



Mobile for Development Utilities African Solar Designs: Trialling the Community Power for Mobile Model in Kenya



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Mobile for Development Utilities

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

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The Innovation Fund

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

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

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

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



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Executive Summary

In January 2014, the Mobile for Development Utilities Programme awarded the Kenya-based company, African Solar Designs (ASD), a Seed grant. The grant was to trial a solar-diesel hybrid energy system for powering an off-grid telecom tower, as the anchor load, along with surrounding businesses and communities. This rural energy business model, referred to as Community Power from Mobile (CPM)¹, was trialled with Airtel Kenya.

Unfortunately, ASD could not complete the pilot within the grant timeframe and structure, as they were unable to agree on a power purchase agreement (PPA) to power an off-grid telecom tower. Discussions and negotiations between ASD and Airtel Kenya (and later, Africa Towers) stretched over six months and ultimately could not be closed following the sale of Airtel's towers to Eaton Towers in September 2014.² This was ASD's first attempt to power a telecom tower and operate the CPM model, and given their early stage of partnership with Airtel, they were not fully aware of the operator's requirements and expectations as highlighted in the key findings below:

Mobile operators seek assurance that pilots have potential to scale rapidly. The discussions with Airtel Kenya, and later Africa Towers, were delayed in part because ASD did not have a plan on how to resource and scale from a single site pilot to a replicable model for all of Airtel Kenya's off-grid towers.

The value proposition of the CPM model must go beyond community electrification to deliver value for owners/operators of telecom towers and generate buy-in at senior levels. For infrastructure owners, the key business drivers of management and operations are high network reliability, capital expenditure reduction and low operating cost. ASD was not properly resourced to provide the level of detail in the PPA needed to assure their partners that technical designs of the power solutions would be fail-proof and reduce costs. While community electrification does benefit tower management and mobile operators, through reduced vandalism and diesel theft, and increased customer phone usage from reliable and convenient phone charging,³ these are secondary to the key business drivers. Additionally, senior buy-in is essential for a pilot that involves core infrastructure. ASD found that while Airtel's operational staff were enthusiastic about the pilot, senior staff were focused on other pressing business priorities, such as the impending sale of their towers.

Firms attempting the CPM model must have a service outlook. Mobile operators seek partners that demonstrate an ability to provide a robust and reliable service model in order to maintain continuous mobile services. ASD is an engineering firm and piloted the CPM model while also managing other projects. ASD therefore set up to operate a demonstration pilot only, and did not have the resources to drive the relationship with their partners, nor demonstrate a full service model. CPM pilots need to demonstrate a robust service offering at the outset.

The CPM model requires flexible and patient financing. While grant capital is still likely needed to de-risk the CPM model in many markets, the structure of the Mobile for Development Utilities grant was inappropriate for ASD, particularly given the early stage of the pilot. ASD began the pilot at a conceptual stage and the 12-month timeline with pre-agreed milestones did not provide adequate flexibility for ASD, given the time it can take to negotiate detailed power purchase agreements with mobile operators and tower companies. Moreover, because mobile operators/tower owners want upfront assurance of rapid scaling and a robust service model, the financing to develop the CPM model will need to be larger and more flexible.

1. The model in which energy is sold to a telecom tower as an anchor customer as well as to business and household customers around that tower is known as Community Power from Mobile (CPM) or the A-B-C model referring to the anchor, business, and community customers.

2. http://eatontowers.com/eaton_towers_acquires_%20airtel_towers_in_6_countries.php

3. Access to phone charging has improved average revenue per user by 10-14% according to a 2008 study by Digicel across multiple markets. GSMA, 2009. *Green Power for Mobile: Charging Choices, Off-grid charging solutions for mobile phones*. http://www.globaltelecomsbusiness.com/pdf/charging_choices.pdf

The GBP 200,000⁴ grant trialled a high-risk business model. Although the pilot failed to meet its objectives, it does not suggest that the Community Power from Mobile model cannot succeed under different circumstances. However, it is evident that companies

wishing to prove the model should be aware of the challenges, the requirements of mobile operators and the time and resources needed to get the business model off the ground.



Airtel tower selected for pilot in Kakuma town, Kenya

4. The original grant amount was GBP 200,000. Although the project never achieved its first milestone, ASD was compensated GBP 20,000 for services rendered.

