

Quality Communication

Quality assurance in Kenya's off-grid lighting market



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Cover photo: A street scene from Kericho, Kenya, at the retail end of the off-grid lighting supply chain during a field research interview of a shop (photo: P.Alstone)

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Executive Summary

Quality assurance (QA) is a core feature of Lighting Global’s support for the growing off-grid lighting market, and there is a recognized need for reliable information about product quality and performance as the market grows towards 10’s to 100’s of millions of users served. Fundamentally, QA is a process of ensuring that accurate and trusted information about product quality is available for those who need it: producers, buyers, regulators, and other market stakeholders. For example, Lighting Global’s voluntary product testing leads to performance results that are published through a standardized specifications sheet that can inform the purchasing decisions of distributors and investors.

In this report we describe how **QA information can be effectively captured and deployed throughout the modern supply chain**. As the market evolves, there are new opportunities for strengthening QA activities. Our findings include new insights on the role of information and communication technology (ICT) access, the emergence of recognized brands and large distributors, and broader awareness of pico-solar.¹ The opportunities we identify build on the successful QA foundations of product testing and verification that are at the heart of the Lighting Global approach.

This work draws on a research effort from May through July of 2014 to understand the current dynamics of the off-grid lighting market in Kenya. An early target for the pilot of Lighting Africa, Kenya displays evidence of a shift from early-stage market entry to a more mature market for pico-solar. We sought to understand the ways that pico-solar is supported, distributed, and sold in markets like Kenya that could provide leading examples for the broader global market.

The **market share of quality-verified² pico-powered lighting systems has dramatically increased** in western and southern areas of Kenya over the period of support from the Lighting Africa program. Based on our research, pico-solar products now represent ~80% of the “electric off-grid lighting” market³ as measured by sales value, up from single digit percentages in 2009, and quality-verified products represent roughly 50% of the solar market. This rapid growth in market share for quality-assured solar and other solar products has been aided by support from the QA program and additional market support from Lighting Africa and other institutions, indicating a degree of success from these early market efforts. We found that QA verification is required or contributes strongly to decisions at several core points of the supply chain (e.g. buying requirements for large buyers) that manifest down the supply chain through the availability of good quality products and increased retail demand.

While QA is a complex set of processes, here we distill it into **two core “flows of information”** that work together to reduce uncertainty and risk in the market: **monitoring** quality so it can be understood and verified by high-level supply chain actors and institutions

¹ In this report, pico-solar refers to solar lanterns and small (< 10 Watts) solar powered lighting systems that can include more than one light point, charge a mobile phone, or power a DC radio or fan.

² Products that meet the Lighting Global Minimum Quality Standards

³ Defined as energy devices that can at least provide lighting service, are sold on a retail basis in a complete package, and may include rechargeable batteries or require primary disposable cells (including torches / flashlights).

(like manufacturers and programs like Lighting Global), and **communicating** verified quality to buyers and other decision-makers in the supply chain. When both mechanisms are working well, buyers can trust that the products they are purchasing will perform as advertised and provide a reasonable service life. We find that both elements of QA are at work in the market, closely linked with the structure of particular distribution channels and financing opportunities.

Key Findings

Communicating Quality through the Supply Chain: Our team explored several strategies that could enable Lighting Africa to improve its communication of QA information to consumers and supply chain stakeholders. These included radio advertising for consumer awareness campaigns, product specification sheets and flip books for distributors and retailers, and the use of electronic communication to connect with an increasingly digitally literate market. We found that specifications sheets and clearly designed flip books were preferred by both retailers and distributors as tools for conveying quality information to buyers.

Signaling Quality to Buyers: We investigated both “traditional QA” quality signals (e.g. product specification sheets and on-the-box performance reporting) and non-traditional quality signals like warranties and consumer financing. We found that on-the-box reporting and online communications were the preferred means of communicating quality information for distributors. Actionable warranties and pay-as-you-go (PAYG) financing can also serve as quality signals for buyers, since they spread the risk of early failure more equitably between sellers and retail buyers. A combination of these mechanisms for signaling quality to buyers is present in the market, with the mix of information evolving along with the broader market.

Building Brands: A core feature of the way retailers and customers recognize good and bad quality products is through brand-recognition and brand-loyalty. Notably in Kenya, the d.light brand (and particularly the S2 model promoted heavily by d.light and SunnyMoney) is widely recognized on a retail level. We also identified a number of “counterfeit” products in the market that look very much like the ubiquitous d.light S2 but with different branding, responding to the form factor loyalty that has been created around the product. Distributors and retailers in the Kenya market attribute the success of d.light S2 to early adoption through broad institutional sales (it was the core model sold by SunnyMoney schools programs for a critical period of market growth), broad advertising efforts, and low price points.

