The Value of Pay-As-You-Go Solar for Mobile Operators
Insights from customer journeys in Benin and Côte d’Ivoire
The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today’s biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world’s largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

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Abbreviations
ARPU  Average Revenue Per User
CDR  Call Detail Record
CGAP  Consultative Group to Assist the Poor
COM-B  Capabilities, Opportunity and Motivation-Behaviour
GDP  Gross Domestic Product
GOGLA  Global Off-Grid Lighting Association
GSM  Global System for Mobile Communications
IFC  International Finance Corporation
M2M  Machine-to-Machine
M4D  Mobile for Development
MMPI  Mobile Money Prevalence Index
PAYG  Pay-As-You-Go
SHS  Solar Home System
SMS  Short Message Service
USSD  Unstructured Supplementary Service Data
Executive Summary

Pay-as-you-go (PAYG) technologies, combined with mobile payments, have enabled a new wave of consumer asset financing for low-income customers. PAYG locking technologies, built on machine-to-machine communication, enable service providers to manage credit risk for low-income and unbanked customers. While the growth of mobile money has enabled cost-effective payment collection from remote customers.

PAYG solar has emerged as one of the strongest use cases for this technology, and the sector has matured from a handful of pilots to a global industry in under a decade. There are now over 420 million people using solar products for energy and lighting. The industry has also seen a dramatic rise in investment. Since 2012, $1.9 billion has been invested in the sector, and $1 billion of that in the last three years. In the last three years, debt accounted for 61 per cent of investment and equity 34 per cent. The synergies between mobile operators and PAYG solar providers have been clear from the start. Mobile operators provide the fundamental ingredients for PAYG through mobile money and connectivity. On the other side, PAYG solar boosts operator revenues from mobile money transactions and other services. Additionally, association with a core utility service allows mobile operators to strengthen their value proposition and gain customer trust.

In May 2020 the GSMA published the first quantitative analysis of the impact of mobile customers adopting PAYG solar on their mobile usage. That study, conducted in partnership with eight operators in five markets, analysed data for over 200,000 PAYG/mobile operator customers. The study compared the use of mobile services of the PAYG customer to a comparison group of other customers with similar profiles and found:

- On average, the average revenue per user (ARPU) increased nine per cent as compared to the comparison group;
- Across markets, 21 per cent to 31 per cent of PAYG customers were new to mobile money or reactivated accounts; and
- Customers increase their mobile money transactions between 27 per cent to 113 per cent depending on the market, and this increase was for transaction types beyond bill payment.

While the previous research clearly demonstrated the benefits quantitatively, it did not shed light on how and why people changed their behaviour. In order to explore these questions, in partnership with MTN in Benin and Orange in Côte d’Ivoire, we conducted a follow-up qualitative study.

This study repeated and updated the quantitative analysis done in the previous research. We then conducted a series of 120 in-depth interviews with end customers, focused on understanding the reasons behind their behaviour change. This report presents ten key reasons why people change their behaviour, and explores the questions of how, when, and for whom behaviour changes.

This study reinforces the deep synergies that exist between mobile and PAYG energy services. With new energy access, via SHSs, we see all aspects of customer behaviour shift. These changes reflect the transformation in peoples’ lives that comes with reliable energy access.

Many mobile operators and SHS providers have established partnerships. However, there are many markets where the PAYG solar sector is still developing, and in developed markets diversification is creating new opportunities. As such, there is still a huge amount of scope for the two sectors to work together.

PAYG solar companies have become increasingly well-positioned to provide consumer credit to low-income and remote customers. This is thanks to the payment histories these companies are generating, that the solar kit remains a lockable asset that can be used as collateral, and that these companies are increasingly specialised and ever increasing their reach.

We are seeing a clear trend in the market for PAYG solar providers to broaden their product and service offering. PAYG solar companies now offer products and services including smartphones, loans and other financial services, cookstoves, water pumps, and much more.

The rapid expansion in product and financial service offerings by PAYG solar companies underscores the fact that their operating model is best thought of as a ‘market-creating’ innovation, rather than simply another product or service. The broadening of the product offering also underscores the fact that these partnerships remain relevant in developed solar markets, perhaps even more so.

Mobile operators are well-positioned to leverage their technical platforms, making them widely accessible to a range of innovative utility service providers. Despite this win-win, many PAYG utility providers still face lengthy administrative and technical barriers working with mobile operators to set-up seamless mobile money integration with real-time notifications. Those mobile operators that seize this opportunity are likely to reap the benefits of increase brand recognition and value, and customer loyalty.

Scaling PAYG solar, or other PAYG products, depends on specialised sales and customer support which differs significantly from existing mobile operator agent network and customer support activities. Unlike the sale of mobile services, the success of PAYG solar depends on targeting the ‘right’ customers who likely have the ability and willingness to repay the loan. Incautious lending will quickly kill any asset financing business. PAYG providers’ specialisation in this area creates the opportunity for mobile operators to reach particular customer segments with critical, and ‘sticky’, services, and without bringing consumer debt onto the balance sheet.

The PAYG opportunity beyond solar is enormous, again reflecting the need and the extent of pent-up demand for affordable pathways to access essential goods and services. PAYG provider and mobile operator partnerships are central to meeting this need. Each side brings value the other does not, PAYG models have mobile services at their core, and PAYG providers have capabilities and a reach that many mobile operators do not.

Deepening these partnerships brings value to both sides, and ultimately results in reaching end users with products and services they have traditionally been excluded from.
Key reasons why people changed their behaviour

The research identified 10 key reasons why people changed their behaviour. These are categorised by if they primarily affected mobile money usage, the use of voice and data services, or both. The size of the factor indicates how significant it is.

Phones charged and on more often
- People used their phones more simply as they were now able to charge them more regularly.

Extended evenings
- Having electricity into the evening changed habits and social norms, with phone use part of this change.

Voice and Data

Switching operators
- Some users changed operators to that which was partnered with the PAYG company.

Frequency of cash-ins
- Because of making solar system payments, users make more frequent cash-ins, and use this opportunity for wider mobile money use.

Keeping money in the ecosystem
- Paying for the solar system meant many users left money in their accounts.

More confident in mobile money
- Because of the training given by agents at onboarding, customers are more confident mobile money users.

Linked subscriptions and add-ons
- When purchasing a solar home system many users went on to buy products that also utilise mobile money.

Higher earnings
- Access to power led many users to earn more from their businesses.

Who changes their behaviour?

We identified two key persona groupings:

- Nascent mobile money users
  - Gaining first time access to electricity
  - Using a feature phone
  - Lower incomes

- Existing mobile money users
  - Using power for business
  - Using a data enabled phone/smartphone
  - Higher incomes

Making payments regularly for solar builds confidence, encourages people to keep money in the ecosystem, and leads to people discovering services.

Frequency of cash-ins

At onboarding users receive key training on the use of mobile money.

Access to power means people have the opportunity to use their phone more, and paying regularly builds social capital, and contributes to higher earnings.

New energy access leads people to charge their phones more, extends evenings and changes social norms, and contributes to higher earnings.

Who changes their behaviour?

Limited drivers of change
- Pre-purchase
- Awareness
- Limited drivers of change
- Moderate driver of change
- Onboarding
- Payments
- Case
- Impacts
- Add-ons

Moderate drivers of change
- Presence
- Comms
- Usage
- Moderate drivers of change
- Linked subscriptions and add-ons
- Using reliable power for their business
- Changing consumption the mobile operator partnered with the solar provider

Biggest drivers of change
- Applying new services and choose to adopt add-ons
- Nascent mobile money users
- Gaining first time access to electricity
- Using power for business
- Existing mobile money users
- Using a data enabled phone/smartphone
- New energy access
- Extended evenings
- Through solar customers discover new products and take up add-on services

When does behaviour change occur?

We have identified the key moments of behaviour change on the solar home system customer journey. This mapping highlights which moments are most significant, and where partnerships are most relevant.

How does behaviour change?

