

### COMBINING MOBILE PHONE AND SOLAR POWER TO PROVIDE AFFORDABLE DOMESTIC ELECTRICITY

#### THE M-KOPA SUCCESS STORY IN EAST AFRICA

*From the African Community of Practice on Managing for Development  
Results at the African Capacity Building Foundation (ACBF)*



Case Study  
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#### SYNOPSIS

Most of sub-Saharan African (SSA) countries have electrification rates under 30%. This means the majority of the one billion population of SSA do not have access to affordable power and most of them do not have electricity to light up their houses at night. This has tremendous impacts on key sectors like education and health. Fortunately, some businesses are emerging on the continent to address the situation and bring electricity to even those who live in remote rural areas. This paper showcases M-Kopa, one of those successful companies in Kenya.

**Key findings:** M-Kopa is a Kenyan company that combines solar power and mobile technology to offer an affordable source of electricity for poor communities. Within two years from 2014, the company had connected over 300,000 homes to affordable solar power in Kenya, Tanzania and Uganda. Revenue generated by the business rose rapidly within one year from about USD 15 million in 2014 to an estimated USD 30 million in 2015. M-Kopa has created employment for over 2,000 people.

**Main lessons:** M-Kopa initiative provides evidence on the market potential that exists among poor people. This is an important lesson that calls on public policies and development organizations to shift their view of low-income population from beneficiaries to customers. The experience of this company shows that the power sector in Africa offers business opportunities and the integration of technology in the power sector can add value. Finally, the case study reveals that initiatives like M-Kopa show promises, but it won't be sufficient to address the power challenges in African countries. It is crucial that states and regional economic communities drive more investments into the overall energy sector to improve the energy generation capacity of the continent.

**Main recommendations:** Not all African countries have the knowledge and resources to effectively integrate Information and Communication Technologies with energy. Capacity development organizations can intervene by developing programmes that will assist governments and private sector to integrate new technologies into the energy sector. On the other hand, many African regional economic communities have policies on renewable energies including solar energy but those policies are barely reflected at the national level. Therefore, there is need to firstly support African states in the domestication and application of those regional policies and secondly assist them in creating the necessary conditions to boost private investments like M-Kopa in the renewable energy sector.

## Introduction

Energy in Africa is a scarce commodity than in the developed world. The situation varies widely across the region. In sub-Saharan Africa (SSA), only 290 million out of 915 million people (31.69%) have access to electricity and the total number without access is rising (IEA, 2014). In rural areas, the odds are worse, with nine out of ten people lacking access to energy (Van der Hoeven, 2013). One of the reasons for that is the ageing power infrastructure that is unable to meet current power demands. All 49 SSA countries generate power for a population of up to one billion, the same amount of power that Spain, which has a population of 45 million, generates (KPMG, 2014). Consequently, power consumption is very low compared to other regions of the developing world. Empirical evidence confirms that good access to energy is critical to sustainable development growth (Wolde-Rufael, 2005). Countries with better access to energy tend to have a more vibrant industrial sector and faster economic growth rather than others. Thus, lack of electricity in SSA remains one of the biggest barriers to the region's development and prosperity (Bhattacharyya, 2012), and continues to trap millions of people in extreme poverty. Access to basic domestic electricity to light up houses at night and access to power remain a key challenge that if properly addressed, would boost key sectors like education, manufacturing and services.

At the same time, Africa is home to an extremely vast quantity of solar power which has the potential to meet the electricity demand of the continent. It is estimated that Africa's solar power is sufficient to provide enough energy for the continent (Trieb, 2009). Solar power is a promising source of energy that can result in increased access to domestic electricity for the hundreds of millions people who lack basic access to it. On the other hand, the growing Information and Communication Technologies (ICT) penetration in Africa offers new and promising opportunities for Africa in different sectors including energy. Today, ICT is instrumental in improving the energy value chain from power generation (e.g. smarter systems and grids) to

customer payment (e.g. mobile payment). An important trend to observe in the growing ICT sector is the increasing rate of mobile cellular subscriptions on the continent. Indeed, this has gone from approximately 87 million in 2005 to 582 million in 2013 and keeps increasing (ITU, 2014). This rapid mobile penetration has brought several innovations and opportunities, especially for remote rural communities.

