IS-Academy

**RENEW**

Policy Brief • September 2011

By M.J. van Asperen

# *Solar Lighting for the off-grid BOP in Kenya*

## *An analysis of business models and challenges to growth*

*IS Academy RENEW aims to improve the understanding of the role of renewable energy and energy efficient technologies for sustainable energy access in developing countries. It is a joint initiative between ECN, IVM and DGIS.*

## Summary


- 2012 is designated the *"International Year for Sustainable Energy for All."* Yet 1.5 billion people worldwide do not have access to electricity, and 33 million live in Kenya. Most of these 33 million – the rural "Base-of-Pyramid" (BOP) – are forced to rely on environmentally hazardous kerosene for lighting.
- Recently, solar lighting products especially designed for the BOP have reached markets, and Kenya has become a regional hub for them. Yet the BOP is usually unable to afford such products, and traditional business models to sell them have proven ineffective.
- In light of this situation, this Report asks: ***what are the challenges enterprises face when selling off-grid solar lighting products to low-income households in Kenya and how can these challenges be confronted?***
- Meeting these challenges calls for business model innovations. The Report takes the four components of a business model: 1) the product; 2) customer interface; 3) infrastructure management 4) financial aspects, to consider how they can be further developed to promote solar lighting in Kenya.
- Through interviews with solar lighting companies and other stakeholders, the existing major challenges in successfully promoting and distributing these products to the BOP in Kenya were identified: 1) affordability; 2) poor quality products; 3) consumer awareness and 4) distribution.
- To fully tap the $10 billion off-grid lighting market in Sub-Saharan Africa, companies were engaging in the following innovations: diversifying stock to cope with low demand; developing new models to reach rural customers, and partnering with existing networks.
- Further suggestions include exploring carbon finance, developing labelling standards, and loan bundling.


Ministry of Foreign Affairs

IVM Institute for Environmental Studies

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## Introduction

Kenya, located on the sunny equator in Eastern Africa, is a country of 38.5 million inhabitants. Its capital Nairobi has 6 million inhabitants and – like many other capitals in developing countries – has grown explosively over the last few decades.


*Figure 1: Map of Kenya. (retrieved from http://tapiwa.files.wordpress.com/2008/08/kenya2.jpg)*

However, this population growth has resulted in a steep increase in the use of kerosene for lighting. Table 1 shows the lighting sources in Kenya (Nassiuma, 2005).

| Source of lighting | Percentage |
|---|---|
| Kerosene | 70.2 |
| Collected firewood | 13.2 |
| Electricity | 7.8 |
| Purchased firewood | 3.9 |
| Solar | 2.4 |
| Grass | 1.0 |
| Dry cells torch | 0.5 |

The main reason for this kerosene dependence lies in Kenya's low rate of electrification. Only 15% of the total population currently has access to electricity, and the number drops to 5% for people living in rural areas. Households without access to electricity usually rely on kerosene for lighting, resulting in severe damage to health and high carbon emissions.

However, Kenya also has a climate very suitable for production of solar electricity, which has many benefits and none of the drawbacks of kerosene. A solar lantern or small solar home system (SHS), once purchased, has no operating costs except for the purchase of a new battery after 3-5 years of use; a kerosene lantern must always be refilled. Solar emits no $CO^2$, and does not present any health hazards. Over the long-term, a SHS is even cheaper than a kerosene lantern: the annualized costs of a $100.00 solar lighting system are $17.88 per year for 10 years (using a lifecycle costing analysis). Kerosene lanterns cost $60.00 per year for the same amount of hours of light (Peon et al., 2005). Solar lighting, in short, has the potential to provide electricity for the rural BOP, who would otherwise need to continue using kerosene, or live in darkness.

These benefits have not gone unnoticed by businesses in the Kenyan market. The first PV panels in Kenya were installed in the 1970's, and Kenya has since become a regional solar lighting hub. It has a well-developed market for solar home systems, with a large choice of system sizes and specifications. In early 2000 a total of around 150,000 systems were installed, giving Kenya, at 2.56%, the second highest share of SHS installed per capita in Sub-Saharan Africa (Nieuwenhout, van Dijk et.al., 2001). The majority of systems are sold at commercial rates in Kenya and the market has developed with minimal donor support (Wamukonya, 2007). And yet only a small fraction of solar potential for lighting has been captured, due greatly to the inability of the target market to afford or access the products.

## Business Models for the Bottom of the Pyramid (BOP)

The income of many Kenyans – at average $640 per capita GDP – is very low. This kind of population segment has been referred to as the Bottom or Base of the Pyramid (BOP), a term coined by C.K. Prahalad in his 2006 bestseller, "The Fortune at the Bottom of the Pyramid." London (2007) refined the definition of the BOP: "the poor at the base of the global socioeconomic ladder, who primarily transact in an informal market economy." Because of its low purchasing power, the BOP is often neglected by larger

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corporations when marketing their products. And yet it represents a huge untapped market, especially for off-grid lighting: over $10 billion is spent annually on lighting by the African BOP (Dalberg, 2010). Traditional business models for developed countries do not work in developing markets, so business model innovations must be made to tap its potential. This Report applies the business model framework developed by Osterwalder to the solar lighting market in Kenya.