For behaviour to change capabilities, opportunity, and motivation need to come together. The figure below highlights how these are influenced by PAYG solar adoption.

The onboarding process teaches users to be mobile money users and to be more confident users.

Users discover new services and choose to adopt add-ons.

Extended evenings as a result of access to power shift social norms.

As a result of power and paying regularly new habits are formed.

Earning more, access to power and regularly paying via mobile money creates physical capacity.

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Introduction

Pay-as-you-go (PAYG) technologies, combined with mobile payments, have enabled a new wave of consumer asset financing for low-income customers. PAYG locking technology, enabled through mobile machine-to-machine (M2M) communication, has opened access to essential services for low-income and unbanked customers, provided opportunities for them to build a credit history, and made it cost-effective and less risky for service providers to collect and manage payments from remote customers.

PAYG solar has emerged as one of the strongest use cases for this technology. In less than a decade, the PAYG solar sector has matured from a handful of pilots to a global industry of diverse and growing companies. PAYG technology is increasingly being used for smartphone financing, cookstoves, water meters, solar water pumps and other solutions. This trend is only set to accelerate in the years and decades to come.

PAYG solar providers and mobile operators: Natural allies

The synergies between mobile operators and PAYG solar providers have been clear from the start. Mobile operators provide the basic ingredients for PAYG – mobile money and connectivity – while PAYG solar boosts operator revenues from mobile money transactions and other services, aided by reliable phone charging. Association with a core utility service also allows mobile operators to strengthen their value proposition and gain customer trust.

Mobile operators seeking to engage with the PAYG solar sector have a range of options depending on their strategic objectives and appetite for risk:

- **Basic engagement** – mobile operators allow PAYG companies to integrate with their mobile money platforms;

- **Intermediate engagement** – operators may work more strategically with partners by leveraging their brand or agent/storefront network for distribution; and

- **High engagement** – operators seek to gain more value by leading their own PAYG services. Even if they outsource their products from vendors, by leading the business model and strategy, operators take on all ownership and risk.

The emergence and growth of the PAYG solar sector

Since 2013, the Mobile for Development (M4D) Innovation Fund has awarded grants to mobile-enabled off-grid energy services, including several frontier companies that provide PAYG solar home systems (SHS). The Fund has awarded grants to both PAYG solar companies working with mobile operators and, in a few cases, directly to mobile operators.2

The PAYG solar sector has grown rapidly over the last few years and now provides hundreds of millions of people with clean electricity. As of 2020, it is estimated that off-grid solar provides lighting and energy services to more than 420 million people.3 With this growth has come increased investment in the sector. When the GSMA began awarding grants for PAYG solar in 2012–2013, annual investment in the sector was $20 million per year. This has since risen to more than $300 million per year by 2020. Since 2012, $1.9 billion has been invested in the sector, $1 billion of which in the last three years.4

From PAYG solar to PAYG everything

The World Bank estimates there is a total potential market of 1.8 billion people for off-grid energy products and that there will be 823 million users by 2030 based on current growth.5 There is therefore plenty of room for the off-grid solar sector to grow and diversify its product offerings.

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4. All investment data from: https://www.gogla.org/access-to-finance/investment-data

5. Ibid.
As the off-grid solar sector has matured, companies have begun specialising in different parts of the value chain, from developing and manufacturing proprietary hardware to sales, distribution and consumer financing. According to a report by CGAP and the IFC, many PAYG solar companies started out as vertically integrated businesses that heavily integrated their retail and lending arms out of necessity. However, these two sides of the business have very different value chains, business operations and risks (Figure 1), and while many companies remain highly integrated, others have specialised in different parts of the value chain or focused on only one value chain.

By specialising over time, many PAYG SHS companies have acquired deep expertise in asset financing for low-income consumers. Additionally, previously unbanked consumers have been able to build a credit history through repayment of their loans. The combination of these two factors is allowing PAYG solar companies to offer a wider range of products and financial services, including smartphone offerings, which are of particular interest to mobile operators. That the solar home system remains a lockable asset means that this wider offering can include goods without locking technology as the solar system can be used as collateral.

For example, M-KOPA’s product range has grown to include smartphones, televisions, refrigeration, cookstoves and loan and insurance products. Similarly, Bboxx has launched a partnership with the Government of Togo to provide PAYG smartphones to accelerate digital adoption. An earlier example is Fenix International’s trial use of SHS as collateral for other loans, whereby they offered school loans secured against a locking SHS.

The value of PAYG solar for mobile operators: Past research

In May 2020, the GSMA, in partnership with eight mobile operators, conducted a quantitative study to explore the connection between customer uptake of PAYG solar and engagement with mobile services. The study looked at the impacts of PAYG uptake on the use of mobile money, airtime, data and financial services. The study analysed call detail record (CDR) data for the six months before and after a new PAYG SHS was activated. This analysis was conducted for cohorts of customers adopting PAYG solar by month, and was completed by analysts at the mobile operators. The results for SHS adopters were then compared with a comparison group of customers (selected by mobile operators) who had a similar customer profile at the time the SHS was adopted.

Data on more than 200,000 PAYG customers of eight mobile operators in five markets were analysed. Among other findings, the data revealed that:

- PAYG solar customers opened or reactivated mobile money accounts. Across the five markets, 21 to 31 per cent of PAYG customers were new to mobile money or had reactivated accounts.
- PAYG solar customers increased their mobile money usage. PAYG solar users in Benin activated a mobile money account at a much higher rate than the comparison group.
- PAYG solar customers became higher value customers for mobile operators. The average revenue per user (ARPU) was nine per cent higher than the comparison group.

Supporting activities

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<th>Customer base expansion</th>
<th>Data collection and analysis</th>
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The value of PAYG solar for mobile operators: New insights

Earlier GSMA research clearly demonstrated the value of PAYG solar for mobile operators. However, it did not shed light on the reasons customers changed their behaviour. To understand why, how, when and which customers changed their behaviour, the GSMA partnered with two mobile operators from the previous study to conduct more in-depth qualitative research on the customer journeys of PAYG solar clients.

The study was conducted in Côte d’Ivoire and Benin in partnership with the mobile operator and corresponding PAYG solar provider:
- In Côte d’Ivoire, this was Orange (operator) and its in-house SHS provider, Orange Energie; and
- In Benin, this was MTN (operator) and independent SHS provider Engie Energy Access (Engie), previously called Fenix.

An updated second round of quantitative analysis and additional in-depth qualitative interviews with customers identified the drivers and barriers to increased use of mobile services, and generated recommendations for how partnerships could unlock the most value. The remainder of this section outlines the methodology for the qualitative research, including the research frameworks used and the sampling and interviewing of respondents.

Methodology: Sampling and respondents

The methodology for the study involved two key stages. In the first stage, the analysis of the CDR data was repeated and updated for recent SHS customers. Details of this methodology can be found in the previous GSMA report. In the second stage, a sample of customers were selected for in-depth interviews.

In each of the two markets, 60 PAYG solar customers were selected based on changes to their use of mobile services. Grouping these customers as ‘doers’ and ‘non-doers’ and first-time and super users (see Table 1) allowed us to identify customers that had changed their behaviour after adopting an SHS.

In each market, the mobile operator (Orange and MTN) recruited customers via SMS or by calling them. Their consent was obtained to be contacted for the study. To eliminate the risks associated with COVID-19, interviews were conducted by telephone. These interviews generally lasted between 45 and 60 minutes. The interviews were conducted in July and August 2021 with customers that had started using their SHS in the last three to four months of 2020.

The profiles of respondents differed slightly in each market. In general, respondents in Côte d’Ivoire were more rural and there was a higher proportion of farmers. A slightly higher number of respondents in Benin used their SHS for business purposes. In both markets, respondents were overwhelmingly male. This was because respondents were identified based on the phone number used to pay for the SHS. It is a weakness of the research that findings were not able to be disaggregated by gender, and future research in this area would be valuable.