Introduction

African Solar Designs (ASD),⁵ a Kenyan company, was founded in 2008 as a clean energy advisory and engineering solutions company. They provide bespoke off-grid solar solutions to companies across East Africa and carry out consulting for government and international development agencies. This includes market studies for GIZ and DFID in Kenya and Tanzania, as well as the development of an online knowledge base for solar providers.

ASD aimed to test the Community Power from Mobile (CPM) business model with a solar-diesel hybrid micro-grid. This model leverages the mobile industry's energy needs for dispersed networks to also power off-grid communities. In the CPM model, a telecom tower serves as the anchor customer for an Energy Service Company (ESCO) while business and household customers in the vicinity of the telecom tower also benefit from energy services that would not be viable without the anchor customer. The anticipated benefits for each stakeholder are as follows:

Energy Service Company (ESCO): regular and significant revenue from tower power consumption make the model more bankable for raising capital than a business that solely sells energy to underserved communities.

Anchor customer (mobile operator or tower company): more efficient and affordable power solutions (e.g. replacing diesel generators with solar); for mobile network operators (MNOs), increased customer revenue from new access to mobile phone charging, which removes a common barrier to mobile usage in rural areas, and positive operator brand image from sharing tower power with the community, which can lead to a sense of shared value from the tower infrastructure and reduce theft and vandalism.

Businesses: more efficient and reliable power access compared to diesel generators leading to longer business hours and more opportunities for productive uses of energy (e.g. agro-processing).

Communities: new or improved power access through grid connections or energy service centres that lead

to improvements in quality of life by replacing dirty energy sources and providing lighting for studying and power for phone charging.

Since 2010, there has been wide interest in demonstrating the viability of the CPM business model. While companies like OMC Power⁷ and initiatives like Rockefeller Foundation's Smart Power India⁸ are trying to find ways to serve multiple off-grid energy customers, including communities, few of these examples exist in Africa. Through ASD's own fieldwork, the company identified significant potential for the CPM model in Kenya, Tanzania, Uganda, Rwanda and South Africa, based on the high number of off-grid telecom towers near small businesses and communities. This ultimately led to their pilot with Airtel Kenya in the town of Kakuma. Kenya has an overall grid electrification rate of just 20%.⁹ Additionally, over 92%¹⁰ of its population is covered by mobile networks indicating that most of the off-grid population has mobile coverage. This means that energy models that leverage mobile networks, such as CPM could serve approximately 30 million¹¹ people.

5. <http://www.africansolar designs.com/>

6. Access to phone charging has improved average revenue per user by 10-14% according to a 2008 study by Digicel across multiple markets. GSMA, 2009. Green Power for Mobile: Charging Choices, Off-grid charging solutions for mobile phones. http://www.globaltelecomsbusiness.com/pdf/charging_choices.pdf

7. <http://www.omcpower.com/>

8. <http://www.smartpowerindia.org/>

9. World Energy Outlook, 2015. Electricity Access Database (data from 2013) <http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/>

10. GSMA Intelligence, Data for 2G period 2015 Q1

11. GSMA, Mobile for Development Utilities. 2014. The Synergies Between Mobile, Energy and Water Access: Africa. <http://www.gsma.com/mobilefordevelopment/programme/m4dutilities/the-synergies-between-mobile-energy-and-water-access-africa/>

Key Facts about ASD

FIGURE 1

Company Overview as of December 2014

Name	African Solar Design
Sector	Energy
Year Established	2008
Country Footprint	Kenya, East Africa
Product/Service	Engineering solution provider
Market Segment	Telecom towers, small businesses and households in off-grid or grid-deficient areas
Total Systems / Customers Served ¹²	The grant was terminated before the micro-grid was installed. No customers were served through this grant.
Use of Mobile: Technology and Partnership	Telecom towers as anchor load

Grant Objectives

Through this Seed grant, ASD attempted to assess the viability of the CPM model in Kenya with the following objectives:

- Connect the mobile operator to a greener, more reliable and affordable energy source;
- Connect local businesses in proximity to the tower and hybrid energy solution to a micro-grid and reduce their dependency on small petrol and diesel generators and thus their overall energy expenditure while extending their hours of operation; and
- Provide off-grid households within walking distance of the market and telecom tower with access to battery charging services and solar pico-products and home systems via an energy sales centre.



