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THE BOTTOM LINE

Lighting Africa, a joint IFC and World Bank program launched in 2007, was the first private-sector-oriented effort to leverage new LED lighting technologies to build sustainable markets that provide safe, affordable, and modern off-grid lighting to communities in Africa that lack access to electricity. By 2030, the program aims to enable the private sector to reach 250 million people who now depend on fuel-based lighting.

Scaling Up Access to Electricity: The Case of Lighting Africa

Why is this case interesting?

Africa faces a huge rural electricity deficit

Global electrification in 2010 was estimated to be about 83 percent. The deficit of 17 percent encompasses some 1.2 billion people,[1] about half of whom live in Sub-Saharan Africa, where the unelectrified population may actually increase between now and 2030.[2]

Most of the unelectrified population relies on fuel-based lighting such as kerosene dry cell batteries, candles, and bio-fuels. These sources are costly, dangerous (to health and safety), and hard on the environment, as well as offering inferior lighting. The lack of reliable access to lighting of good quality limits the productivity of nearly a quarter of the world's population, hindering their ability to carry out basic activities at night or in the early morning, including household chores, reading and schoolwork, and business.

Achieving universal access to modern energy services is one of the three complementary objectives of the Sustainable Energy for All (SE4ALL) initiative. Formally launched in the UN General Assembly in September 2012 and co-chaired by the president of the World Bank Group and the UN Secretary-General, SE4ALL calls governments, businesses, and civil society to address urgent energy challenges by 2030 (SE4ALL 2012).

Expansion of the electrical grid is a long-term solution for many unelectrified African households, but off-grid electrification will have to play a major role if the SE4ALL goal of universal access by 2030 is to be reached. Many of the benefits of better lighting can be captured through stand-alone home solutions, including solar light products such as Pico-PV lanterns and solar home systems (SHS). Solar's suitability for off-grid electrification has been affirmed by growing levels of private investment in solar lighting solutions, technological advancements that have lowered unit costs, increasing consumer awareness and acceptance, and the ease of tailoring solar lighting products to changing needs.

The primary market for solar lighting solutions is the population that presently lacks access to electricity and uses kerosene and other inferior fuels for lighting. But solar-powered lanterns are also popular with people whose access to electricity is unreliable or intermittent and who experience frequent blackouts and those who need portable solutions.

Solar lighting is not a static solution. After consumers pay off the upfront lantern costs, they usually start accumulated savings that would have otherwise gone toward purchases of kerosene. These savings enable consumers to buy more lanterns or larger systems.

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Daniel Murphy is a senior energy specialist in the World Bank's Africa Energy Practice (dmurphy@worldbank.org).

Arsh Sharma is an energy analyst in the World Bank's Energy Practice (asharma15@worldbank.org).

1 World Bank 2013.

2 In the World Energy Outlook's business-as-usual scenario (defined as implementation of the government policies and measures that had been enacted by mid-2013), Africa's unelectrified population in 2030 will be larger than it is today (IEA 2013).

who now depend on fuel-based lighting. Low-income households and small and medium-size enterprises (SMEs) are Lighting Africa's target customers. The goals of the program are to:

- Demonstrate market viability by supplying companies and investors with intelligence on market size, consumer preferences and behavior, and "base of the pyramid" business models and distribution channels.
- Remove market barriers and improve the enabling environment (i) through a quality assurance program, (ii) by facilitating business-to-business partnerships through conferences, workshops, and a dedicated website, and (iii) working with governments to make the policy environment favorable for off-grid lighting markets.
- Build sustainable off-grid lighting markets by forming the Global Off-Grid Lighting Association, institutionalizing quality-assurance methods, and scaling-up and replicating successful business models.

Lighting Africa has also helped governments integrate off-grid lighting into their electrification programs.

"Before the creation of Lighting Africa, the solar off-grid market had no system of quality assurance. More than 95 percent of available products had not been tested for quality."

What were the key challenges?

Barriers affect the supply chain

Sub-Saharan Africa would seem a good market for portable solar lighting products, given its low grid penetration, low levels of urbanization, large population, and high energy prices, but Lighting Africa encountered challenges across the entire supply chain of the market as well as in the policy realm and business environment. These challenges can be grouped into market barriers and early-stage development challenges, as discussed below.

Before the creation of Lighting Africa, the solar off-grid market had no system of quality assurance. More than 95 percent of available products had not been tested for quality. The region lacked credible testing facilities and manufacturing standards, which allowed the quality problems of local manufacturers and distributors to persist. For most consumers, lighting decisions emerge as a choice between kerosene-based and non-kerosene-based sources. For first-time customers in the non-kerosene category, the initial experience colors future purchase decisions. The poor performance of substandard lighting devices (with disposable or rechargeable batteries) in the US$1–5 price range had biased many consumers against modern lighting devices.