Analysis of the interview transcripts revealed key drivers of behaviour change. These were identified in two ways: i) by confirming or refining hypotheses developed in advance of the data collection (see the Appendix for details); and ii) through an exploratory analysis that identified common themes in the transcripts. Three research frameworks were used to examine the key drivers of behaviour change, which are outlined below.

### Methodology: Understanding behaviour change

To understand customer behaviour, three frameworks were used to examine three dimensions of behaviour change:

1. **When was behaviour change triggered?** This was explored using the SHS Customer Journey Framework.
2. **How did each driver change behaviour in mobile use?** The motivations of customers were examined using the Capabilities, Opportunity and Motivation Behaviour Change (COM-B) framework.
3. **For whom is each driver changing behaviour?** This was examined by considering the characteristics of customer personas most relevant to behaviour change.
When: The SHS customer journey

Although the customer journey of each SHS provider differs slightly, a customer journey framework was developed by industry researchers that studied PAYG SHS customers in Rwanda. Our research team adapted that journey, as shown in Figure 5, to highlight key points in the pre-purchase, purchase and usage stages where SHS may be able to drive behaviour change. It should be noted that while the customer journey has been simplified into a linear graphic, customers often move along this journey in non-linear ways. Overall, Orange and Engie share a very similar journey, although there are some key differences, as shown in Figure 5.

How: The COM-B behaviour change framework

The COM-B14 behaviour change framework explores how capabilities, opportunities and motivations influence behaviour choices. These categories help to isolate how drivers of behaviour change are working and to identify strategies that promote behaviour change. Each of the three categories is further divided into two subcategories, as shown in Figure 6.

- **Capabilities**
  - Physical capability involving a person’s physique/body; and
  - Psychological: Capability involving one’s mental function.

- **Opportunities**
  - Physical: Opportunities involving resources (money/time); and
  - Social: Opportunities involving other people/organisations.

- **Motivations**
  - Reflective: Conscious thought processes (plans, choices, risk management); and
  - Automatic: Subconscious motivators (desires, habits).

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Who: Developing customer personas

Like many companies, PAYG SHS providers may observe that customers with similar profiles exhibit similar behaviours. These similarities may be based on demographics and lifestyle, behavioural or attitudinal factors. These groups are often referred to as ‘personas’ or segments of users who are clustered together to better understand existing behaviour or to target them for behaviour change interventions.

In this research, direct engagement with providers and interviews with SHS customers revealed several characteristics that may influence whether they are likely to change their mobile usage behaviour. Six of the most important characteristics used in the analysis are highlighted in Figure 7.

### Key characteristics of SHS customer personas

**Mobile money customer journey**

- **Unaware**: Customer has never heard of mobile money
- **Aware**: Customer has heard of mobile money
- **Understand**: Customer understands how mobile money can be useful to them
- **Registered**: Customer has registered for the service
- **Tried**: Customer has tried the service at least once
- **Regular user**: Customer has made at least one payment over three months

**Electricity customer journey**

- **Unaware** → **First-time electricity**: Customer gains first-time access to energy at home
- **Aware** → **More reliable electricity**: Customer previously used the grid, generator, basic SHS
- **Understand** → **Enhanced electricity**: Customer previously used other SHS

**Mobile data customer journey**

- **Unaware** → **Power user**: Customer previously used other SHS
- **Aware** → **Equipped**: Customer previously used other SHS
- **Understand** → **Tried**: Customer has purchased data and used the internet on their phone
- **Regular user**: Customer has made at least five transactions in the previous month

**Device journey**

- **Basic phone**: No internet access on phone
- **Feature phone**: Limited internet access on phone (e.g., WhatsApp)
- **Smartphone**: Full internet access via phone (browsing, video, etc.)

**Income**

- **Low income; Irregular income**
- **High income; Regular income**

**Proximity to mobile money agent**

- **Far**
- **Near**

---

**FIGURE 7**

Key characteristics of SHS customer personas
Key factors driving behaviour change

This section discusses the 10 key factors driving behaviour change or, in other words, why SHS customers changed their behaviour. Each of these factors is discussed individually and addresses when, how and for whom this behaviour changed. This section also presents an updated analysis of mobile operators’ CDR data for recent solar customers.

The 10 drivers of behaviour change are grouped by the two main changes observed in mobile use: increased voice and data consumption and increased use of mobile money (see Figure 8).

While interviews indicated that each of these drivers primarily influenced one of these behaviours (voice/data or mobile money), there was some overlap and the drivers may influence both.

- **Phone charged and on more often:** Could also influence mobile money use, although interviews did not reveal uncharged phone as a primary barrier to mobile money uptake.
- **Extended evenings:** Could also increase mobile money use, especially when mobile money agents are open later.
- **Higher earnings and Keeping money in the ecosystem:** Additional money stored in mobile money accounts can be used to purchase more voice/data.

**Voice and data usage**

The analysis of CDR data shows that in both Benin and Côte d’Ivoire, voice and data usage jumped sharply for SHS customers after adoption. This is also reflected in increased ARPU across services:

- In Côte d’Ivoire, revenue from all sources increased by nine per cent in the six months after SHS adoption compared to the six months before. By contrast, there was a one per cent drop in revenue for the comparison group, and
- In Benin, ARPU for SHS customers increased by 17 per cent overall, with a 10 per cent increase in voice and SMS revenue and a 24 per cent increase in data revenue.

The following drivers were identified as having the biggest impact on customer behaviour changes in voice and data usage:

- Customers were able to charge and have their phones on more often;
- Lighting products extended people’s evenings; and
- In some cases, SHS adoption meant that customers switched mobile operators and began using their services more.

**FIGURE 8**

Key drivers of behaviour change

<table>
<thead>
<tr>
<th>Behaviour changed</th>
<th>Drivers of behaviour change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased voice/data usage</td>
<td>Phone charged and on more often</td>
</tr>
<tr>
<td></td>
<td>Extended evenings</td>
</tr>
<tr>
<td></td>
<td>Switching mobile operators</td>
</tr>
<tr>
<td>Increased mobile money usage</td>
<td>Frequent cash-ins</td>
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<td></td>
<td>More trust in mobile money</td>
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<tr>
<td></td>
<td>Linked subscriptions and add-ons</td>
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<td></td>
<td>Higher earnings</td>
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<tr>
<td></td>
<td>Keeping money in the ecosystem</td>
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<tr>
<td></td>
<td>Discovering new services</td>
</tr>
</tbody>
</table>
Phones on and charged more often

By far the greatest impact on increased data and voice usage is that SHS allow users to charge their phones more easily and, therefore, use their phones more often.

Prior to having a SHS, many users would have to travel to access electricity, either through friends and family or by paying to charge their phones. These barriers prevented people from using their phones more often and more extensively. Phones were more likely to remain out of power for extended periods. Other times, people would intentionally switch off their devices to preserve remaining battery life for important calls or activities later.

PAYG SHS allow people to use their phone for more hours in a day and without having to worry whether certain uses, such as data consumption, would deplete the battery too quickly. Greater availability of powered devices therefore also translates into greater use of data and voice services.

Extended evenings

SHS users often have more leisure, social and work time later in the evenings since their homes are now powered with electricity. This extra time is often spent on activities that consume data and voice services.

With more light, households are also awake later in the evening, often engaging with family and neighbours. Likewise, for SHS users who purchased a TV, family and friends often gather late into the night to watch news, sports and entertainment programmes.

As behaviours and social norms shift due to newfound electricity, activities that rely on mobile data become more mainstream. For example, users with smartphones reported downloading music and movies.

Those who may have rarely used the internet before sign up for social media accounts and connect for the first time online with others through photos, videos and messages. Together, these changes in lifestyle organically lead to more data use for those who can afford it. In communities where PAYG SHS are present, there is a ‘snowball’ or ‘herd’ effect whereby other households also start to desire electricity, entertainment and information like their peers.

How is behaviour changed? (COM-B)

Physical opportunity:

Thanks to new charging access in their homes, SHS create opportunities for increased usage.

