near future which would make the global SIM even more attractive.

40. Stephan Faris, Bloomberg Business Week, December 2015, "The solar company making profits on poor Africans", <http://www.bloomberg.com/features/2015-mkopa-solar-in-africa/>

Embedded SIMs would also be the next technological evolution to facilitate M2M deployments. Developed by the GSMA,<sup>41</sup> the Embedded SIM Specification provides a standard mechanism for the remote provisioning and

management of M2M connections, allowing for “over the air” provisioning of an initial operator subscription, and the subsequent change of subscription from one operator to another.

## How low power wide area networks can further support IoT deployments

Given that most of the utility applications only require occasional connectivity with minimal throughput, novel technologies are already disrupting current applications relying on GSM connectivity. Moving to a full Internet of Things environment, there are two main

alternative Wide Area Network connectivity solutions:<sup>42</sup> cellular technologies (standardised such as GSM, WCDMA, and LTE) and unlicensed LPWA (proprietary radio technologies such as Sigfox and LoRa).<sup>43</sup>

### Using LoRa to connect systems

In the context of decentralised clustered systems, such as minigrids, LoRa networks in combination with current GSM networks enable local and wide area network connectivity in the most economical sense. As currently used by SteamaCo, meters connected through a privately set up LoRa network are installed at different locations in their AC electricity network (plant level, poles, households). Each of these meters is connected to a core system connected to SteamaCo servers through GPRS or GSM (SMS). Other assets can be remotely monitored and managed in the same way (irrigation pumps, agri-processing systems), which could also enable the replication of the PAYG solar model for financing such assets and appliances.

The GSMA Mobile IoT Initiative is designed to accelerate the commercial availability of Low Power Wide Area (LPWA) solutions in licensed spectrum. Using a standardised approach, MNOs are promoting the ability of cellular technologies to make data accessible on multiple platforms. These cellular LPWA technologies, designed specifically for the Mobile IoT can support a range of mobile network bandwidth and performance requirements, suitable for many smart cities and smart utility applications. In June 2016, standards body 3GPP published the Release-13 specifications for the three licenced spectrum Mobile IoT technologies, which will be ready for commercial deployments in 2017. These technologies will be

deployed for IoT applications in the low-end sensor segment, with very low data throughput, price and power consumption, similar to proprietary solutions in unlicensed spectrum already available for deployment.

In South Africa, MTN in partnership with Huawei has already launched the first Narrowband Internet of Things (NB-IoT) solution in Africa for a Smart Water Metering solution<sup>44</sup> to be commercially deployed in 2017. The data gathered will be used to control waste water flows from each property, identify faults across the network and improve health and safety outcomes. According to the article,<sup>45</sup> the number of cellular IoT connections in Africa will grow seven-fold over the next three to four years.

41. GSMA, Connected Living, “Embedded SIM”, <http://www.gsma.com/connectedliving/embedded-sim/>

42. Ericsson, January 2016, “Cellular Networks for Massive IoT”, [https://www.ericsson.com/res/docs/whitepapers/wp\\_iot.pdf](https://www.ericsson.com/res/docs/whitepapers/wp_iot.pdf)

43. GSMA Mobile for Development Utilities, 2016, “Unlocking access to utility services: the transformational value of mobile”, <http://www.gsma.com/mobilefordevelopment/programmes/m4dutilities/annual-report>

44. IT News Africa, November 2016, “MTN, Huawei partner on IoT”, <http://www.itnewsafrika.com/2016/11/mtn-huawei-partner-on-iot/>

45. Ibid

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# Key lessons and recommendations

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## Support the growth and replication of PAYG solar deployments in more markets

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The PAYG solar market is on a solid path to growth and, after several years of pilots, a number of providers have now reached the stage at which they are seeking triple-digit million dollar amounts in debt capital to finance an accelerated roll-out of their services. What appears crucial is access to capital to scale deployments within country but also funding to be able to launch operations in new and unproven markets, where for example mobile money ecosystems are less mature. New commercial deployments in Cote d'Ivoire and Nigeria, and pilots such as d.light in Haiti, Brighterlite in Myanmar and Greenlight Planet with MTN in Benin will provide learnings on the replicability and scalability of PAYG models.

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## Test the viability of new utility PAYG models

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Although the PAYG model seems to get traction for solar home systems or minigrids, it remains to be seen how other utility assets can be financed and repaid for in the same manner. To better understand how applicable the PAYG model is to new assets and services, the M4D Utilities programme is currently financing three pilots: SunCulture is testing their Pay-As-You-Grow model for irrigation pumps in Kenya, Kopagas pilots mobile-enabled Liquefied Petroleum Gas (LPG) canisters in urban Tanzania and container based toilet provider Loowatt in Madagascar tests how mobile money can improve payment efficiency, reduce operational expenditure and create new revenue streams.