Power lines in Kakuma town connecting small businesses to privately owned diesel generators

12. ASD's core work as an engineering consulting firm is not driven by increasing purchases by end customers.

The expected learnings as defined by ASD at the outset of the pilot were:

- Demonstration that private ESCOs, through partnerships with mobile operators or other anchor customers, offer an effective business model to provide energy to rural, underserved areas covered by mobile networks; and
- The role of community engagement to make CPM models sustainable and for energy security in rural areas.

Proposed Site Configuration

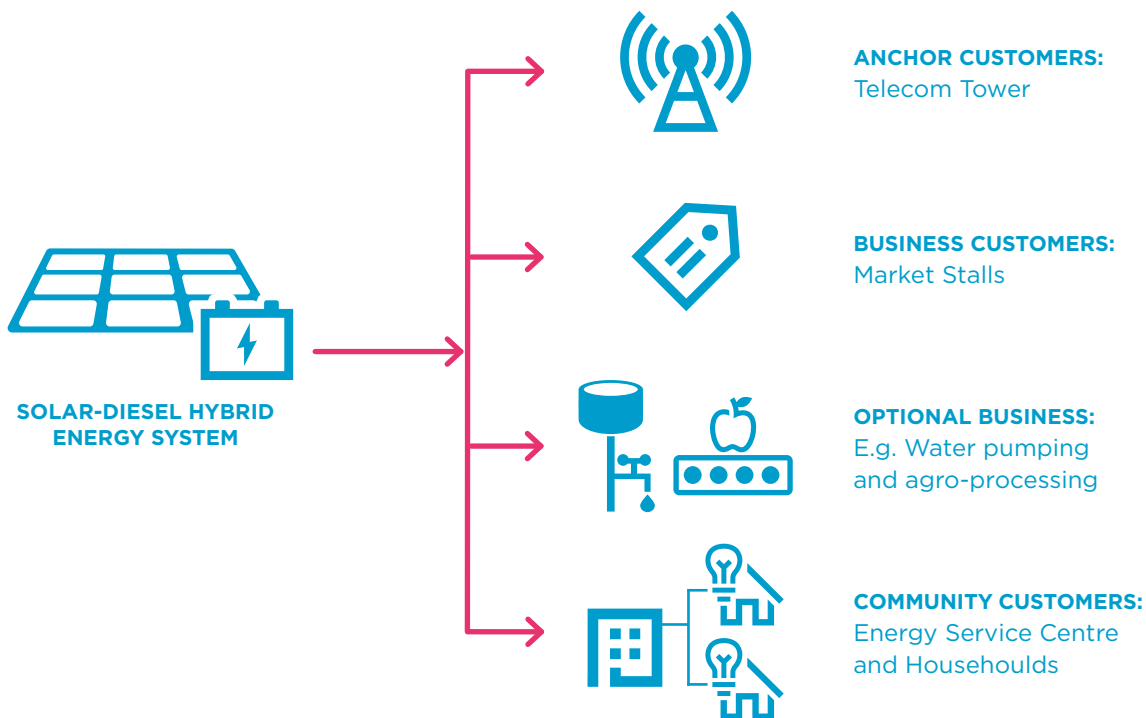
The selected site location was an Airtel Kenya tower in Kakuma, a remote town over 12-hours’ drive from Nairobi and approximately 125km from Lodwar and the nearest airport. The town of Kakuma is adjacent to the Kakuma refugee camp, although they remain separate. According to UNHCR, over 180,000 people from 20 African countries live in the camp.¹³

The proposed site configuration included a solar-diesel hybrid energy system with long-life batteries, a micro-

grid to serve local market stalls and other businesses via metered connections, and an energy sales centre to sell services to off-grid households. Beyond the micro-grid and energy sales centre, the energy system would have potentially powered at least two of the following services, depending on which ones were most appropriate: internet café/infotainment centre, water kiosk, artisanal shops, agro-vet shop, food/drink kiosk and power mill. Figure 2 illustrates the proposed site configuration.