In 2008, the largely undeveloped and unexplored African off-grid lighting market was devoid of essential information on market potential, consumer needs and lighting preferences, product attributes and design characteristics, and distribution channels.

Restricted access to capital and financing along the entire supply chain has been a major impediment to growth of the solar off-grid market. Lack of domestic and international capital for manufacturers also affected distributors, as they could not benefit from supplier credit, while local financial institutions were reluctant to lend to small enterprises with innovative but untested products. Retailers also felt the squeeze, as there were no natural providers of capital in this space (such as microfinance institutions or commercial banks). Without access to finance, end users must assume the high upfront costs of lanterns.

Potential consumers lacked awareness about reliable solar-powered lighting products and their benefits. Among those who were aware of the products, there was the misperception that portable solar products were more expensive than fuel-based lighting. Communication campaigns aimed at key but remote rural customers are difficult to design and implement when both manufacturers and distributors are cash-strapped.

Inconsistent government regulations and a poor business climate has been the rule in much of Sub-Saharan Africa, making it hard for the off-grid lighting market to thrive. Policies to incentivize the adoption of solar lanterns were either absent or have not been properly implemented. Solar components and products in many places were subject to multiple taxes (import duty, excise duty, value-added tax, and surcharges), increasing the price of product by 5 to 30 percent. Meanwhile, kerosene subsidies, which suppress demand for modern lighting devices, remained the primary tool of government to increase access to lighting while awaiting extension of the grid.

Lighting Africa expected these challenges, but others were unexpected. For example, in its early days, the program anticipated

that large international businesses would drive the manufacturing-to-sales supply chain. Instead, small, entrepreneurial firms came to dominate the off-grid lighting market in Sub-Saharan Africa. The needs, shortcomings, and concerns of these firms varied greatly from those of large businesses:

- Their limited working capital made them unattractive for mainstream financing based on balance sheets. Even growth in the customer base was stunted by lack of operating liquidity.
- They had limited knowledge of operations and supply chains in the fast-moving consumer goods markets in Sub-Saharan Africa, despite identifying appropriate target markets and understanding consumer needs.
- They could not find skilled labor (especially technicians).

The absence of any large corporations to provide capacity and leadership to transform the business landscape was an overarching challenge faced by the market as a whole. The situation stands in marked contrast to the success of mobile telephony in the region, where large multinational firms presided over rapid change.

Lighting Africa stepped in to provide public goods that would benefit the entire nascent industry, especially by helping manufacturers to produce quality products (a function assured in the telecom space by large firms with established brands), by educating consumers, and by helping distributors and retailers to better understand and market to consumers (paralleling the large marketing campaigns undertaken by telecom firms).

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What solutions were adopted?

Lighting Africa addressed market barriers with targeted interventions

Lighting Africa has remained a constantly evolving program, changing with the off-grid electrification market. The program leverages the World Bank's comparative advantage in supporting governments to structure activities financed by the public sector, complemented by IFC's expertise in helping the private sector to develop commercial markets.

Market intelligence. The market for off-grid electrification existed before Lighting Africa, but intelligence on consumer preferences, distribution, and quality was scarce. Such intelligence was needed to help emerging players in the supply chain make informed business decisions. Lighting Africa's market intelligence work, such as its report entitled "Solar Lighting for the Base of Pyramid: Overview of an Emerging Market" (Lighting Africa 2010), helped to build upstream knowledge by assisting manufacturers, importers, wholesalers, and distributors in understanding market opportunities. Lighting Africa also undertook in-depth market research for five countries (Ethiopia, Ghana, Kenya, Tanzania, and Zambia) to get detailed consumer insights on pricing, design, and features of off-grid lighting products.

Product quality assurance. Lighting Africa's quality assurance efforts provided manufacturers with incentives and opportunities to differentiate their products. Early emphasis on quality assurance was one of the key reasons why the Lighting Africa program took off. Lighting Africa tested commercially available products on minimum quality standards. Initially, the minimum requirements included also performance standards, such as how bright the light is, but these were later removed, and the focus shifted to the truth-in-advertizing to certify that the lantern's performance is as advertized. Lighting Africa developed a standardized specification sheet for manufacturers to help them communicate about their products effectively and credibly (www.lightingafrica.org/specs).