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## Ongoing support to mobile money integration

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The process to integrate with mobile money platforms can be long and costly, especially for emerging providers who lack the scale and capacity to quickly connect with the mobile operator's software platforms. As mobile money ecosystems mature, stakeholders such as aggregators can facilitate integration for a service fee. The GSMA aims to help make integration faster and cheaper by piloting an IPN Hub in Rwanda, providing a single point of integration for service providers to operators. In the longer term, mobile operators have the opportunity to participate to the harmonization of APIs to create a standard layer, independent of geographies and platforms.



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## Facilitate M2M connectivity for small and larger scale deployments

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An increasing number of organisations working in the utility space are looking to add mobile connectivity to their solutions and be able to collect data on operations and/or control systems remotely. It takes time to develop a working prototype, especially when it has to be applied to developing markets. The M4D Utilities Programme will publish in the first half of 2017 a report outlining the IoT development journey for utility service providers looking to integrate M2M in their model. Mobile operators also have a role to play to facilitate M2M connectivity for new players, by being willing to pilot solutions at a small scale, but also by enabling larger players to benefit from connectivity management and enterprise solutions. As new LPWA commercial deployments will start in 2017, there's also an opportunity for service providers and mobile operators to pilot this new technology, in order to reduce the cost and power consumption of M2M modules.

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## Engage mobile operators as partners for the digitization of utilities

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For mobile operators, there's an opportunity to partner with decentralized service providers to support access to basic services for their customers but also generate new revenues through the adoption and usage of mobile services in underserved off grid settings. Facilitating mobile money integration processes and offering access to their distribution and/or marketing capacity are ways to fast track deployments of PAYG services. Newer types of partnerships with PAYG providers. i.e., mobile-based credit scoring, would help better address potential customers, while creating new potential revenue streams. As more governments also roll out smart city projects, mobile operators could establish their Internet of Things strategies to lead the digitization of large utilities, as Dialog Axiata and Orange are respectively doing in Sri Lanka and Tunisia. Providing a set of hardware and software tools and analytics platforms would help utilities become efficient, enable more accurate monitoring of leaks and theft or improve payment collection through mobile money.

## Appendix 1 - GSMA M4D Utilities grants provided to PAYG pilots

The table summarizes some of the key learnings that have been collected in Phase 1 and are currently collected in the ongoing Phase 2 pilots (click on the links below to read case studies).

Key Questions	Phase	Company	Country
What are the lessons from launching prepaid SHS (household and productive usage) in a new market and what is the payment behaviour?	1	<a href="#">Mobisol</a> <a href="#">PEG</a> <a href="#">Kamworks</a> <a href="#">EcoEnergy</a> <a href="#">Lumos</a> <a href="#">Easypaisa</a> <sup>46</sup>	Rwanda Ghana Cambodia Pakistan Nigeria Pakistan
	2	<a href="#">Brighterlite</a> <a href="#">d.light</a> <a href="#">SNV</a>	Myanmar Haiti Benin
Are repayment behaviours of the target customers strong enough to support further credit-based energy financing?	1	<a href="#">MKopa</a> <sup>47</sup> <a href="#">Mobisol</a> <a href="#">Lumos</a> <a href="#">Fenix</a>	Kenya Rwanda Nigeria Uganda
What are the lessons from replicating/licensing the PAYG model in new markets?	1	<a href="#">PEG</a> <a href="#">EcoEnergy</a>	Ghana Pakistan
Can airtime credit be a viable way to collect customer payments?	1	<a href="#">Lumos</a>	Nigeria
What is the profile of PAYG adoption in immature or greenfield Mobile Money markets?	1	<a href="#">PEG</a> <a href="#">EcoEnergy</a> <a href="#">Lumos</a> <a href="#">Easypaisa</a>	Ghana Pakistan Nigeria Pakistan
	2	<a href="#">Brighterlite</a> <a href="#">d.light</a> <a href="#">SNV</a>	Myanmar Haiti Benin
What is the impact of prepaid SHS on mobile money adoption and account activity for mobile operators?	1	<a href="#">Mobisol</a> <a href="#">Fenix</a> <a href="#">PEG</a>	Rwanda Uganda Ghana
	2	<a href="#">d.light</a>	Haiti
What is the impact of leveraging MNOs' distribution/agent network for joint distribution and/or acquire new customers and collect payments?	1	<a href="#">Fenix</a>	Uganda
	2	<a href="#">Brighterlite</a> <a href="#">d.light</a> <a href="#">SNV</a>	Myanmar Haiti Benin
What is the viability of the PAYG model for new solar products (LPG, irrigation pump)	2	<a href="#">Kopagas</a> <a href="#">SunCulture</a>	Kenya