Who changes their behaviour? (Customer characteristics)

**Electricity customer journey**

<table>
<thead>
<tr>
<th>SHS</th>
<th>First-time electricity</th>
<th>SHS &gt; More reliable electricity</th>
<th>SHS &gt; Enhanced electricity</th>
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<td>Device journey</td>
<td>Those with more advanced devices stand to gain the most as their devices discharge more quickly than basic phones.</td>
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Who changes their behaviour? (Customer characteristics)

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When do we see behaviour change from SHS? (SHS journey)

Use cases: New electricity from the SHS allows users to charge and keep their phones on more often.

Impacts: Secondary impacts from SHS also drive users to keep their phones on more often.
Changing mobile operators

After purchasing an SHS, some users shift their data/voice business from one mobile operator to another. In some cases, users start engaging with a new mobile operator primarily because of their SHS. One user in Benin who had primarily used another operator before signing up for Enegy, switched to MTN because of his SHS. After trying out data bundles purchased via mobile money, he started shifting his internet use to the new network, discovering that their service was more suited to his needs.

How is behaviour changed? (COM-B)

Psychological capability: Using a mobile operator platform for SHS enables customers learn how to purchase other services, such as data.

Reflective motivation: Exposure to new product/purchase options can motivate SHS customers to consider alternatives to current services.

Automatic motivation: As SHS customers get in the routine of regularly paying for SHS via mobile money, they can likewise get in the habit of purchasing mobile services from the associated mobile operator.

Who changes their behaviour? (Customer characteristics)

Mobile money customer journey

Unaware → Aware → Understand → Registered → Tried → Regular user → Power user

Those at an earlier stage of their mobile money and mobile data journeys are more likely to switch to competitor networks.

Mobile data customer journey

Unaware → Aware → Understand → Equipped → Tried → Regular user → Power user

Proximity to mobile money agents

Far → Near

Those who are located closer to mobile money agents are able to take advantage of more frequent cash-ins.

Key factors driving behaviour change

Increased mobile money usage

In both Benin and Côte d’Ivoire, mobile money usage by SHS customers jumped sharply after they adopted their systems. In Côte d’Ivoire, the average number of monthly transactions jumped by 33.8 per cent after adoption versus just 11.5 per cent in the comparison group, and in Benin by 84 per cent.

Importantly, data from both Benin and Côte d’Ivoire show an increase in mobile money use for all transaction types after SHS adoption. This clearly indicates that the change in the overall number of transactions is not simply due to paying for the SHS, but is also a much broader change in behaviour related to mobile money use.

The seven following factors explore the key drivers of behaviour change related to mobile money. Once again, each driver is discussed in terms of when, how and for whom behaviour has changed.
Impact on mobile money transactions: Insights from Orange Côte d’Ivoire

FIGURE 10

Impact on mobile money transactions: Insights from MTN Benin

FIGURE 9

Impact on mobile money transactions: Insights from MTN Benin

FIGURE 11

Frequency of cash-ins

Since many users make frequent SHS payments, they are also making more mobile money deposits.

In Benin, the majority of users interviewed were depositing and immediately paying Engie multiple times per week in very small amounts. In Côte d’Ivoire, users paid less frequently – often weekly or monthly – and in larger amounts. However, in both countries, most SHS payments were closely preceded by mobile money deposits, rather than being made using money saved in mobile money accounts over time.

The difference in payment behaviour between the two markets is likely because incomes in Benin are lower and more irregular than in Côte d’Ivoire. Users there often mentioned they would pay for their SHS when they could find the money. “We used to pay 10,000 francs at once, but because times are hard we now pay 2,000 every few days,” noted one user. Another shared, “If I have money, I put a little on Fenix [Engie]. If I don’t, I don’t.” In Côte d’Ivoire, where respondents indicated having fewer financial challenges, SHS is a service that more users can pay for in larger amounts. It is also worth noting that the sample of respondents in Côte d’Ivoire was more rural and would likely have higher transaction costs due to a lower density of mobile money agents.

Agent density is a critical factor in both mobile money uptake and financial inclusion, and the findings of this research confirm that it drives behaviour with PAYG solar. According to 2019 figures from the GSMA, a mobile money agent has approximately seven times the reach of ATMs and 20 times the reach of bank branches, but it can differ substantially within and across countries. In 2019, the density of the agent network averaged 228 active mobile money agents per 100,000 adults, a three-fold increase since 2014. Meanwhile, commercial bank branches in the same markets averaged 11 per 100,000 adults, a figure that did not change substantially between 2014 and 2018.

Past research by BFA Global has highlighted the importance of payment flexibility to the central value proposition of PAYG solar, as it drives financial inclusion and access to services. In both countries, payment flexibility is an option, but where incomes are lower and payments are more frequent, certain norms appear to form around how agents explain payments to customers. In Benin, more respondents noted that agents explained that the SHS functions for a daily price – the more you pay, the more days of electricity you receive. In Côte d’Ivoire, however, it appears that pricing was framed more in terms of a monthly amount with the option to accumulate over time.

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How is behaviour changed? (COM-B)

Automatic motivation: SHS drives habitual payments via mobile money in return for a basic need: electricity.

Physical opportunity: Because of the requirement to pay for SHS via mobile money, an opportunity is created for customers to engage more with the platform.

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Who changes their behaviour? (Customer characteristics)

Income

<table>
<thead>
<tr>
<th>Low income: irregular income</th>
<th>High income: regular income</th>
</tr>
</thead>
</table>

Proximity to mobile money agents

<table>
<thead>
<tr>
<th>Far</th>
<th>Near</th>
</tr>
</thead>
</table>

When do we see behaviour change from SHS? (SHS journey)

Onboarding: Agents that frame the SHS price as a daily amount can encourage more frequent cash-ins.

Payments: As SHS require payments via mobile money, this drives corresponding cash-ins.

Communications: Payment reminder messages can encourage more frequent cash-ins.

PERSONA 2

Felix: Mobile money maturer

Key characteristics

- Gender: Male
- Age: 28
- Family: Wife and two children; four in household
- Lives in: Rural town
- Job: Carpenter

His SHS story:

Felix has been using MTN Mobile Money for a while to receive payments from clients. He would withdraw the money and spend it.

Since he started using his SHS, Felix says he is engaging more frequently with his mobile wallet: "I deposit money every two days when I pay for my solar panel, whereas before I wouldn’t touch my account for days. It’s because of the solar system that I got used to using it. Now, if somebody sends me money on my mobile wallet, I might leave it on my account because I now can use it to pay for Fenix (Engie) in a few days."

His family primarily benefits from light in the evenings, which his kids use to study. While he’s not a data user, he wants to save up to buy a smartphone.

More confidence using mobile money

Thanks to the onboarding they received for their SHS and the frequency with which customers pay for their SHS through mobile money, they have become more confident mobile money users.

Before acquiring their SHS, many customers were nascent mobile money users, lacking the confidence to conduct transactions on their own. Many, especially in Benin, reported they did not use mobile money very often, primarily used it to receive and withdraw funds and did not have a good understanding of the wider system.

When installing SHS, agents for both Orange Energie and Engie show customers how to use mobile money and almost always leave behind a piece of paper with the USSD code on it. This helps customers understand and gain confidence in paying for their subscription. As they make these transactions more regularly, they often become more confident in using mobile money for other types of transactions and on their own, rather than relying on an agent for assistance.

How is behaviour changed? (COM-B)

Physical capability: As a result of making SHS payments, users gain skill and proficiency in navigating mobile money menus.

Psychological capability: As a result of making SHS payments, users gain more knowledge of mobile money menus and products.

Onboarding: SHS agents demonstrate how to pay via mobile money and almost always leave behind a piece of paper with the USSD code on it. This helps customers understand and gain confidence in paying for their subscription. As they make these transactions more regularly, they often become more confident using mobile money for other types of transactions and on their own, rather than relying on an agent for assistance.