During the initial phase, only 6 of the 32 products tested passed. To increase the pass rate, Lighting Africa provided services to companies that demonstrated a strong commitment to quality and published a series of need-based technical notes. The International Electrotechnical Commission (IEC) has since adopted Lighting Africa's test methodology and minimum quality standards as a reference point for quality assurance of off-grid lighting products. A hundred products have now been tested using the global IEC technical specification 622257-9-5. Lighting Africa built its testing capacity for manufacturers, distributors, nongovernmental organizations, and other stakeholders by partnering with test laboratories in the United States, Germany, and Kenya. As the market evolves toward larger

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lighting systems (such as solar home systems and plug-and-play solar solutions), Lighting Africa will keep step with the market by providing certifications of these large systems.

More than 40 percent of the off-grid lighting market now consists of products that have met minimum quality standards, up from just 3 percent in 2009. More than four million quality-approved products have been sold.

Lighting Africa has also become an important advocate for modern off-grid lighting products through the organization of the Global Off-Grid Lighting Conferences, at which key stakeholders in the private sector, government, academia, civil society, and the donor community come together.

Lighting Africa's efforts to focus on market intelligence and quality assurance paid off as the program grew quickly in scope and relevance. However, the obstacles encountered—and aggravated—by the small firms that dominated the market, as well as the growing importance of improving the regulatory and business climate, caused Lighting Africa to move to tackle several new issues to ensure continued success. Those issues are discussed below.

Access to finance and business support services. Lighting Africa leveraged IFC's investments and advisory services to provide working capital and trade finance to manufacturers and distributors. The approach evolved over time. Lighting Africa's first attempt to provide access to finance was through a Development Marketplace Grant Competition that offered more than US$3 million in seed funding to 16 winning projects. The goal was to encourage innovative business and financing models and approaches that delivered improved lighting products to low-income consumers.

As supply chains started to form, Lighting Africa focused on providing targeted assistance (such as advisory services) to manufacturers and distributors. The program helped link manufacturers with local distributors and, through its website, provided a virtual networking and information-sharing platform. In parallel, Lighting Africa engaged local financial institutions to encourage them to lend to distributors and consumers, providing them with information, training, and risk-mitigation instruments. Today, eight microfinance institutions help consumers purchase off-grid lighting products that have passed Lighting Africa quality tests.

As the number of distributors grew, Lighting Africa could not provide the same one-on-one support, and so began to phase out or outsource some of its support and to become more selective in choosing companies with which to engage. To be able to assist a growing number of local distributors, Lighting Africa developed a risk guarantee facility for modern lighting products in partnership with the Bank of Africa.

Lighting Africa also facilitated access to carbon finance for modern lighting products. The recently updated methodology of the UN Framework Convention on Climate Change and Clean Development Mechanism prequalifies any product that meets the Lighting Africa standards and targets for CDM projects.

Consumer education. Lighting Africa's consumer education campaigns, which focused on behavior change rather than just awareness, helped people with very limited disposable income to make informed buying decisions. Campaigns were piloted in Kenya and Ghana. About 11 million people in Kenya and 676,000 people in Ghana have been reached through road shows, social and trade group forums, door-to-door consumer engagements, and retailer recruitment drives. Focusing on the rural poor, some 1,300 village forums have been organized by Lighting Africa in Kenya and Ghana to educate rural families about the benefits of solar light over kerosene.

Because behavioral change campaigns tend to require substantial funding and the dominant early-stage startups lacked the necessary financial and human capital capacity, Lighting Africa's role was critical.

Policy and public sector operations. Lighting Africa's policy component was not initially part of the program, which had a market focus, but it became prominent because of the many policy and regulatory barriers that market participants faced. Most Sub-Saharan governments did not consider solar lanterns as credible instruments for electrification, favoring kerosene instead. As Lighting Africa evolved, it became clear that government support (or at least endorsement) would be necessary for large-scale success. Lighting Africa thus began to engage in systematic discussions with governments, while also carrying out comprehensive policy studies in eight interested countries (Cameroon, the Democratic Republic of Congo,

"Lighting Africa's policy component … became prominent because of the many policy and regulatory barriers that market participants faced."

Ethiopia, Ghana, Kenya, Rwanda, Senegal, and Tanzania) to identify key policy barriers (related to subsidies, taxes, tariffs, standards, and procedures) and mitigation strategies. Eventually, governments began to integrate off-grid lighting programs into their rural electrification initiatives. Five countries have now integrated Lighting Africa activities into energy-access projects funded with US$27.7 million in World Bank financing.

These changed perceptions about the importance of removing market barriers resulted in other government actions both within and outside the Lighting Africa program. For example, the government of Ethiopia has waived duties on all off-grid lighting products that meet or exceed Lighting Africa's recommended performance targets. In Kenya, all imported LED lighting equipment and solar components are exempt from taxation. The Ugandan government implemented a 45 percent subsidy on solar equipment as part of its Energy for Rural Transformation program.