46. Case Study will be available in 2017

47. Ibid

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## Appendix 2 - Energy addressable markets

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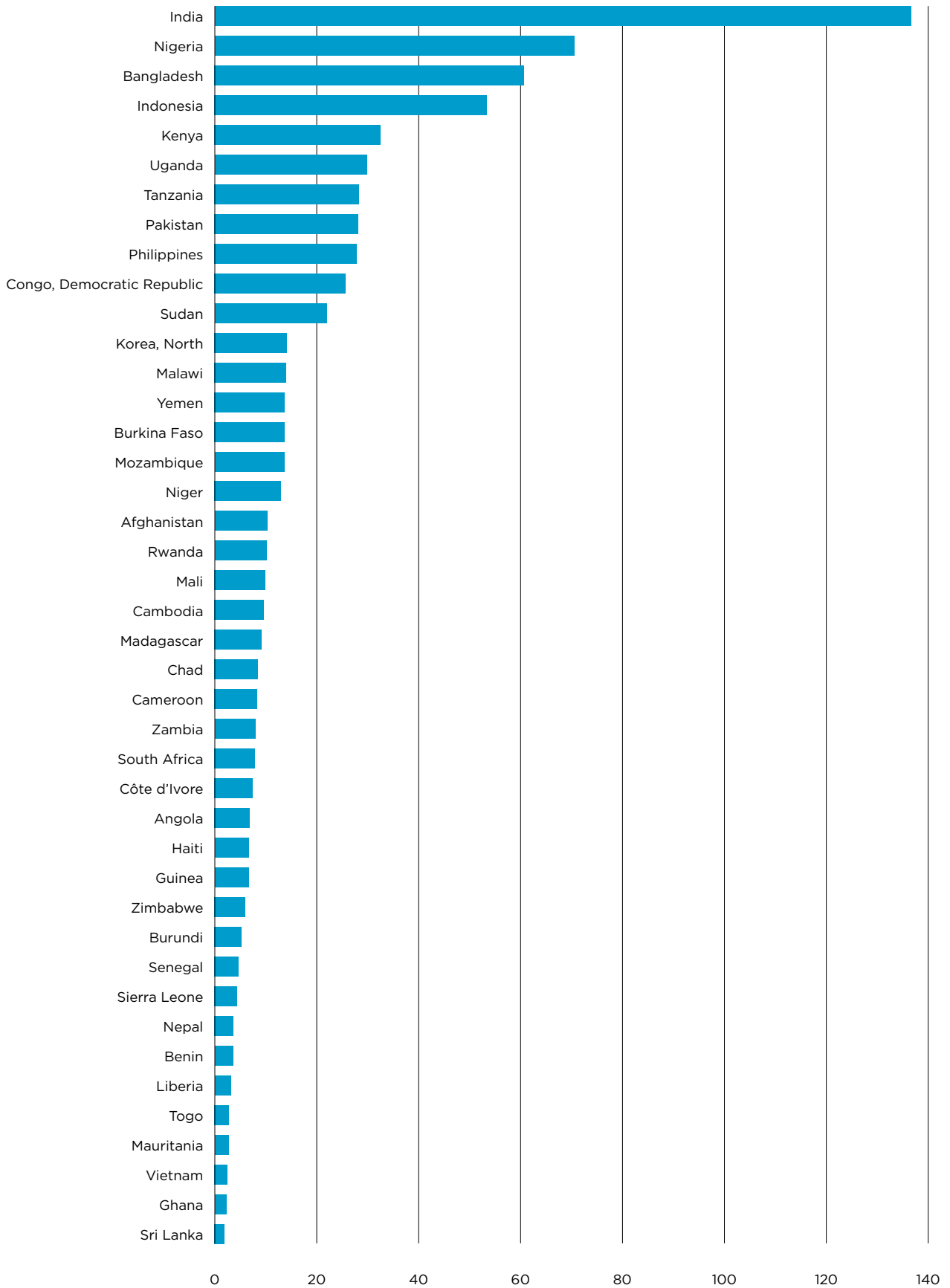
The total addressable market is an estimate of the number of people who live within range of GSM networks and have no access to electricity and water, but could be hence impacted by the deployment of mobile-enabled services. It does not represent the number of addressable mobile customers as we are not taking into account age categories or the number of person per households.

For a total of 114 developing countries, the total addressable markets were calculated by overlaying the following data in urban and rural locations on a country basis:

- The percentage of the population with access to electricity and water (2013 from IEA and WHO/UNICEF sources);
- The percentage of the population being covered by GSM networks (the most recent data available from mobile operators and GSMA)

More information [Sizing the Opportunity of Mobile to Support Energy & Water Access](#)

## Energy addressable markets (population in millions)







For the full report please visit the GSMA website at [www.gsma.com](http://www.gsma.com)

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