

Overview of market attractiveness analysis

DFID Mozambique wishes to explore ways in which it can support and accelerate the development of the off-grid-solar market, including through encouraging market entry from successful actors in adjacent markets. M-KOPA Solar, headquartered in Nairobi, Kenya, is the global leader of "pay-as-you-go" solar energy, serving over 400,000 customers in Kenya, Uganda and Tanzania. M-KOPA has a proven, scalable approach to this sector and brings this experience to bear in assessing the attractiveness of new markets.

Purpose of study

The purpose of this study is to provide DFID with a preliminary understanding of the enablers and constraints in the market in Mozambique from a commercial perspective. Notable enablers and constraints include customer demand for energy, ability and willingness to pay for solar products, the current status of the off-grid market, the mobile money market, the size of the addressable population, and potential business partners. Other business enabling factors analysed in this report include the following:

- regulatory,
- legal,
- fuel subsidies,
- tariffs/taxation,
- immigration,
- labour/employment laws and practices,
- infrastructure,
- logistics,
- educational/vocational capabilities of labour force, and
- business risks.

Methodology employed

The findings from this report are based on desk research, stakeholder interviews and field research. Interviews were undertaken with a range of relevant stakeholders during a one-week field visit in Maputo in March 2016. Organisations and individuals interviewed included:

- Greenlight (Energy and environment consultancy),
- Vodacom Mozambique (CEO, Legal and logistics departments, and M-PESA team),
- FUNAE,
- World Bank,
- Ministry of Science and Technology,
- GIZ,
- Socremo (Microfinance bank),
- FSD Mozambique,
- SNV,
- AFD,
- Emmett Costel (energy entrepreneur, BoP shops), and
- Gilda Monjane (Lojas de Energia)

M-KOPA also commissioned Greenlight to help assess current energy costs incurred by households in an off-grid area of Maputo province. While these findings are not necessarily representative of Mozambique as a whole, they do provide an indication of the potential for PAYG Solar to displace other energy costs.

Findings

Current status of the off-grid market

Lighting

Mozambique is different to Kenya where kerosene is a primary source of energy for rural households. In Mozambique, batteries are the primary source of energy for lighting for the majority of households. According to the National Institute of Statistics (INE), the main sources of energy for lighting in 2014/15 were:

- **Batteries** (small size, rechargeable or not, e.g. AA): 39.7 per cent of households.
- **Grid electricity**: 24.8 per cent of households.
- **Firewood**: 14.2 per cent of households.
- **Oil and gas** products: 13.2 per cent of households. It is plausible that **kerosene** has the largest share in this category. According to the report, Oil and gas products were used by 44.5 per cent of the population in 2008/09

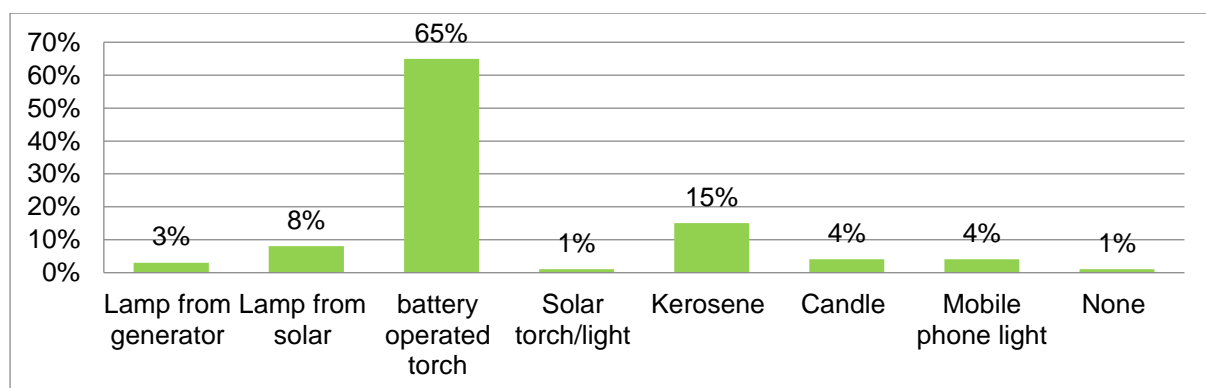
In rural areas, batteries are used by 51.9 per cent of households, firewood by 19.5 per cent, and oil and gas by 13.9 per cent. However, **the type of energy used for lighting differs from province to province**. For example:

- Maputo city and Maputo province are largely connected to the grid, and therefore use electricity,
- the southern provinces of Inhambane and Gaza are still largely using oil and gas products, and
- the northernmost provinces of Cabo Delgado and Niassa mostly use batteries. So do the Tete and Zambezia provinces.

As a consequence, the cost of lighting is not uniform across the market, varying according to the source of energy used.

Based on a sample of 80 households interviewed in June 2016 by Greenlight in an off-grid area of Moamba district (Maputo province), the top 3 energy sources of lighting are: batteries (65 per cent); kerosene (15 per cent); and solar (8 per cent use solar kits, 1 per cent use solar lamps). Figure 1 provides the breakdown of lighting sources used.

Figure 1: Primary source of light within surveyed population Source: Greenlight



The majority of respondents quoted batteries (mostly D size) as their primary source of lighting, preferred to kerosene because of the lower cost. The majority of both kerosene and

battery users purchase these items on a monthly basis. Table 1 provides the average expenditure per energy source used for lighting.

Table 1: Average expenditure per energy source used for lighting purposes

Energy source for Light	Average monthly expenditure	Average daily expenditure
Batteries	221 MZN (4 USD)	7.4 MZN (0.12 USD)
Petrol generator	1,125 MZN (19 USD)	37.5 MZN (0.62 USD)
Kerosene	388 MZN (6.5 USD)	13 MZN (0.22 USD)
Candles	152 MZN (2.5 USD)	5 MZN (0.08 USD)

Source: adapted from Greenlight

Given the predominance of battery usage, an off-grid solar provider would have to target an average daily energy cost of **US\$0.12/day** (using the June rate of 60 MZN per USD).

Solar kits owned by the respondents normally include two lights and have the capability to charge a mobile phone. The **average price paid for a solar kit was 1,000 MZN, or approximately US\$17.**

Phone charging

According to the Greenlight study, 95 per cent of interviewed households own mobile phones. “The average number of phones owned is two per household. 37 per cent of respondents pay for their phones to be charged. Households spend an average of 40 minutes just to travel back and forth to the phone charging location if it is away from home.” However, 45 per cent of the respondents charge their phones at home, and 38 per cent of them charge their phones in another person’s home (whether for free or not).

The most quoted charging frequency was once every three days, and the great majority of paying households (36 per cent) pay 10 MZN per charge. As such, a typical paying household with two phones will pay **6.66 MZN (US\$0.11)/day** for phone charging. However, given that only about one third of respondents pay for phone charging, the average daily spend on phone-charging should not form part of the ability to pay assessment.

Radio

35 per cent of respondents use battery-operated radios. Almost half of these households purchased batteries for their radios only once a month, spending on average 75 MZN (US\$1.13) each time, or an **average of 2.5 MZN (US\$0.04)/day**. Given that only a third of respondents own radios, we conclude that the average daily spend on radio should not form part of the ability to pay assessment.

Conclusion

Given that the majority of respondents did not incur any energy cost for phone charging or radio use, a conservative estimate is that **households in the Moamba district of Maputo province pay approximately US\$0.12 per day for energy services**. If average phone charging and radio costs are included, this increases to **US\$0.27 per day**.

If this daily cost is representative of the whole country, the “cost saving” argument that works well in other East African markets will be challenged. A possible argument would be that solar home systems (SHS) can cut down travel times to battery retailers and phone-charging points, therefore removing certain transaction costs relating to energy access. However, anecdotal evidence suggests that most rural Mozambicans do not necessarily value time

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savings in monetary terms. In addition, while the great majority of respondents knew what solar energy was, the average price paid by those who owned solar kits was only US\$17.