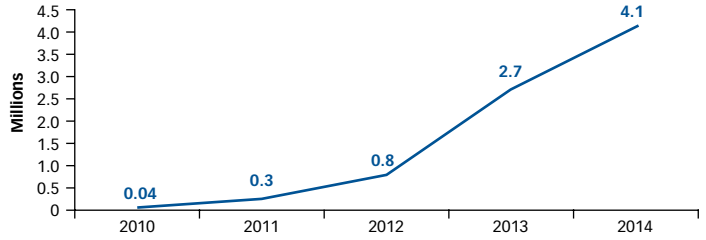
What were the key lessons?

Lighting Africa was a successful catalyst and inspired new programs

Lighting Africa succeeded as a catalyst for the off-grid lighting market in Sub-Saharan Africa. As of December 2013, products approved by Lighting Africa had provided more than 11 million people in Africa with clean lighting and better access to energy due to solar lanterns. More than four million units of 58 different off-grid lighting products from 32 manufacturers, which have met the global Lighting Africa quality standard, have been sold in 29 African countries through local distributorships since 2010 (figure 1).

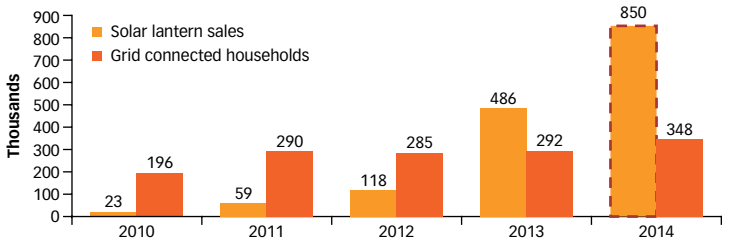
Another success is apparent in the spectacular trajectory of solar lantern sales in Kenya (figure 2). In 2010, sales of solar lanterns were equivalent to just 12 percent of grid-connected households, but by 2014, they far exceeded them, registering a 37-fold increase in sales within four years. The intervention in Kenya helped manufacturers and distributors reach a large base of unelectrified people.

Figure 1. Growth in unit sales of quality-approved solar lighting products across Sub-Saharan Africa, 2010–14



Source: Lighting Africa.

Figure 2. Solar lantern sales and household grid connections in Kenya, 2010–14



Source: Lighting Africa.

On the climate front, the program has avoided 274,000 tons of greenhouse gas emissions, the equivalent of taking 35,000 cars off the road. Upstream, 15 technical briefing notes have helped manufacturers design and improve their lighting products, and three Eco Design notes have explored health and safety issues for consumers, distributors, and manufacturers.

Important lessons were learned during the first phase of the program. Some interventions were very successful; others could have been done differently. The lessons from an independent review conducted in 2011 are summarized in table 1, with specific examples to help guide future programs.

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Table 1. Lessons learned during Lighting Africa's first phase

What worked	What could have been done differently
Lighting Africa was regarded as a highly relevant and innovative program that contributed to the development and growth of the market. It was recognized as an innovative example of base-of-pyramid market transformation and best practice for IFC–World Bank collaboration	Market selection criteria for country pilots should be well documented and should be geared to emphasize the need for intervention rather than overweighting the existing IFC-WB footprint. Ghana was not an ideal pilot country as it already had a high electrification rate and an aggressive rural grid electrification campaign with subsidized connections. Conversely, Kenya's success should not serve as a blanket yardstick for all African nations, as Kenya has a highly developed entrepreneurial culture with somewhat developed distribution channels and a strong tradition of microfinance.
Quality standards were a critical component of market transformations given the high risks of promoting inferior products in opaque markets.	Cost-effectiveness is enhanced through scalable activities that have market-wide effects instead of one-to-one advisory support, particularly where IFC and World Bank staff is concerned. In the beginning, Lighting Africa worked one-on-one with firms, but as the market grew, this became inefficient. There was a need to wholesale IFC's support and to focus on companies that could help achieve scale.
Cross-cutting platforms, such as industry-wide forums and websites, were and remain powerful tools for market mobilization. Lighting Africa conferences have mobilized key stakeholders and provided a good platform for knowledge exchange.	In-country government engagement is critical in ensuring progress even in private-sector-focused market transformations with relatively limited public policy dimensions. The policy component, which was missing from the pilot initiatives, proved to be a constraint, especially in Ghana. The program needs to try to make governments "own" Lighting Africa as theirs. Ethiopia's government accepted Lighting Africa's recommendation to allow certified products to enter the country duty-free and provided loans denominated in U.S. dollars to distributors to overcome the barrier imposed by foreign exchange regulations. The program has now distributed more than 100,000 lanterns.
Sound ideas are more important than innovative ideas. The Lighting Africa Development Marketplace competition was Lighting Africa's first engagement with the market. It chose innovative ideas that were not always sound from a business perspective. These lessons were valuable when Tanzania decided to run its own competition with Lighting Africa's support. Here, where the main criterion was the strength of the business plans, nine out of ten grantees over-delivered on their targets.	Interventions that address critical barriers and require on-the-ground engagement need dedicated local specialist resources in addition to global expertise. Lighting Africa's financial access program has struggled because of a lack of committed in-country expertise. This component took a long time to develop, and IFC has had difficulty convincing both its investment colleagues and outside investors to provide funding for off-grid lighting companies.