Who changes their behaviour? (Customer characteristics)

Mobile money customer journey

Unaware Aware Understand Registered Tried Regular user Power user

Those at an earlier stage of their mobile money journey stand to gain the most confidence.
More trust in mobile money

Prior to having a SHS, many users did not fully trust mobile money. However, after using mobile money regularly for their SHS payments, they have developed more trust in the platform. There are numerous reasons for this lack of trust. Some cited instances in the past where they felt they had lost money from their mobile money accounts. Others, especially in Côte d’Ivoire, noted there are many instances of scammers trying to take advantage of mobile money users. Others simply did not trust mobile money because they had limited experience using it.

Because SHS users are frequently depositing funds, paying their bill and seeing their transactions result in regular electricity, they now experience mobile money working as it was designed. Receiving a confirmation SMS after depositing funds into mobile money accounts and making an SHS payment plays a big role in building customer trust. Experiencing the speed and convenience of mobile money also strengthens their trust. This was most evident among users who said that when they first got their SHS, they were afraid of scammers. When it comes to Fenix [Engie], it’s a different story. They have a code and when you dial, the money goes to them. I trust them.”

Victor, Côte d’Ivoire

“I am afraid of scammers. When it comes to Orange, it’s a different story. They have a code and when you dial, the money goes to them. I trust them.”

Euphreme, Benin

58% of doors said their trust in mobile money has increased.

“With Orange when you charge it’s done, it does not change - your money comes same amount. I see that there is a lot of confidence with them, Orange.”

Victor, Côte d’Ivoire

“Before, I was working with my MTN chip, now I work more with Orange because I trust Orange more.”

Desire, Côte d’Ivoire

Linked subscriptions and add-ons

When purchasing an SHS kit that includes a TV, many users add on satellite TV services that are also paid for via mobile money. Additional SHS appliances also increase transactions. An obvious reason for increased mobile money transactions among SHS users who purchase TVs is that they also subscribe to satellite TV services, often through the same agents that sell them the SHS. Canal+ and Star Times are the two leading TV providers in Côte d’Ivoire and Benin.

The impact of these linked products has been most pronounced for Orange Energie, which include a TV in all their packages. In Benin, meanwhile, many users opted for packages without TVs because they were more affordable or the lowest level entry into SHS ownership.

Mobile money transactions also increase when SHS providers offer add-ons beyond their main kits. For example, Orange Energie allows users to add fans that they pay for separately.

Who changes their behaviour? (Customer characteristics)

How is behaviour changed? (COM-B)

Income

Low income; Irregular income

High income; Regular income

Those with higher incomes have the ability to take advantage of additional subscriptions more than those with lower incomes.

Device journey

Basic phone

Feature phone

Smartphone

Those with more advanced devices are more likely to take advantage of additional subscriptions. For example, a smartphone owner may opt for music or video streaming add-ons.

When do we see behaviour change from SHS? (SHS journey)

Use cases: The products offered by SHS providers can drive linked subscriptions (i.e. TVs in bundles).

Add-ons: The add-ons offered both by SHS providers and mobile operators can drive additional mobile money usage.
Clement: Solar upgrader and barber

**PERSONA 3**

**Clement:** Solar upgrader and barber

- **Gender:** Male
- **Age:** 27
- **Family:** Single; lives with family
- **Lives in:** Small town
- **Job:** Barber

**His SHS story:**
Clement decided to purchase an Orange Energy SHS after one year with another SHS provider. His other provider offers a hair clipper kit, which he uses to cut hair when his on-grid connection goes off. He decided to add Orange because of the TV, which his customers can watch while waiting for a cut (thanks also to his Canal+ subscription). His new SHS also allows his customers to charge their phones and brings in a little extra cash.

Clement views his new purchase as part of his growth as a business owner. The extra light that he uses in the evening at home also helps him save more, as it is cheaper than public electricity. He was a power mobile money user before so he hasn’t seen much change since the switch.

Clement allows his customers to charge their phones and brings in a little extra cash.

**Key characteristics**

- **Mobile money (pre-SHS):** Please use doing five to 10 transactions a day
- **Electricity (pre-SHS):** Has one other bit from a competitor and an on-grid connection (although spotty)
- **Mobile data (pre-SHS):** Regular user; consumes $2/week for data
- **Proximity to mobile money agent:** 5-minute walk
- **Average income:** Business is steady and he has expanded over the past 12 months
- **Device:** Smartphone

**Higher earnings**

For many SHS users, longer business/working hours are allowing them to earn and save more money, which often ends up in mobile money accounts.

This finding is in line with industry research that has found evidence of how access to electricity affects income. A 2018 GOGLA study in five African markets found that more than a third of new solar users increased their access to electricity. A 2018 GOGLA study in five African markets found that more than a third of new solar users increased their access to electricity. A 2018 GOGLA study in five African markets found that more than a third of new solar users increased their access to electricity. A 2018 GOGLA study in five African markets found that more than a third of new solar users increased their access to electricity. A 2018 GOGLA study in five African markets found that more than a third of new solar users increased their access to electricity.

Several users who were interviewed indicated they believe their SHS has allowed them to increase their business revenues, primarily by extending their hours at night or by avoiding lost revenue during power cuts. This is especially true for shopkeepers/traders, barbers and mobile money agents. Not only are agents earning more money, but they are also facilitating more mobile money transactions for their community members later in the evening, creating a multiplier effect. Those who are earning more often share examples of how this money finds its way into their mobile money accounts, whether via savings in the accounts or sent to family/friends via P2P transfers.

**Who changes their behaviour? (Customer characteristics)**

**Mobile money customer journey**

- **Unaware**
- **Aware**
- **Understand**
- **Registered**
- **Tried**
- **Regular user**
- **Power user**

**Proximity to mobile money agents**

- **Far**
- **Near**

**Electricity customer journey**

- **SHS + Past-time electricity**
- **SHS + More reliable electricity**
- **SHS + Enhanced electricity**

**92%** of those using their SHS for their business say they now earn more money

**How is behaviour changed? (COM-B)**

**Physical opportunity:** SHS are providing opportunities for users to earn more financial resources.

**Social opportunity:** SHS can shift social norms in communities since people are out later in the evenings conducting business transactions.

**Automatic motivation:** SHS users start to habitually work longer as a result of light created by SHS.

**Who changes their behaviour? (Customer characteristics)**

**Mobile money customer journey**

- **Unaware**
- **Aware**
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**Proximity to mobile money agents**

- **Far**
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**Electricity customer journey**

- **SHS + Past-time electricity**
- **SHS + More reliable electricity**
- **SHS + Enhanced electricity**

**When do we see behaviour change from SHS? (SHS journey)**

**Use case:** Light and electricity generated by the SHS allow businesses to operate more frequently.

**Impacts:** Secondary impacts from SHS drive additional income and savings.

---

Hermine: Working later, earning more

Key characteristics

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
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<tbody>
<tr>
<td>Gender</td>
<td>Female</td>
</tr>
<tr>
<td>Age</td>
<td>36</td>
</tr>
<tr>
<td>Family</td>
<td>Husband and four kids; seven living in household</td>
</tr>
<tr>
<td>Lives in</td>
<td>Village</td>
</tr>
<tr>
<td>Job</td>
<td>Sells household products from her home</td>
</tr>
<tr>
<td>Her SHS story</td>
<td>Hermine heard about Engie when an agent came to her village. Her sister had purchased a similar system last year and encouraged her to buy one. This is the first time Hermine’s family has had electricity. Before, when it got dark they relied on candles and flashlights, but now they have three lightbulbs. Hermine uses the light to keep her store open for two to three extra hours each night. While working, she’s busy chatting on WhatsApp with friends and family. She used to worry that using her phone at night would deplete the battery and she’d miss important calls, but now she knows she can recharge anytime. Thanks to her extended business hours, she’s earning more overall. “I’ve more than doubled my contributions to my tontine (savings group) since I got my lights,” she notes. “I also started sending a little money to my mother via MTN when I go to make my deposit for Engie. It saves me a trip and I feel confident I can make the payment on my own.”</td>
</tr>
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Keeping money in the ecosystem

Whereas mobile money users may have previously withdrawn funds from their mobile money accounts, more are now leaving those balances on their phones to pay for their SHS. Keeping money in the ecosystem is vital to strengthen it. As highlighted in the GSMA State of the Industry Report on Mobile Money 2021, as of December 2020, $23 billion was circulating in the mobile money ecosystem. Very few SHS users reported depositing more money in their mobile money accounts to save for their SHS payments. Instead, most opted for deposits followed by immediate SHS payments. However, it was observed that users may reduce the number and value of cash-outs they make to use their account balance for SHS payments. This was especially true for users who received peer-to-peer transfers from friends and family or payments from customers. Some users may be shifting more of these types of transactions onto the mobile money platforms used by SHS providers. All these actions deepen user engagement with the mobile money ecosystem.