FIGURE 2

Schematic Diagram



13. UNHCR, Kenya Kakuma Refugee Camp, August 2015 <http://data.unhcr.org/horn-of-africa/download.php?id=1690>



Airtel Kenya tower selected for pilot; market stalls with telecom tower in background



This previously installed, but inoperable solar water pump is an example of another potential anchor client that ASD considered powering as part of their business model.

Progress

ASD began the pilot through discussions with Airtel Kenya to identify an appropriate site. Within Kakuma town, Airtel operated a tower that relied on diesel in the absence of any national grid. ASD made site visits to assess the energy requirements for the tower, a nearby market with businesses and surrounding households. The town also had an existing but inoperative energy centre, established by an NGO to provide some energy services and an internet café for the community. Instead of building a separate centre, ASD planned to refurbish the existing energy centre hardware and work with the established community management committee.



Existing but inoperative energy centre

ASD initially aimed to sign a commercial agreement with Airtel Kenya by April 2014 and have the micro-grid and energy service centre fully operational within five months. An initial verbal agreement on the price per kWh was reached between ASD and Airtel Kenya in late January 2014. Following a second meeting in late March 2014, ASD was redirected to speak to Africa Towers, Airtel's own tower company in Africa. Africa Towers required ASD to develop a more detailed power purchase agreement, inclusive of a service level agreement. Negotiations continued through June and July 2014 but ultimately an agreement was not signed between ASD and Africa towers or Airtel Kenya by the time it was announced that Airtel was selling its towers to Eaton Towers. While Eaton Towers showed initial interest to support the pilot, it was not deemed a key priority within the first few months of the acquisition.

The negotiations with Africa Towers were delayed by disagreements on the technical design of the solar-

diesel hybrid power system, which Africa Towers required for the detailed PPA, as well as the time needed to develop a full service level agreement. For example, Africa Towers had planned improvements for the GSM hardware in the tower and ASD did not agree with them on how these improvements would impact their power requirements. Given that ASD had not previously powered telecom towers, and Africa Towers required absolute assurance that the new power solution was fail-proof, the design discussions took far more resources and time than ASD had anticipated.

ASD made significant progress with the business and community focussed aspects of the CPM model including securing access to land, analysing the energy demand and signing a Memorandum of Understanding with the existing energy centre. Despite this, they were unable to move the pilot forward within the time frame that the grant could support.

Lessons Learned

The early termination of the grant before the power purchase agreement was signed and systems installed limited the opportunity for ASD to learn the expected lessons previously outlined. Nevertheless, some important lessons emerged from the cancellation of the pilot, which ASD did not independently continue. An overarching takeaway is that the time and resources required for agreeing with mobile operators or tower companies on power solutions may exceed ESCOs' expectations.

The potential to scale rapidly is important to mobile operators. The fact that the pilot covered one site, and ASD did not have clear plans or resources for scaling the solution was an obstacle in advancing discussions with Africa Towers. Mobile operators and tower companies have thousands of towers, and prefer them to be configured and serviced in a similar manner to reduce complexity. The lack of a plan to scale the model to tens or hundreds of sites made Africa Towers' management team hesitant to push the proposal to senior staff, thereby causing a delay in negotiations.

The CPM model must go beyond community electrification to address core business drivers of tower operation. ESCOs seeking to pilot the CPM model must be aware of two things: mobile operators' most critical requirement is the reliability of their network and, increasingly, mobile operators are trying to reduce their network capital expenditure and are seeking partners that provide cost-optimised operational services. Therefore, an ESCO must firstly demonstrate their ability to fulfil the strict energy uptime requirements of the mobile industry's licensing agreements at an attractive price before mobile operators will show significant interest in a pilot. Tower owners/operators may need more time to work with ESCOs that do not have a track record of providing power to towers and require detailed technical designs and power purchase agreements at an early stage. The broader benefits of community electrification, such as reduced vandalism and diesel theft, as well as increased operator revenue from regular phone charging, are secondary to mobile operators' concern over their primary asset and the key business drivers.

Senior level buy-in is crucial for a model that leverages a mobile operator's core infrastructure.

ASD found that Airtel's operational staff were very enthusiastic about the model. However, senior decision-makers faced other pressing priorities, such as the impending sale of their towers. As noted, the CPM pilot was not within their primary business objectives. Without greater interest at a senior level, ASD struggled to advance the pilot discussions.