An encouraging factor relates to Greenlight's study's willingness to pay section. Indeed, **67 per cent of respondents claimed that they would be ready to pay 1,750 MZN (US\$30 in June 2016) as a deposit for a SHS**. This is probably due to the fact that most respondents were able to see the value and additionality of the solar kit, as opposed to cheaper alternatives. However, a caveat of this finding is that, at the time of the survey, 1,750 MZN was equivalent to about US\$30 only (as opposed to US\$35 when the study was commissioned).

It is our understanding that Solarworks!, another PAYG solar actor, has recently entered the Mozambican market through Matola – Maputo's largest suburb. Based on information from its website, **Solarworks is a perpetual leasing solar company**. Their relevant products include the:

- Solar Power Ball (Crystalline 1.8 Watt peak panel), which includes one small light and a phone charging port;
- Solar Home System (14 Watt peak panel), which consists of five lights and a phone charging port; and
- Solar Roof Light (Poly Crystalline 1 Watt peak panel), which consists of one light for a single room of up to 10 square meters.

Mobile network and mobile money market status

Mobile network

The mobile penetration rate in Mozambique is reasonably high at 80%. MCell, the partly state-owned mobile network operator (MNO) has a market share of 41 per cent (Q3 2014) - the largest in the country. It is followed by Vodacom (34 per cent) and the Viet-Nameese owned Movitel (25 per cent). However, Movitel has seen a significant growth since its market entry in May 2012, with rapid expansion and infrastructure development, particularly in rural areas. Movitel is the most price-competitive option, especially for SMS, whereas mCel offers the cheapest data rates. However, the quality of Movitel's network infrastructure has been criticized compared to other MNOs.

The mobile money market

It is currently estimated that only 13 per cent of Mozambicans are financially included, including through the use of brick and mortar banks. While digital financial services have the potential to dramatically improve this rate, given high national mobile penetration rates, mobile money usage is currently very low. Current mobile money providers include mCel (mKesh) and Vodacom (M-PESA), but Movitel has recently acquired an operating license from the Central Bank, and is said to be launching a mobile money service in 2016. According to Greenlight's study, only 12 per cent of the interviewed households in Moamba had a mobile money account.

Various barriers to mobile money penetration currently hinder usage growth rates similar to east Africa. These include an underdeveloped regulatory framework, poor infrastructure and reach, limited agent network, and low literacy levels among users. In addition, anecdotal data suggests cultural barriers in rural areas, such as a higher reliance on barter, rather than financial transactions.

Among these MNOs, we were only able to make contact with Vodacom and its M-PESA team. As a consequence, our analysis excludes mKesh from mCel. In the absence of an active offering by Movitel, it is hard to say how the entry of this newest player – with its strength in the rural market – will affect the mobile money market.

Vodacom M-PESA

Vodacom M-PESA is currently set up as a separate entity from Vodacom, due to its “credit institution” operating license requirement. Its service coverage and adoption have seen a rapid growth since its launch in May 2013, reaching approximately 800,000 (30-day active) customers in early 2016. It is understood that this represents an increase of 500,000 customers in only one year. In addition, M-PESA has set an ambitious objective of reaching 1.5 million active customers by April 2017. It currently has a network of 10,000 agents, with hubs located within Vodacom dealers of partner retailers.

Regarding usage, users and agents are mainly located in urban and peri-urban areas in Maputo City and Maputo Province, and limited agent services exist in all provinces. Key services include peer-to-peer transfers, airtime topups and bill payment services such as electricity bills. Unlike Kenya, commercial and B2C usage is very limited.

Bank integration is expected via the national switch programme SIMO, but this is likely to benefit only 13 per cent of the population who are banked. All M-PESA data are hosted locally by Vodacom and other providers in accordance with the law, but this also creates a hurdle for service roll-out and upkeep, due to infrastructure challenges.

In our understanding, rural reach and agent float management constitute important barriers to mobile money expansion.

Assessment

At the moment, Vodacom appears to be an attractive candidate in terms of service quality and growth plans.