How is behaviour changed? (COM-B)

**Physical opportunity:** SHS is providing an opportunity for customers to store money in their mobile wallets for future payments.

**Reflective motivation:** SHS users consciously choose to leave money in their mobile wallets to make solar payments.

Who changes their behaviour? (Customer characteristics)

**Income**

- **Low income:** Low income; Irregular income
- **High income:** High income; Regular income

Those with higher incomes are more able to save money in their mobile wallets rather than withdraw for other expenses.

Keeping money in the ecosystem

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Discovering new services

Because they must make their SHS payments via mobile money, many users have discovered new services or conveniences that prompted them to use mobile money for new types of transactions. Several interviewees shared stories of how their mobile money usage expanded organically as they engaged more with the platform. For example, some users who visited the platform frequently were more likely to discover other types of transactions, such as paying other bills or sending money to friends and family. Other users pointed to new types of transactions they either had not been familiar with or did not know were possible with mobile money.

How is behaviour changed? (COM-B)

Psychological capabilities: As a result of making SHS payments, users gain knowledge of a mobile operator’s mobile money products and services. Automatic motivation: As SHS customers get in the routine of paying for SHS via mobile money, they can also get in the habit of purchasing mobile services from the associated mobile operator. Reflective motivation: Exposure to new products and services can motivate SHS customers to choose new options.

Who changes their behaviour? (Customer characteristics)

Mobile money customer journey

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Those at an earlier stage of their mobile money journey are more likely to discover new services on mobile money.

When do we see behaviour change from SHS? (SHS journey)

Payments: Because mobile money is required for SHS payments, money is kept in wallets longer.

Non-doers

SHS customers who did not increase their mobile usage did so for five main reasons.

They were already high-volume mobile money users. Changes in mobile behaviour are less pronounced for those who already make a high number of mobile money transactions. In these cases, much of the additional use comes simply from paying for their SHS. In Côte d’Ivoire in particular, several Orange Money users reported they already used mobile money regularly to pay bills, send/receive money and purchase airtime/data. For them, the additional SHS payments were less significant. In other cases, users who saved frequently on their mobile money accounts did not see their deposits increase like many other SHS users since the money was often already in the system and ready to be used for SHS payments.

They already had access to electricity. Those who did not increase their voice/airtime and data usage often already had the means to charge their phones at home through other SHS providers, generators or the public electricity grid. These users were therefore less likely to experience the benefits of first-time or more consistent electricity.

They are slower adopters of mobile money. As with any service, there are those who do not use the services as fully as others. Despite several examples of SHS helping customers understand, trust and gain experience with mobile money, there are still customers who do not feel completely confident making payments on their own. Others are more limited by literacy, and users like Koudou in Côte d’Ivoire often turn to others to complete transactions for them: “I go to the man who does Orange Money; I give him the money and then he pays for me.”

There are network limitations. There were some examples of poor network coverage or service quality preventing customers from fully engaging with the products and services offered by a mobile operator. In these cases, customers may make sacrifices to pay for and retain the vital service they receive from their SHS. However, they are unlikely to increase voice, data or mobile money usage beyond the bare minimum. Koffi in Côte d’Ivoire noted that he travels more than 12 kilometres once a month to pay his SHS bill, but “given my situation in the village, the Orange network is not very good, so I can’t make any other transactions.”

They choose to pay for their SHS in bulk. Users who pay for their SHS either upfront or in large instalments tend to increase their mobile money usage less. In Côte d’Ivoire in particular, customers tend to pay monthly, which results in a smaller shift in mobile money behaviour. There are various reasons for making bulk payments, including seasonal income (farmers often receive most of their earnings at once), the desire to ‘own’ the system more quickly or, as one user in Benin noted, “I stopped leaving money in my mobile money account because of scammers” and decided to pay for two to three months at a time.
Summary of key findings

Revisiting the SHS customer journey

The SHS customer journey helped to answer when SHS drives behaviour change (see summary in Figure 13. Four key points stand out:

- The most significant impacts on behaviour came from access to electricity. There is a clear relationship between access to electricity and engagement with mobile services, as electricity provides the foundation for customers to adopt mobile money. Likewise, connectivity is central to the PAYG business model and is a critical enabler of access to electricity in the first place.

- Behaviour change is primarily driven in the ‘usage’ phase of the customer journey. Because mobile money is required to make SHS payments, customers are engaging with mobile money platforms regularly and many for the first time. Products offered by SHS providers (basic lighting/charging capabilities as well as more advanced add-on appliances like TVs) are also major drivers of behaviour change.

- On-boarding and communication play a role, but a smaller one. By introducing users to new services during SHS training and through communication strategies that include sending users payment confirmations, some users – especially those newer to mobile money – develop more confidence and trust in mobile money.

- Differences in sales and marketing approaches do not appear to have a significant impact on the degree of behaviour change. The research team hypothesised that the channels through which users become aware of and purchase their SHS (e.g., fixed store location, door-to-door agents or call centres) may influence the degree to which users increase their mobile usage. However, interviews with users did not indicate that different engagement strategies made a significant difference to behaviour. This may be explained by the fact that most users in this study engaged with a person when they purchased their SHS. Earlier research by CGAP found that engagement with a person is important in encouraging mobile money adoption.

19. See: An Innovator’s Dilemma: Teaching Mobile Payments (CGAP blog post)
Revisiting COM-B

Capabilities – In terms of an SHS customer’s ability to use mobile services, greater knowledge, understanding and confidence largely came with the requirement to pay for SHS via mobile money and the on-boarding provided by SHS agents. These factors tended to have more of an impact on mobile money usage than data/voice, as SHS users in both markets were less experienced with mobile money than data/voice users before signing up for SHS.

Opportunities – SHS customers had opportunities to expand their mobile money, mobile data and mobile voice usage, primarily through direct use cases (more electricity), secondary impacts (more earnings and savings) and linked products (satellite TV subscriptions and SHS appliances). Social norms have also shifted, creating more opportunities to use electricity, technology, data and entertainment services.

MOTIVATIONS – As SHS customers make regular payments via their mobile money account, they grow to trust mobile money and perceive it as convenient. This, in turn, motivates them to use it for other transactions, and SHS customers are now consciously choosing to shift additional business to the mobile operator they use to pay for their SHS. Users are also developing new habits around SHS payments and electricity use that drive automatic shifts in behaviour.

Social norms have also shifted, creating more opportunities to use electricity, technology, data and entertainment services. These norms have led to changes in behaviour, with more people using mobile money transactions, and paying for electricity, technology, data and entertainment services using mobile money.

Revisiting customer personas

This section discusses how the characteristics of SHS customers shape the use of mobile services and the most significant impacts experienced by these different ‘personas’.

In general, new SHS customers who are less experienced mobile money users often increase their mobile transactions more. Those in the early stages of their mobile money customer journey stand to gain the most from a greater ability and motivation to use mobile money since their knowledge, understanding and trust all improve. For those who have more experience with mobile money, it is more opportunities or use cases that are largely responsible for shifting them from a user who has simply tried mobile money to regular and power users.