Firms attempting the CPM model must have a service outlook. Mobile operators seek partners that demonstrate the ability to provide robust and reliable operations and maintenance for continuous mobile services. As the pilot was structured as a demonstration, ASD resources were partially allocated to other engineering projects. With the delays in negotiations, coupled with Airtel Kenya's interest in developing a scalable model, it became increasingly clear that in order for ASD to successfully pilot the CPM model, they would need to allocate the same level of time and resources as if developing a new business unit. ASD's experience highlights the importance, for this model in particular, for companies partnering with operators to develop a robust service offering beyond a demonstration pilot from the very start.

Flexible and patient financing are needed for pilots that are heavily dependent on partnerships. While grant capital is required to trial and de-risk the CPM model, the structure of the Mobile for Development (M4D) Utilities grant was inappropriate, considering a commercial agreement had not been signed between ASD and Airtel Kenya as originally planned. The tight 12-month timeline of the grant with pre-agreed milestones did not provide the adequate flexibility for ASD to successfully pilot the CPM model. While equity investment, or longer term research funding could have accommodated the significant delay faced on achieving an agreement to power a tower, the short duration and structure of the M4D Utilities grant could not. Trialling new business units and ventures requires more flexible and patient financing.

Conclusion

At the outset of the pilot, ASD set out to prove that the Community Power from Mobile business model could profitably serve the needs of the mobile industry, as well as local businesses and households through shared power generation equipment for a micro-grid and energy service centre. In hindsight, it is evident that this was an ambitious goal for a 12-month pilot where the core commercial agreement between the mobile operator and ESCO had yet to be penned.

The delays in negotiations between ASD and Airtel Kenya/Africa Towers were further complicated by the sale of Airtel's towers to Eaton Towers, during which senior staff did not consider the pilot a priority. With the formal announcement of the acquisition, it was clear that Eaton Towers would not be able to prioritise the negotiations with ASD within the timeframe of the grant.

While the experience of ASD provides valuable lessons to other firms seeking to test the CPM model, it provides limited insight for or against the validity of the overall business model. As third-party infrastructure and tower companies continue to acquire tower assets

from mobile operators across Africa, it may change how these anchor clients are incentivised by the potential benefits outlined in the introduction. Tower companies' management of thousands of towers may be a stronger driver (as compared to individual mobile operators with fewer towers) to seek out ESCOs that provide power solutions with reduced operational expenditure, for example moving from unpredictable diesel costs to solar. Tower companies could even offer CPM models directly (without an ESCO) to receive additional revenue streams through the sale of energy services, while mobile operators might be less interested and able to manage these extra businesses. Both tower companies and mobile operators are likely to be incentivised by reduced diesel theft and site vandalism once local communities share more of the benefits from these off-grid sites. However, tower companies would not likely be driven by the key CPM benefit of increased revenue from regular phone charging through community electrification that a mobile operator would seek. Thus, it remains somewhat unclear if third-party tower management will favour or deter implementation of the CPM model.

ASD sees future opportunity in the CPM model

While ASD is not currently pursuing the CPM model with operators or tower companies, the company still sees a strong opportunity for the model, which perhaps needs more time to see wider adoption. There has been continued interest in the model from the off-grid energy community based on its technical potential for increasing energy access to rural communities. However, ASD believes that tower companies and operators do not yet have a strong understanding or interest in the energy access opportunity in terms of both the size of the market and the tangible benefits to them. Operators and tower companies in many markets remain focused on their core businesses. Yet ASD looks forward to increased investment into off-grid energy services signalling to operators and tower companies a viable business opportunity.

The lessons learned from ASD and other grantees were incorporated in the second phase of the M4D Utilities programme. In Phase 2, grant periods were extended from 12 to 18 months and pilots were required to demonstrate that they had the necessary commercial agreements in place before pilots were approved for implementation and grant agreements signed.

Overall, while ASD was unable to complete this CPM pilot within the grant timeframe, the insights from the pilot on the requirements of the mobile industry, timelines and resources will help inform ESCOs and tower companies seeking to serve the energy needs of multiple customers in the future.



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