However, a more thorough analysis of partnership potential of mCel and Movitel needs to be undertaken as this was not completed in the first visit.

Key enablers/blockages in the business enabling environment

FUNAE

One of the essential government entities in the rural electrification space, although not regulatory, is FUNAE – a public energy fund under the Ministry of Natural Resources and Energy. FUNAE’s objective is to promote and facilitate projects contributing to rural electrification, partly by providing loans and credit guarantees to implementing partners. FUNAE has been specifically interested in enabling the introduction of small PV systems in the Mozambican market, and has procured consultancy services from Greenlight to develop its market development approach for this purpose. Potential roles for FUNAE in market entry would consist of:

- providing loans or credit guarantees (given FUNAE’s operating model and uncertainty of its financial viability, this may be deemed risky),
- acting as an advisory platform for all government-related issues, and
- facilitating a friendlier tax and tariff regime for PAYG Solar companies.

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Regardless of FUNAE's direct role in potential market entry, various sources have emphasised the importance in engaging with them prior to the start of operations.

Registration and licensing requirements

To operate in Mozambique, the most straightforward operating license type would be incorporation as a limited liability company "Limitada/SA", which is a process initiated via the CPI (Centro de Promoção de Investimentos). The CPI is also able to advise applicants on their entitlement to various advantages under Mozambican investment law, as well as on any applicable tax incentives or exemptions. Another consideration relates to potential licensing requirements, as a "credit institution" providing micro-credit or financial services. If this was to be the case, obtaining a license would take considerably longer than a standard business operating license, up to one year. However, the central bank has the reputation of being a fair and efficient institution. Based on conversations with FSD Mozambique, this risk is relatively low, but should still be considered.

Fuel subsidies

Unlike in Kenya, the majority of off-grid Mozambicans use battery lamps for lighting. However, it is understood that in some of the southern provinces such as Inhambane and Gaza, the population largely uses kerosene for lighting. Kerosene is currently subsidised by the Government of Mozambique. Using the current exchange rate, one of kerosene costs 0.31 USD (24 MZN). Further work will be required to understand the daily spend on lighting for households who still use this source of energy.

Labour/employment laws and practices

Operating sales models in east Africa include the use of salaried sales teams, third-party distributors (or franchisees) as well as independent sales people incentivised with commission payments. For the latter, there are sometimes complications in using commissioned agents but based on an interview with Vodacom on their own engagement with agents, it appears that labour law does not apply to commissioned agents. A simple contract specifies the terms of the relationship.

Regarding employees, the Mozambican labour law protects and favours the employee relatively more than in other African markets. Various sources strongly advise foreign investors to pay particular attention to this issue. **Legal assistance would be required to understand the labour law specificities relevant to a foreign investor.**

Immigration

Companies registered in Mozambique can employ foreign workers in the following ways.

- The employment authorisation scheme. The employer must prove that no Mozambican national has the necessary qualifications to fulfil the vacant job.
- The quota scheme. Under this scheme, any company can employ a certain number of foreign nationals according to their total number of employees. Companies wishing to do so must apply through the ministry of labour. The quotas for hiring foreign workers are:
 - five per cent of the total number of employees in large companies (more than 100 employees);
 - eight per cent of the total number of employees in medium companies (between 10 and 100 employees); and

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- ten per cent of the total number of employees in small companies (up to 10 employees).
- The investment projects scheme. For certain investment projects approved by CPI, employers can employ an unlimited number of foreign nationals. Under this scheme, the employer simply has to notify the Ministry of Labour 15 days prior to the worker's entry in Mozambique.
- The short term employment scheme. An employer can hire a foreign worker for up to 30 days, provided it notifies the Ministry of Labour in advance.

Obtaining an authorisation from CPI for unrestricted employment of foreign nationals would be the favourable option. However, it is understood that obtaining this authorisation can be burdensome. As such, **assistance to obtain CPI's exemption would be desirable.**

Infrastructure and logistics

Based on Vodacom's experience in the importation of handsets and other electronic devices, importation of finished goods appears relatively straightforward. Administrative steps are similar to those in Kenya, and commercial clearing agents are used to facilitate entry and customs clearance of goods.