Both these findings were evident among mobile money users in Côte d’Ivoire and Benin. Users in Côte d’Ivoire tended to be more established, already taking advantage of a wider range of mobile money transactions. Their usage was therefore less influenced by the purchase of an SHS. In Benin, users were in earlier stages of their mobile money customer journey, and gaining knowledge and trust in mobile money played a bigger role in moving them further along.
A data-ready smartphone or feature phone is a prerequisite for mobile data use, and once users have one they can reap more benefits from their SHS. Perhaps unlike mobile money, mobile data usage is less likely to change for SHS customers who are at an earlier stage of the customer journey. Once users have an internet-ready device, SHS can unlock opportunities and motivations to consume more data since their phone can be kept charged. Social norms around electricity use have changed or linked products like TVs allow music and movies to be played. PAYG smartphones offered via mobile operators or SHS providers may be a major opportunity to drive behaviour change.

A user's income and ability to accumulate money has an impact on their mobile usage. Those with lower and more irregular incomes were more likely to pay for their SHS in much smaller amounts and more frequently, creating the opportunity for greater behaviour change in mobile money usage. This was reported in interviews with SHS customers in Benin. Customers with higher incomes and the ability to save over time often do not increase their mobile money transactions as much as the lower-income customers interviewed, but those with more income have the capacity to increase their data spend and adopt additional services, such as satellite TV or more appliances.

Gaining access to reliable electricity for the first time affects how much a customer's mobile usage is likely to change. SHS users who already had fairly reliable access to electricity via other solar providers were likely to have already experienced some of the positive impacts of solar products, such as more frequent phone charging. If they switch to a new SHS provider, they are unlikely to reap those benefits again. However, those who are getting power for the first time register the most growth. This was reflected in data from Côte d'Ivoire where most SHS customers had access to other sources of power before switching to Orange Energie. Meanwhile, most MTN/Engie customers in Benin were gaining access to electricity for the first time, and more indicated that their phones were charged and consuming more data than customers in Côte d'Ivoire.

The farther a new SHS customer lives from a mobile money agent, the less likely they are to experience an increase in mobile money transactions. Interviews revealed that the more often a customer deposits cash into their mobile money account and pays for SHS, the more likely they are to increase the volume of their mobile money transactions. However, those who do not live near an agent have less ability to make frequent SHS payments. Close collaboration between SHS providers and mobile operators can help ensure that targeting – both who SHS providers seek to reach and where mobile operators seek to their build agent network – is enhanced by the other.

Comparing the markets

The two companies explored in this research have several differences, including how much their customers earn, how new they are to mobile money, how new they are to electricity, how their products are framed and how they arrive as customers to SHS providers and mobile operators.

Benin
- SHS users were newer to mobile money. They had developed more confidence and trust and experienced more impacts that would support future mobile money growth.
- More likely to not have any electricity prior to purchasing an SHS. More reliant on candles and torches.
- Lower incomes. SHS customers made smaller and more frequent payments.
- Product and price framed in terms of daily use. Together with lower incomes, this led to smaller, more frequent cash-ins and payments.
- Engie’s reputation with SHS drove people to try MTN for the first time or for more services.

Côte d’Ivoire
- More experienced mobile money users. They already understood how to use mobile money, but were more likely to deposit higher earnings into other mobile money services like P2P transfers and savings.
- More likely to have electricity. They already had electricity via other SHS providers, public grids or generators.
- Higher Incomes. They paid for SHS less frequently, and had more to spend on data/voice.
- More linked services. Since all packages come with TVs, more customers added on satellite subscriptions, which they also paid for via mobile money.
- Orange’s reputation as a mobile operator drove people to try Orange Energie for the first time.
The Value of Pay-As-You-Go Solar for Mobile Operators

Takeaways for mobile operators and SHS providers

This study has confirmed deep synergies between mobile and PAYG energy services. Accessing energy for the first time via SHS changes all aspects of customer behaviour (capabilities, opportunities, and motivations) and transforms people’s lives as they discover the opportunities that come with reliable energy access.

Many mobile operators and SHS providers already have established fruitful partnerships. However, in many markets, the SHS sector is still developing and has tremendous scope for the two sectors to work together. For SHS providers, mobile services and partnerships with mobile operators are key to reducing barriers to market entry and scale. Even in markets with established partnerships there are opportunities to deepen them, especially with the launch of new PAYG products and services, such as smartphones, loan offerings, productive use assets and clean cooking, as well as financial products such as school loans.

With a decade of experience working at the intersection of mobile and energy services, the GSMA Digital Utilities programme has identified some key lessons for mobile operators engaging with the PAYG solar sector:

1. Mobile operators are well positioned to make their technical platforms widely accessible to a range of innovative utility service providers. However, many PAYG utility providers still face significant administrative and technical barriers to working with mobile operators and setting up seamless mobile money integration with real-time notifications.

The GSMA has helped to bridge this gap through initiatives such as the harmonised Mobile Money API specifications and the Instant Payment Notification Hub (IPN Hub). These important tools help to reduce the time and cost of connecting new businesses to mobile money platforms, which is critical for mobile operators to pursue a ‘payments as a platform’ approach. Mobile operators that seize this opportunity are likely to reap the benefits of stronger brand recognition and greater value and customer loyalty.

2. Scaling PAYG solar or other PAYG products depends on specialised sales and customer support, which differs significantly from existing agent network and customer support activities. Unlike the sale of mobile services, the success of PAYG solar depends on targeting the ‘right’ customers who have the ability and willingness to repay their loan. Incautious lending brings a quick end to any asset financing business.

The specialisation of PAYG solar companies (operator- or non-operator owned) in different parts of the customer value chain (sales, distribution and asset financing) is what makes partnerships valuable for mobile operators. The nature and value of partnerships with PAYG providers differ between markets and providers, but all create the opportunity for mobile operators to reach particular customer segments with critical, ‘sticky’ services without adding consumer debt to the balance sheet. In the past decade, PAYG solar companies have gained experience managing credit risk for low-income customers, and this has laid the foundation to offer a wider range of products to customers with an established payment history. As highlighted in a MasterCard white paper, the solar sector is driving the PAYG revolution, and PAYG models are, in turn, driving a new wave of financial inclusion.

This study has generated new evidence and insights into the experiences of customers who have adopted PAYG solar. These can be used to inform the targeting and structure of mobile operator and SHS provider partnerships, and these are discussed in the following section in turn.

Implications for targeting and customer segmentation

The impact of energy access on mobile usage differs substantially by customer profile. This study found that those who are in the early stages of their mobile money
journey, those who are gaining access to electricity for the first time and those who are using a feature phone are most likely to see the greatest changes in behaviour. These findings underscore the fact that mobile operators are likely to reach new customers and market segments through partnerships with SHS providers. Rural populations and other populations gaining reliable electricity for the first time stand to gain the most from PAYG service providers. These users stand to mature the most in their mobile money journey. With those who are more advanced mobile money users, providers should focus more on creating income-generating opportunities via SHS that can flow back into the mobile money ecosystem. Some examples include hair clippers, chicken incubators and multi-phone charging stations.

Recommendations for PAYG service providers

This research has identified the points in the SHS customer journey where impacts are most significant. Some of the greatest impacts on behaviour are in the sales and on-boarding stages, as these are critical moments to build customer trust and capacity. It is also an important area in which to deepen mobile operator-SHS partnerships and a first step in moving from the most basic level of engagement (operators making their services available to SHS providers) to deeper engagement.

Use cases and add-ons are also critical areas in which to deepen partnerships. For many SHS customers, making repayments via mobile money is their first opportunity to develop a credit history. Experience with asset financing has enabled many SHS providers to diversify their product offering, which adds value to partnerships in terms of serving existing customers. Ultimately, value is generated from the benefits customers reap from accessing essential products and services for the first time and, for many people, accessing credit on a flexible and convenient basis, which was simply not an option until recently. Growth in the PAYG sector reflects this pent-up demand for access to affordable basic products and services, and the transformative value of digitally enabled, market-creating innovations that can address this demand in a commercially sustainable manner.