| **Table 1: Osterwalder's business model framework (based on Osterwalder 2004)** | |
|---|---|
| Product | What business the company is in, the products and the value propositions offered to the market |
| Customer interface | Who the company's target customers are, how it delivers products and services to these customers and how it builds a strong relationships with them |
| Infrastructure management | How the company efficiently performs infrastructural or logistical issues, with whom, and as what kind of network enterprise |
| Financial aspects | What is the revenue model, the cost structure and the business model's sustainability |

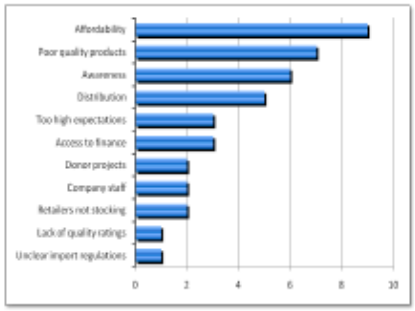
Optimally addressing these four components in a BOP context is challenging. In order to do, we must first identify what technological and regionally-specific issues are present. To do so, the author interviewed key stakeholders in the Kenyan solar lighting market and attended the 2010 World Bank Lighting Africa conference. Based off these interviews, several key challenges to successfully unlocking the rural solar market in Kenya were identified. Figure 2, below, shows the challenges and the number of times each challenge was mentioned.

**1) Affordability**

Affordability was mentioned by the most interviewees as problematic, who pointed to the relatively high upfront cost of solar products as the culprit. But some claimed it was the initial *access* to finance that was the problem, not overall cost: "Many homes have 3 mobile phones, whose market value is more than $25, which is the price of a small solar lantern." While $25 upfront may be too much, $25 over a period of months or years may not be.

**2) Poor Quality Products**

"When a customer buys a product that fails they tell all their neighbours so it ends up destroying the market." The African solar market has suffered from the 'dumping' syndrome: foreign companies offloading their sometimes sub-standard products into the African markets. This lowers consumer confidence in new, solar, products, and they prefer to remain with traditional kerosene.




**3) Consumer Awareness**

The rural nature of the off-grid solar lighting market makes it difficult to increase awareness of new products. Some entrepreneurs interviewed claimed that "most people in Kenya have the perception that solar is for rich people." This perception is driven by more visible, larger donor-funded projects, and a lack of networking among interested sectors.

**4) Distribution**

It does not matter how perfect a product, if it cannot get to the right party. The rural population in Kenya is very dispersed, and roads are often in poor condition. Piecemeal retail orders also increases the price for the initial seller, and provide stumbling blocks for many, especially outside businesses.

**5) Other Challenges**

High expectations, unclear import regulations, and finding willing retailers were other

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## Reworking Business Models to meet BOP Challenges

In order to meet these challenges, the traditional business model must be reworked. In the case of solar lighting in Kenya, this Report noted certain innovations, and offers suggestions for further improvement of the BOP business model for solar lighting in Kenya:

**1) Product ← → Affordability**

Many companies responded to low demand by diversifying, though selling products at comparable prices. One company however was developing a pedal-powered lighting product. By lowering the cost of a solar lantern to simple lights, this made the product more affordable to a wider population and helped meet the challenge of affordability.

**2) Customer**

**Interface ← → Distribution/Awareness**

Companies were responding to the challenge of accessing consumers in different ways. Some employed the "Tupperware Model," using local entrepreneurs to invite people to a product demonstration and who received a commission for every product sold. Another employed so-called "foot soldiers," who work

Several interviewees have entered into partnerships with logistical companies for the transportation of their products from Nairobi to the retailers and end-consumers. One uses a courier service, another, a "milk-run model."

**4) Financial Aspects**

**← → Affordability/Consumer Awareness**

In order to deal with the lack of access to finance and low consumer awareness, some companies have created innovative ways to sell their product: one sells to the employees of large companies, like coffee and flower plantations, which do not yet have electricity. The employees get a loan from their employer and pay for the lights in installments by a small amount that is withheld from their monthly wages. Another organization (an NGO) hands out solar lanterns for free in

interviewees.

on a commission basis and sell products in a certain area by going into the field instead of selling in a retail outlet: "the advantage for us is that the foot soldiers are likely to speak the same language as the people…they know the terrain."

**3) Infrastructure**

**Management ← → Distribution**

*Figure 3: Typical supply chain for pico solar products (adapted from GTZ, 2010)*


In this model, small solar products, larger PV panels, and other products are shipped to retailers together, lowering overall transport costs. More could also be done in terms of advertising, and using relatively low-cost 'traveling road shows.'

preselected local communities. The recipients do not pay for the ownership of the lanterns, but pay a monthly fee to the NGO that is similar to or slightly lower than the money they would otherwise be spending on kerosene for lighting. This money is set aside by the NGO to be invested in community projects that are chosen by the local communities. These projects contribute to the economical development of the communities

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## Conclusion

Traditionally aid programs that are based on donations have been an important driver in poverty alleviation, but are unfortunately not economically sustainable. By adjusting traditional components of a business model to meet the needs of the Base of the Pyramid, a huge market may be unlocked, while also meeting basic needs of millions of people.

## Further Information

IS Academy RENEW is a joint initiative between the Energy Research Centre of the Netherlands (ECN), the Institute for Environmental Studies at Vrije Universiteit (IVM) and the Directorate-General for International Cooperation (DGIS) at the Dutch Ministry of Foreign Affairs. For further information about IS-Academy RENEW, contact Pieter van Beukering at IVM (pieter.van.beukering@ivm.vu.nl).

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