Combining mobile phone and solar power, an enterprise called M-Kopa (see website at: <http://www.m-kopa.com/>) is providing the financing and distribution for a pay-as-you-go, mobile phone-enabled home solar panel system for off-grid rural villagers in Kenya, Tanzania and Uganda. The mobile payment service used is M-PESA, one of the most successful in the world. This initiative is one of the rare on the continent to simultaneously address the low access of African communities to electricity and the challenges they face to pay for it. Therefore, it is essential to analyze this initiative and disseminate its approach and outcomes, so as to leverage further support and promote its replication in other regions of Africa. The specific objectives of this case study are (i) to highlight a successful mobile phone-enabled home solar panel system used to provide affordable domestic electricity for rural villagers and (ii) to draw lessons and policy recommendations which may be used to promote this kind of initiatives and unleash the potential of solar power in Africa.

## Presentation of the M-Kopa initiative

### Context and Opportunity

With a population up to 45.5 million and a Gross Domestic Product (GDP) estimated at USD 47.8 billion in 2014, Kenya is the largest economy in East Africa. Like all SSA countries, Kenya faces tremendous challenges to ensure access to energy. The country has less than 2,000 MW of generation capacity to serve its population of over 45 million (KPMG, 2014). Although the Government is working to increase generation capacity to 15,000 MW by 2030 with a medium term objective of 5,000 MW by 2017, most of Kenyans do not have access to electricity. As an alternative, most of Kenyans rely on

kerosene to light up their houses. The World Health Organization (2016) and many researchers (see for example Lim et al. 2012; Lambe et al. 2015) have repeatedly reported the negative consequences of fuel-based lighting on both human health and environment. If Kenya is to realize its development objectives, access to electricity should be increased by involving new stakeholders in the sector and developing innovative mechanisms.

Notwithstanding the aforementioned facts, opportunities exist both in conventional power sources and new ones like the solar power. The majority of African countries avails untapped resources for generating solar power and Kenya is a leading country in the domain. The market opportunity of M-Kopa lies on the expensive cost of the conventional power. For the average Kenyan, the cost of connecting to the country's national grid is at USD 400 associated to the cost of monthly bills and frequent power outages. Furthermore, M-Kopa has taken advantages of the high penetration of mobile phone in Kenya and in the overall region. For example, mobile penetration in Kenya increased from 0.38% in 2000 to 79% in 2013 and figures are increasing (ITU, 2014). This high mobile penetration – compared to other SSA countries – has given an opportunity to M-Kopa to integrate mobile technology in its solution.

**The affordable solution offered by M-Kopa**

M-Kopa was founded in 2011 and headquartered in Nairobi, Kenya. M-Kopa primarily develops its activities in Kenya and is now expanding in other East African countries such as Tanzania and Uganda. The company developed an innovative

approach to offer solar home systems to off-grid customers. The system is unique of its kind as it provides access to electricity through the combination of solar power with a pay-as-you-go mobile solution. This section presents the technology and the business model developed by M-Kopa.

**The technology**

The solar power kit offered by M-Kopa includes a solar panel, two light-emitting diode (LED) bulbs, a LED flashlight, a rechargeable radio and adaptors for charging a phone. For the light, M-Kopa relies on LED technology. A LED lamp is a product which is assembled into a lamp (or light bulb) for use in lighting fixtures. LED lamps have a lifespan and electrical efficiency which are several times longer than incandescent lamps (Jacques, 2014).

A central element of the technology is M-Pesa. M-Pesa (M for mobile, for money pesa in Swahili) is a mobile phone-based money transfer, financing and microfinancing service, launched in 2007 by Vodafone for Safaricom and Vodacom (CCK, 2012). It has since expanded to Afghanistan, South Africa, India and in 2014 to Eastern Europe (Reuters, 2014). M-Pesa allows users to deposit, withdraw, transfer money and pay for goods and services easily with a mobile device. Users are charged a small fee for sending and withdrawing money using the service. According to Jack and Suri (2010) M-Pesa has spread