Availability and Choices: The wide distribution of quality-verified products in distributor, proprietary, franchise, and NGO distribution channels is based on reaching key decision makers higher up the supply chain with QA. Over 63% of retailers cited distributors as the main source of information about new products. Decisions made by distributors ultimately determine the products and opportunities for comparison shopping that are available to end-users, indicating that distributor and retail networks should remain a core focus area for QA engagement. We did identify one sales channel with a notable absence of products that meet the Lighting Global quality standards: the large, legacy wholesale traders in Nairobi that import electronics goods to Kenya. While specialty distributors that focus on pico-solar have been central to the market's

growth, the wholesaler traders could play a unique role in facilitating the large-scale distribution of solar products to small retailers from rural areas through existing channels.

The Importance of Nimble QA: One of the biggest challenges facing pico-solar products is the fact that they are essentially consumer durables in competition and co-mingled with fast-moving consumer goods (FMCG) like kerosene lamps or torches. Pico-solar sales have increased dramatically in distribution channels where creative distribution and financing strategies allow customers to access and purchase pico-solar products more like an FMCG. Traditional QA for electronics is focused on the consumer durables market, and for QA to support rapid growth in pico-solar there need to be “nimble” strategies for monitoring and communicating quality that can scale with and respond to the market. Accelerated testing and novel avenues for verifying quality should continue to be priorities for QA support of the market. For example, products employing mobile connectivity for PAYG can also capture remote in-field monitoring to verify ongoing product operation and offer responsive after-sales support.⁴

Key Opportunities

While a variety of opportunities were identified for improving the flow of quality assurance information through the off-grid lighting supply chain in Kenya (please see Conclusions and Recommendations), the following three opportunities were identified as having the highest priority for current quality assurance efforts:

1. Create simplified specification sheets with product performance results that can be accessed easily on the Lighting Global website for each product, and encourage manufacturers and distributors to reference and disseminate the print matter when interacting with vendors. Also explore the publication of an illustrated flip book that explains how solar technology works, what the benefits are, how to maintain solar products, and how to service a warranty. These flip books could be shared with distributors to facilitate training and promotion higher up in the supply chain, and they could also be piloted among select retailers to test their impact on sales.
2. Create a Lighting Global or Lighting Africa Facebook page with information for distributors, retailers, and consumers. In addition, the Lighting Global and Lighting Africa websites should be made compatible with smart phones, starting with the product page.
3. Engage with wholesale traders in Nairobi’s markets where many of the low-level retailers source their products. Increasing the presence of solar products in such areas could significantly improve comparison shopping opportunities for consumers further down the supply chain.

⁴ Please see Alstone, et al., "Off-Grid Power and Connectivity: Pay-as-you-go financing and digital supply chains for pico-solar" (2015).

Quality Assurance for the Off-Grid Market

For most countries belonging to the Organization for Economic Co-operation and Development (OECD), quality assurance (QA) and warranty mechanisms are safeguards that operate in the background of the modern manufacturing and sales industries. Although the average consumer is scarcely aware of them, certifications from the Underwriters Laboratory (UL) or trade associations ensure that the products that make it to market are safe and in compliance with a variety of national and international quality standards. In addition, customers are generally able to return faulty products for repair, exchange, or refund, although the quality of response can vary. **An effective QA framework therefore employs three distinct mechanisms for protecting consumers: voluntary or compulsory product testing, a reliable warranty program, and repercussions for poor quality products or poor warranty servicing.** Product testing serves as a preventative measure to protect consumers from low-quality products before they make it to market. However, if low quality or unsafe products are sold to consumers, the company can be held accountable through a warranty program, legal repercussions, or the rejection of their brand by consumers. Thus product testing, warranty servicing, and legal repercussions must work in tandem as institutional mechanisms in order to effectively safeguard consumer interests.

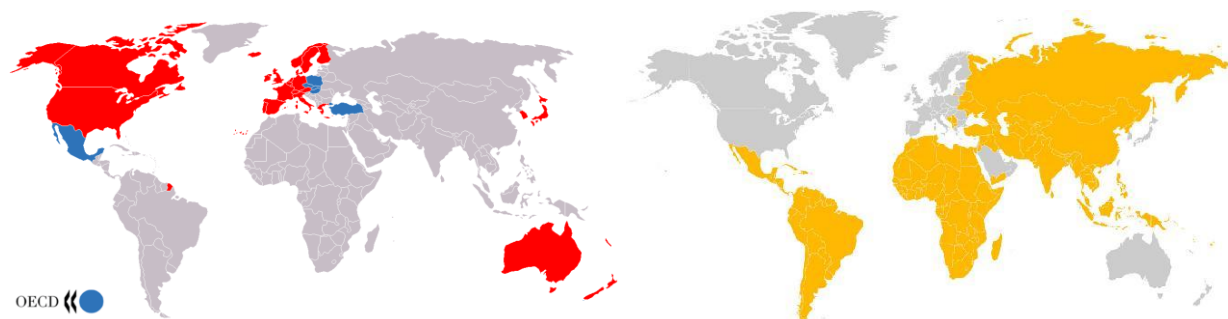


Figure 1: Left: countries belonging to the Organisation for Economic Co-operation and Development (OECD); Right: non-OECD countries.