Looking ahead: Development outcomes and the energy-mobile nexus

The GSMA Mobile Money Prevalence Index (MMPI) combines country-level data on mobile money adoption, activity and accessibility, providing the most comprehensive, publicly available cross-country analysis of the state of mobile money. Benin and Côte d’Ivoire both rank high on the index, which provides important context for the findings of this research. It is clear that markets with less developed mobile money ecosystems
stand to gain a great deal from the continued growth of the PAYG sector/ecosystem. Additionally, as highlighted in this report, the uptake of PAYG products by new SHS customers is a critical step towards greater financial inclusion and a thriving mobile money ecosystem. Globally, more than 700 million people still lack access to electricity. This huge unmet need means the addressable market for PAYG solar products is still significant, and is one reason why the growth projections for the industry remain so strong.

Governments are also increasingly recognising the benefits of solar, pursuing deeper partnerships with the sector and developing supportive regulation. The findings of this study on customer behaviour change are likely not limited to household solar, but also relevant to other energy use cases. For example, digital payments and mobile are a core part of the operating models of other off-grid energy models, such as solar microgrids and anchor-business-client models that leverage telecom towers as anchor clients, while also providing power to surrounding rural areas. The research findings on the benefits of income and access to add-on services are likely to be very relevant to these use cases.

Finally, the findings of this research have implications for PAYG products beyond solar. As highlighted throughout this report, PAYG solar companies are increasingly well positioned to provide consumer credit to underserved populations thanks to the payment histories they are generating. The solar kit also remains a lockable asset that can be used as collateral, and SHS providers are becoming increasingly specialised and expanding their reach. Limited financial inclusion not only affects people’s access to electricity; the rapid expansion of product and financial service offerings by PAYG solar companies also demonstrates that their operating model is best thought of as a market-creating innovation, rather than simply another product or service.

The PAYG opportunity beyond solar is enormous given the extent of pent up demand for affordable pathways to access essential goods and services. PAYG provider and mobile operator partnerships are central to meeting this need as each side brings unique value. While PAYG models have mobile services at their core, PAYG providers have the capabilities and reach that many mobile operators do not. Deepening these partnerships will ultimately reach end users with products and services they have traditionally been excluded from accessing.

25. See: https://trackingsdg7.org/
27. See: What we’ve learned about the role of mobile network operators in pay-as-you-go solar (GSMA blog post)
Appendix: Research methodology

Sampling and data collection

Data analytics teams from each of the participating mobile operator partners selected a cohort of SHS customers who started using an SHS six to eight months prior to data collection. Mobile usage indicators were analysed to compare the transactions these customers made in both the six months preceding and following sign-up with the SHS provider. The change in usage was then compared to a comparison group of similar mobile operator customers who had not taken up PAYG SHS.

The research team provided the mobile operators with desired profiles of respondents based on demographics and mobile usage characteristics. These were used to produce a list of customers to contact for the qualitative research. We wanted to learn from both customers who increased their mobile usage significantly more than the comparison group (“doers”) within six months of joining SHS providers, and those who did not (“non-doers”). Doers included a diverse set of users who changed their mobile behaviour in one or more of the following ways:

- Increased their mobile money transactions more than the average user;
- Increased their mobile money usage significantly more than the average user;
- Increased their mobile voice/airtime consumption more than the average user;
- Increased their mobile data consumption more than the average user; and/or
- Became mobile data consumers for the first time.

Likewise, we wanted diversity in terms of gender, geography, SHS products purchased, SHS distribution channels and locations where the SHS were used (home, business or both).

Participants were recruited via SMS. Interviews were conducted via outbound calls and lasted 45 to 60 minutes on average. Calls were conducted in French and other local languages, and participants were provided with a small financial incentive for their time.

Limitations and sample bias

It should be noted that the sample of users we spoke with is not nationally representative of the two markets. Some segments were inevitably represented more or less to capture diverse perspectives. Likewise, the lessons from these two markets and SHS providers may not be indicative of all SHS providers and mobile operators globally. The drivers and barriers to behaviour change are certainly influenced to a degree by the unique features of each market.

Furthermore, as we only explored cohorts of users who had registered for SHS six to eight months ago, it is possible that recollections of certain experiences may not be completely accurate. Likewise, the insights we gleaned from the interviews only apply to behaviour change in this initial six- to eight-month period. It is possible, and even likely, that mobile usage behaviour may continue to change at later stages of the PAYG SHS customer journey as users upgrade to additional appliances or systems with greater capabilities or stop using SHS altogether. However, these changes fall outside the scope of this study.

Finally, as noted in the report, the sample of respondents was overwhelmingly male. This was because the sampling and customer identification strategy was based on the phone number that is tied to the SHS payment, and these were primarily registered in a man’s name. The unequal gender representation in the sampling of respondents is a limitation of this research. Additional research on impacts by gender would be valuable.

Translating frameworks into qualitative research questions

Interviews were analysed on the basis of whether they supported or refuted a set of predefined assumptions and hypotheses. The development of these hypotheses was based on expert and practitioner interviews. These assumptions were then built out into detailed hypotheses, overlaid with the COM-B framework, as shown in Table 2. These hypotheses were used to develop the interview guides. The questions contained both open-ended enquiries to capture the stories behind customers’ experiences, along with some predefined answer choices to standardise comparisons across the 120 respondents.
### Table 2: Key assumptions

| Pre-purchase | Awareness | The ways in which customers hear about SHS play a role in changing mobile usage behaviour. |
| Sales | The channels through which SHS are distributed/sold play a role in changing mobile usage behaviour. |
| Onboarding | The ways in which customers are on-boarded/trained on SHS play a role in changing mobile usage behaviour. |
| Payments | The channels through which SHS collects payments play a role in changing mobile usage behaviour. |
| Comms | The ways in which SHS providers communicate with customers play a role in changing mobile usage behaviour. |
| Usage | The ways in which the customer uses SHS plays a direct role in changing mobile usage behaviour. |
| Use cases | The secondary impacts of using SHS play a role in changing mobile usage behaviour. |
| Impacts | Additional products facilitated by SHS play a role in changing mobile usage behaviour. |
| Add-ons | The types of users targeted by SHS providers play a role in changing mobile usage behaviour. |
| Persona | Targeting |  |

### Table 3: Mobile money hypotheses

| Onboarding | Because they didn’t use mobile money much before, they didn’t understand it well. The SHS sales agent trained them how to use it. Because they didn’t have mobile money before, the SHS sales agent helped set it up. Because they have to make payments via mobile money for SHS, they have organically explored the menus and discovered services they weren’t aware of before. Because they have to make payments via mobile money for SHS, they now feel more confident using it. |
| Sales | SHS provider partnered with mobile money kiosks to sell SHS to customers who were likely to make mobile money transactions. They store money on their mobile wallets to pay for their SHS slowly over time, but then they use it for other expenses as well. There are other services paired with their SHS that they can pay for via mobile money (e.g. satellite TV). SHS enables them to buy electronic devices and pay them off in mobile money instalments. They can charge their phone more because of the SHS, so it is on more and they can use it more for mobile money. They used their SHS to start a new business (e.g. phone charging) and now receive mobile money payments for their products/services. They used their SHS to start a new business or business line for which they use mobile money to pay for supplies/merchandise. They earn more money now because their SHS helped them open a new business or business line or save on expenses, so they have more disposable income to spend on mobile money. They can send money to family using the additional money they have earned/saved thanks to their SHS. |
| Payments | They get payment reminders from SHS providers, which in turn drive them to the mobile money platform more often. They get promotions from mobile operators because they are an SHS customer (or because they are new to the mobile money platform). SHS provider starts to promote different products (e.g. solar irrigation) that are paid for via mobile money. Because fees are low/non-existent for SHS payments via mobile money, they realise they could save on other services if they paid with mobile money. SHS users trust mobile money services more after using it to pay for their SHS. They feel it works. SHS users start to discover the convenience of mobile money. |
| Use cases | Add-ons |  |
| Impacts |  |
| Add-ons |  |