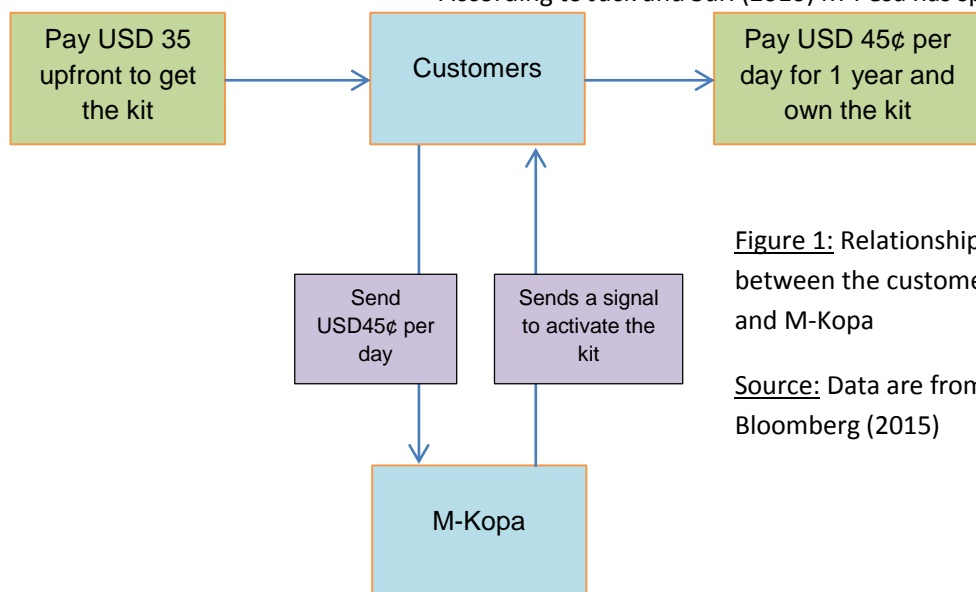


Figure 1: Relationship between the customer and M-Kopa

Source: Data are from Bloomberg (2015)

quickly, and by 2010 had become the most successful mobile-phone-based financial service in the developing world. By 2012, a stock of about 17 million M-Pesa accounts had been registered in Kenya, and a considerable part of the country GDP passes through the mobile banking system. The service has been lauded for giving millions of people access to the formal financial system and for reducing crime in an otherwise largely cash-based society. M-Kopa uses the mobile payment service of M-Pesa to make its customers pay for the solar kit. The payment is made on a pay-as-you go base i.e. utilization of the M-Kopa kit is regulated by the payment customers made. This has two positive side effects: the customers pay at their own rhythm and M-Kopa ensures that customers are effectively paying back.

### The business model

The core innovation of the company is not related to the technology. Solar power is an accessible technology which is no longer an innovation in itself. It's rather the business model that is an innovation of its kind (Figure 1). The solar kit costs USD 200. The business model of M-Kopa is described in a recent article on Bloomberg (2015). Clients pay USD 35 upfront and agree to make a daily payment of USD 45¢ for a year through M-Pesa. When clients paid off, the kit belongs to them. Therefore, each kit sold by M-Kopa is in effect a loan of USD 165 that is disbursed enabling financial inclusion for thousands of people who are normally excluded from the classical banking sector. To ensure payment by the client, a mobile-based system is installed in the kit and sends a signal to activate the battery when the customer made a payment.

The design of the relationship between M-Kopa and its customers also offers possibilities to include new services as the two actors are in contact for at least one year (Box 1).

### Box 1: More opportunities for M-Kopa

M-Kopa's current customer contract stipulates that the data the company amasses can be used only to improve customer experience, but the company has plans to collect listener and viewership data from its radios and televisions. "There's data we can gather that practically no one else can," Larson says. The company has received a grant from the reinsurer Swiss Re to explore the possibility of using its system to collect weather data from its devices. Solar panels can already tell the company when the sun is shining, and it's experimenting with adding instruments that measure barometric pressure, humidity, temperature, and perhaps even rainfall.

Source: Bloomberg, 2015

### Outcomes and overall assessment

After four years of operations, the outcomes of M-Kopa can be presented as below.

#### More people have access to electricity

As of January 2016, M-Kopa had connected over 300,000 homes to affordable solar power in Kenya, Tanzania and Uganda (M-Kopa, 2016). Thanks to the equipment provided by M-Kopa, these homes have LED lamps to light up their houses at night; rechargeable radio to have access to information and finally the possibility to charge their phones without walking miles to reach a charging point.

#### Revenue are generated and more jobs are created

According to Bloomberg (2015), as of December 2015, M-Kopa has 700 full time workers along with about 1,500 sales agents. Workers encompass call center operators who assist the new customers in signing up each day, and handle queries from existing users. Revenue generated by the business is rising rapidly from about USD 15 million in 2014 to an estimated USD 30 million in 2015. Every single day, the company has about 600 new customers, meaning it is extending loans of almost USD 100,000 a day. The repayment rate is 93 percent for the solar system and 98 percent for secondary products.