Where is the program headed?

As the market evolves, so do Lighting Africa's challenges

Going forward, the Lighting Africa program will support the geographic expansion of ongoing activities to enable market-based solutions for affordable, modern off-grid lighting. The following challenges will be addressed:

- **Solar home systems.** Lighting Africa will expand its focus to multi-light and small-scale solar home systems.
- **Consumer awareness.** Lighting Africa will develop additional mixed-media materials to be customized and rolled out at the country level.
- **Impact evaluation.** Impact evaluation experiments will be conducted to better understand the outcomes of various program interventions.

MAKE FURTHER CONNECTIONS

Live Wire 2014/9. "Tracking access to electricity," by Sudeshna Ghosh Banerjee and Elisa Portale.

Live Wire 2014/21. "Scaling up access to electricity: The Case of Bangladesh," by Zubair Sadeque, Dana Rysankova, Raihan Elahi, and Ruchi Soni.

Live Wire 2014/22. "Scaling up access to electricity: The Case of Rwanda," by Paul Baringanire, Kabir Malik, and Sudeshna Ghosh Banerjee.

The emergence of the Lighting Asia program is a major development in scaling up the Lighting Africa program. Lighting Asia provides an overview of the off-grid lighting market in India, Bangladesh, Nepal, Cambodia, Indonesia, Pakistan, the Philippines, and Papua New Guinea, offering investors and industry players the opportunity to serve communities that presently lack access to reliable electricity.

In Africa, Lighting Africa continues to expand to new countries, as it is now mainstreamed into World Bank and IFC operations. Lighting Africa also has inspired initiatives from governments and other multilateral development banks. For example, GIZ programs on off-grid electrification in Africa have adopted a market-based approach similar to Lighting Africa. Governments in Kenya, Tanzania, and Burkina Faso have launched market-based initiatives in off-grid electrification. Barclays Bank (Kenya) will soon launch a solar lantern program targeted at youth entrepreneurship and employment.

With the initial market barriers now largely overcome, challenges and trade-offs for the next level include those discussed below.

Building sustainable retail channels. Most of the sales in Kenya were through bulk purchases by nongovernmental organizations. Although a growing share of sales now moves through retail channels and microfinance institutions, profitable retail channels that can reach rural areas are still underdeveloped. Further development of these retail channels is necessary to ensure long-term sustainability of off-grid lighting markets.

Serving difficult markets. Lighting Africa is seeking solutions for so-called difficult markets, such as fragile states and remote households that are expensive to serve and have a low ability to pay. There is a trade-off between the objectives of developing markets as quickly as possible (by supporting manufacturers and distributors in the markets of their main interest) and ensuring that the populations most in need are served. The program must be pragmatic about how private players perceive difficult market destinations—for example, by providing adequate additional incentives.

Providing access to finance. Access to finance remains a major issue for local distributors and retailers. Experience in Kenya has shown that, as the program matures, the local financial institutions become more inclined to lend to local distributors. However, this has only occurred after years of program implementation and as a result of Lighting Africa's intensive engagement with these institutions. Faster solutions in new markets will be needed.

Changing markets. The acquisition of basic lighting through solar PV lanterns (and the savings those lanterns generate for users) should cause many consumers to transition to a larger home lighting system. Greater emphasis on larger plug-and-play systems will ensure that Lighting Africa keeps pace with the needs of consumers.

Recycling. As the Lighting Africa program winds down, a strategy to recycle the millions of lanterns sold should be developed.

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The peer reviewers for this note were Dana Rysankova (senior energy specialist, World Bank Energy Practice), Arthur Itotia Njagi (senior operations officer, IFC Sustainable Business Advisory practice), and Mohua Mukherjee (senior energy specialist, World Bank South Asia Energy Practice).

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