But what about non-OECD countries? What does quality assurance look like in markets where product testing, legal enforcement, or consumer protections are underdeveloped? How can companies be held liable for low-quality or unsafe products where there is little brand-recognition or where access to information about product quality or performance is limited?

Given the particular constraints facing off-grid lighting markets, Lighting Global has developed a QA framework that includes rigorous testing for products before and after they reach the market and various mechanisms for communicating information about product quality and performance to buyers, retailers, investors, and other market stakeholders. **The overarching goal of the QA framework is to support good quality products and prevent market spoilage from bad buying experiences.** This approach seeks to increase the visibility of high quality lighting products in the market while helping individuals and businesses in the off-grid lighting supply chain make informed decisions about the products that they are purchasing.

Currently, Lighting Global has four distinct mechanisms for communicating information about product quality and performance: engagement with manufacturers, distributors, and other key

market stakeholders in the supply chain, regional consumer awareness campaigns, product specification sheets and technical notes on the Lighting Global website, and on-the-package reporting and labeling requirements. This report will attempt to characterize the flow of QA information in Kenya's off-grid lighting market and identify key opportunities for improving QA information access throughout the supply chain.

Study Methods

This research was conducted in five different counties in Kenya from May through July of 2014. Kenya was chosen because it is one of the market leaders for pico-powered lighting systems (PLSs) in Africa, and because the Lighting Africa program originally started in Kenya in 2007. This study also draws from years of experience developing and operating the Lighting Global Quality Assurance program. In order to map the flow of products, information, and finance through the off-grid lighting supply chain in Kenya, our research team partnered with several NGOs and businesses to collect over four hundred surveys from consumers, retailers, distributors, finance providers, manufacturers, and non-profit organizations. Surveys were conducted in-person across Kenya, Germany, and the United Kingdom, and over the phone from the United States and the United Kingdom. We conducted these key informant interviews across the supply chain for off-grid lighting, from global head offices to regional distribution houses (interviewing approximately 30 individuals). We also undertook detailed in-person surveys (approximately 130) at the retail level for sellers of both quality-verified and unverified off-grid lighting products. This mixed methods approach gives our team unique insight to the contemporary market, particularly in Kenya. In addition, we partnered with SunnyMoney (58 pico-solar customers) and M-KOPA (170 solar home system customers) to gather information related to pay-as-you-go (PAYG) financing and digital literacy among their customer base. Finally, we conducted two focus groups with SunnyMoney customers to learn more about what customers think of PAYG financing and data collection from PAYG devices.

The Off-Grid Lighting Supply Chain

While each product follows a particular path from the factory to the end-user, that path can depend as much on the flow of finance and QA information as it does on transportation infrastructure. Where products, information, and finance flow freely through the supply chain, supply chain actors are able to comparison shop, make informed decisions, and ultimately access the products and services that they need and want. In this sense, the flow of products, information, and finance are critical for understanding the various facets of energy access. Figure 1, below, captures the flow of products from their origin in Nairobi to their sale in urban, peri-urban, and rural markets.