### Livelihoods of low-income population are improved

By replacing the kerosene that was used to light up houses, M-Kopa is improving the health of thousands of poor people. In addition, having access to electricity opens up new possibilities for families: children can study at night, family members who run small businesses can work at night and the family can have access to information through the radio. Furthermore, the solution offered by M-Kopa saves money for families as an average off-grid household in Kenya spends about USD 272 a year on energy (M-Kopa, 2016). Therefore, M-Kopa helps families to save about USD 750 over the first four years following the installation of its solar kit.

### Investments in M-Kopa solution are rising

Bloomberg (2015) recently reported that M-Kopa completed a USD 19 million investment round, including USD 10 million from Generation Investment Management, a fund co-founded by former U.S. Vice President Al Gore that's also invested in SolarCity, the biggest U.S. rooftop solar installer, and digital thermostat maker Nest Labs. "We think they have the potential of being a multibillion-dollar African success story," says Colin le Duc, GIM's head of research, reported by Bloomberg. M-Kopa has also been recognized for its pioneering business model and scale, notably winning the 2015 Zayed Future Energy Prize, being selected as the top New Energy Pioneer at the 2014 Bloomberg New Energy Finance awards and earning the 2013 FT/IFC Excellence in Sustainable Finance Award.

### Box 2: The impact of M-Kopa

As of January 2016, M-Kopa has connected over 300,000 homes to affordable solar power.

Based on this scale, the positive impact that M-Kopa has made includes:

USD 170M projected customer savings – based upon USD 750 saved per household over 4 years using M-Kopa Solar instead of buying kerosene  
260,000 tonnes of CO<sub>2</sub> reduced – based upon 1.3 tonnes of CO<sub>2</sub> reduced per M-Kopa Solar system over 4 years

2200 total employment created – based upon 700 full time employees plus 1500 commission-based sales agents across Kenya, Uganda and Tanzania

Source: [www.m-kopa.org](http://www.m-kopa.org)

### Conclusion and policy recommendations

#### The power sector in Africa offers business opportunities

Power consumption at 124 kilowatt hours (kWh) per capita per year and falling in Africa, is only a tenth of that found elsewhere in the developing world, which is barely enough to power one 100-watt light bulb per person for three hours a day. That explained why most countries in sub-Saharan Africa have an electrification level below 30%. The aforementioned statistics demonstrated the existence of business opportunities in the power sector in Africa. M-Kopa is an example. Yet, there are conditions to unleash the business potential of the sector. Those conditions include among others sustaining a stable investment climate for private sector participation in the sector, enforce cost-reflective tariffs and reducing inefficiency in the sector to support more affordable end-user tariffs.

#### Poor people can make up a highly lucrative clientele

The general observation is that low-income people are charity cases who need assistance. M-Kopa estimates that 80 percent of its customers live on less than USD 2 a day. Three-quarters of them have small-scale farming as their primary or secondary

livelihood; the rest run small businesses. M-Kopa initiative provided evidence on the market potential that exists among poor people. This is an important lesson that calls on public policies and development organization to shift their view of low-income population from beneficiaries to customers. If treated as customers, poor people are more likely to sustain development interventions and improve their livelihoods.

### **The integration of technology in the power sector can add value**

The rapid penetration of ICTs in Africa is an opportunity to transform how business is delivered in some sectors in Africa. M-Kopa leverages mobile technology to develop an innovation business model in the power sector in Africa. ICTs offer much more possibilities to add value to how the power sector is managed on the continent. New affordable technologies like smart grids, smart metering, mobile and internet payments offer the best bets for disruption to the sector. However, not all African countries have the knowledge and the resources to effectively integrate ICTs and energy. Capacity building organizations can intervene by developing programmes that will assist the government and the private sector to integrate new technologies into the energy sector.

### **Initiatives like M-Kopa show promises but African countries need to go beyond**

First, African countries need to support companies like M-Kopa and establish an enabling environment that help the creation of such businesses. On the other hand, many African regional economic communities have policies on renewable energies including the solar energy. For example the COMESA has adopted a Model Energy Policy and the ECOWAS has established the Regional Centre for Renewable Energy and Energy Efficiency. However, those policies and regional initiatives are hardly reflected at the national level of member states. Moreover, this case study has showed that some promising initiatives are ongoing in the field of renewable energy in Africa. Therefore, there is a need to first build the capacities of African states in the domestication and application of those regional policies and second assist states in creating the necessary conditions to boost private investments like M-Kopa in the renewable energy sector. RECs and capacity development organizations like ACBF can develop initiatives to address these two issues. However, such effort will not be sufficient to close the energy gap in African countries. It is also important to increase the generation capacity of the continent and develop affordable tariffs through infrastructure linkages of power utilities and regional power pools.

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