However, Mozambique displays major infrastructure and logistics challenges such as the following.

- A heavy reliance on Maputo and Beira as major sea ports, although more northern ports exist. This implies significant domestic shipping after importation.
- Deficient road systems, especially to reach inland rural areas or away from coastal corridor.
- High cost of land transportation.
- Security risks, especially in central parts of the country preventing land transport of goods through them.
- Occasional need to use air freight for domestic logistics from southern ports (Maputo, Beira) to northern and inland areas. This can be due to various issues preventing road transport such as conflict or urgency (given road commuting times).
- Poor communications network quality inhibiting information flows essential for supply chain activities e.g. trucks cannot communicate for long periods of time.

Vodacom currently uses DHL for the distribution of its products to its retailers, but no direct contact was made with DHL. The importation and distribution model must be refined throughout the assessment process (e.g. e.g. bonded warehousing in Kenya for importation to Mozambique, followed by centralized or distributed warehousing locally). Different sales and distribution model.

It may be helpful to study logistics and supply chain operations of major distributors such as Coca-Cola.

Tariff regime

There are currently no tariff exemptions for solar products in Mozambique. They are classified in the same broad category of electronic products, estimated at around 20 per

cent. In a new market that may prove difficult, this is a significant disadvantage compared to the Kenyan tax regime, where solar products have been exempt from customs duties. However, duty exemptions could potentially be obtained through the following methods.

- Obtain assistance from the Investment Promotion Centre (**CPI**), a government institution whose goal is to “attract and retain substantial direct domestic and foreign investment”. CPI can assist investors in obtaining tariff exemptions. Exemptions and other incentives can only be obtained if foreign investors satisfy certain requirements set by CPI. Corporate Income Tax deductions, equivalent to 5 per cent of the investment made, can also be awarded for investments carried out outside the City of Maputo.
- Through DFID’s compact with the Government of Mozambique, renewable energy products may soon be exempt of all tax.
- FUNAE may be able to act as a facilitator to help solar companies obtain tax exemptions.
- Exemptions relating to Mozambique’s membership in SADC and COMESA (not a member of EAC).

Given the potentially high costs of operating in Mozambique, as well as potential shifts in our pricing strategy, obtaining tariff conditions similar to those in Kenya appear to be crucial.

Language and literacy

Although Portuguese is the only official language in Mozambique, it is still not spoken by a portion of the population, especially in rural areas. This may have implications on many aspects of operating in the country: day-to-day relationship with customers (e.g. for after-sales services), communication with customers through device interface, agent relationship, and so on. Despite this issue, it has been brought to our attention that, in most cases, at least one member per household speaks Portuguese fluently and can assist the rest of the family when needed.

Literacy levels may also represent a challenge for basic interaction with targeted or existing customers. According to UNESCO, only 50 per cent of Mozambican adults (15 years old and above) are literate. This may result in a lack of ability to educate the targeted population on solar products, or make the post-sales relationship more difficult.

As such, **assistance will be required to better understand the implications of language and illiteracy-related issues.**

Business risks

Additional business risks include the following.

- Fraud risk. Although anecdotal, it was noted that solar companies could potentially be exposed to hacking/fraud by customers – this will be harder to control/react to in a dispersed user population.
- Exchange rate risk. Given recent fluctuations, this risk seems to be higher than in Kenya and several businesses have faced losses in recent months due to currency instability. Figure 2 illustrates the instability of the MZN.

Figure 2: MZN per 1 USD



Source: www.xe.com

Addressable market

It is estimated that 75 per cent of the Mozambican population lives off-grid. With a total country population currently estimated at about 28 million, this is equivalent to an immediately addressable market of **21 million off-grid people, or 4.2 million households** (using a conservative estimate of five members per household). In addition, most stakeholders interviewed seemed to suggest that, even in connected areas, electricity supply is often unreliable, especially outside Maputo.

On the other hand, the government has set very ambitious electrification targets, and plans to have the grid reach 50 per cent of the population in 8 years. One of our interviewees has deemed this target unfeasible, given large investments needed and the current political crisis in the centre of the country. In addition, distances being very large between buildings in rural areas, the grid will most likely not reach a large number of people in the foreseeable future. DFID estimates that 40 per cent of the population will be covered by 2030.

Given the large share of the off-grid population, a strong population growth and the unreliability of grid electricity supply, the addressable market is material.

Conclusion

Based on preliminary findings from available data and initial market and partner assessment visit in Mozambique, a number of opportunities and challenges affecting our willingness to enter this market have been identified and listed in this report. The main opportunity lies in the size of the addressable market. With low grid access and unreliability of electricity supply, PAYG Solar products have the potential to satisfy large numbers of people. In addition, mobile phone ownership is quasi-universal, and coverage levels are improving throughout the country.

A number of challenges have also been covered in this report. Are SHS solutions likely to be affordable to consumers? Other key challenges include logistical barriers in running operations and the low penetration of mobile money. As such, we believe that the three main obstacles are as follows.

- Pricing: the daily cost of SHSs should not exceed what the targeted population currently pays for lighting and phone charging. Volume will most likely only be reached if it is

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possible to compete with existing energy solutions (i.e. battery lamps and remote phone-charging).

- Logistics/supply chain: With very large distances, primary and secondary distribution (from port to warehouse, and from warehouse to shop) may be very costly. Although Vodacom has been able to cope with this, SHS products are much larger and therefore costlier to transport. With bad road quality at the district level and large distances, last mile distribution may prove more challenging than in Kenya.
- Mobile money uptake: with only 800,000 active users at present, low uptake is likely to limit our customer acquisition capacity.

Opportunities and threats

Opportunities	Threats
<ul style="list-style-type: none"> • Large market • Mobile phone coverage increasing • Low grid extension and unreliable electricity supply 	<ul style="list-style-type: none"> • Low mobile money uptake • Transport infrastructure and logistics • Labour law rigidities • Customs duties • Multiple languages and illiteracy • Foreign exchange risk

Recommendations

The findings outlined in this report shed light on certain conditions that can be addressed by tangible market interventions to potentially ease entry for PAYG Solar companies in the Mozambican market.

Ultimately, to deliver sustainable, scaled access to clean energy, service providers must have confidence in the path towards a viable commercial market. In the early stages of market development, there will be certain risks to address, some of which organizations like DFID will be well placed to help mitigate. In our opinion DFID would best be able to facilitate market entry by addressing the following issues:

- Financial or in-kind support for early-stage market development, enabling service providers to innovate, pilot and validate new business models and market entry/expansion approaches. The following would be key issues to look at testing during a pilot phase:
 - pricing and payment plans;
 - payment channels;
 - sales and distribution channels;
 - forward/reverse logistics channels;
 - marketing strategies – promotion of ‘clean energy’ acceptance;
 - user research – customer insights that might be specific to Mozambique’s culture;
 - product localization and development;
 - market segmentation; and
 - attractiveness of additional credit services.

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- Engaging with government (Ministry of Natural Resources and Energy or CPI) with the view to obtain tariff exemptions.
- Legal assistance for:
 - Incorporation of a legal entity.
 - Understanding labour law specificities and implications.
 - Obtaining rights to employ foreign workers without restrictions. This is deemed important in order to transfer the expertise and know-how acquired in East Africa over the past five years.
 - Understanding potential licensing requirements with the central bank.
- Identifying and engaging with implementing partners such as:
 - Supply chain and logistics companies.
 - Distributors.
 - Technical service providers if locally hosted backend systems/platforms.
 - Microfinance institutions.
 - Mobile money providers other than Vodacom, should this be required.
 - Employees and agents.
- Translating products and instructions, and elaborating strategies to reach non-Portuguese speakers and the illiterate.
- Supporting the establishment of working capital, especially in local currency / exchange rate risk hedging.