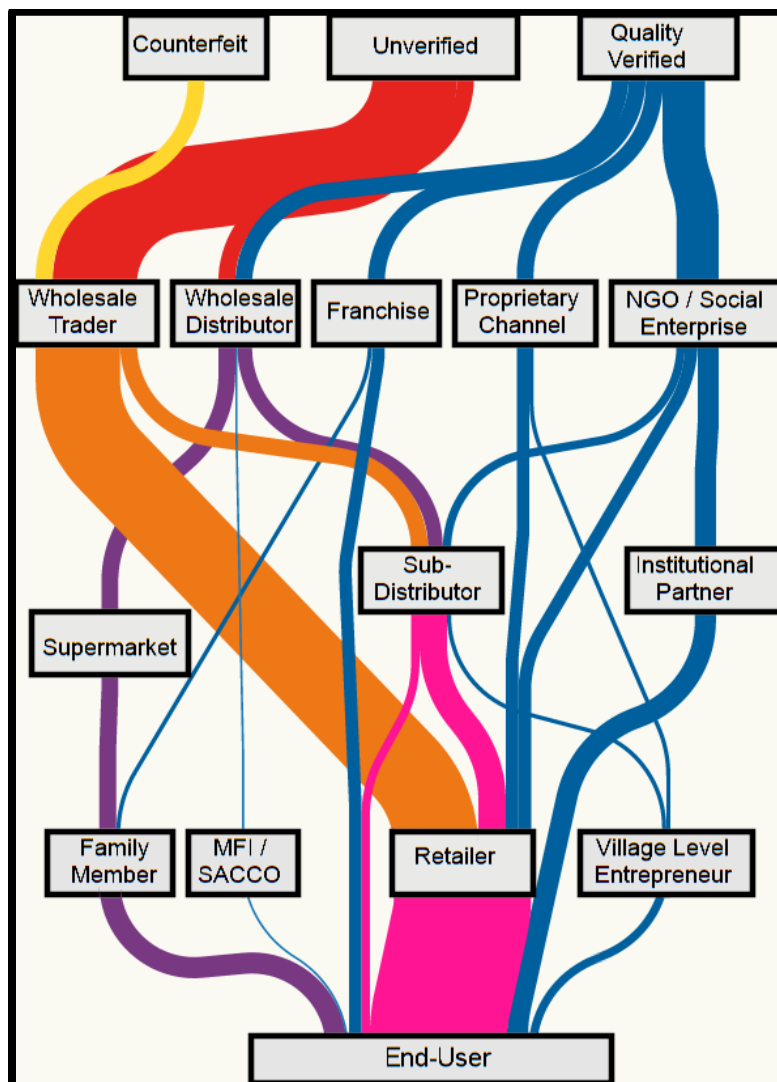


Figure 2: Distribution channels observed in the off-grid lighting supply chain in Kenya. The blue lines represent the flow of products that have met the Lighting Global quality standards; the red lines represent all other off-grid lighting products (including torches, key chain lights, emergency lights, etc.); and the yellow line represents the flow of counterfeit products. Gradations within the color scheme represent the confluence of different product flows (orange: unverified and counterfeit products; purple: quality-verified and unverified products; pink: quality-verified, unverified, and counterfeit products). Line width approximates the quantity of products flowing through each channel based on market observations and interviews with retailers, MFIs, and distributors for the three towns and the Nairobi wholesalers market that were surveyed. The product flows indicated may not be fully representative of national sales volumes for each category if sales in other regions differ from those in the regions covered in this study.

Six Core Sales Channels

We identified six core channels through which pico-solar products were distributed in Kenya (summarized in Table 1). This investigation confirms previous findings that the majority of solar lighting products flow through **distributor and retail channels**,⁵ with most off-grid lighting products flowing through **wholesale traders** and **wholesale distributors**⁶ first and then

⁵ Dalberg Consulting. (2012) "Lighting Africa Market Trends Report." IFC.

⁶ The distinction between wholesale traders and wholesale distributors is imprecise, but for the purposes of this investigation, wholesale traders are defined as shop owners in Nairobi who source products directly from manufacturers to sell primarily on a wholesale basis. The majority of wholesale distributors are also located in Nairobi, with some notable exceptions located in Mombasa, and source products directly from manufacturers. However,

being sold to end-users by retailers.⁷ A fraction of lighting products are sold through **franchise distribution** channels like Total petrol stations. In addition, family members can play an important role in conveying products from urban or peri-urban markets to relatives in rural areas. A large number of quality-verified products are sold through **proprietary and NGO-partnership channels** by companies like SunnyMoney and M-KOPA.⁸ SunnyMoney notably sells more solar lights in Africa than any other company by combining institutional sales through schools with a developing network of sub-distributors that sell through traditional brick-and-mortar retail shops. With a few exceptions, **microfinance institutions** (MFIs), savings and credit cooperative organizations (SACCOs), and supermarkets do not move a substantial volume of product.

Table 1: Six primary distribution channels in the off-grid lighting market.

Supply Chain Classification	Central Organizing Actor	Other Key Actors	Example
Non-Governmental Organization (NGO)	Non-profit social enterprise	Institutional partners, global manufacturers	SunnyMoney and Kenya public schools
Wholesale Distributors	Headquarter offices, global manufacturers	Institutional partners	SolaTaa
Wholesale Traders	Regional distributors and retail networks	Global manufacturers, a diverse set of retailers and resellers	Wholesale traders in Lithulu Avenue markets
Proprietary Channels	Global manufacturer or private company	Retail channel partners	d.light or M-KOPA
Franchise	Global retail chain owner	Global manufacturers	Total petrol stations
Microfinance	Microfinance institution (MFI) or Savings and Credit Cooperative Organizations (SACCO)	Global manufacturers, regional distributors	Rafiki , K-REP , or Unilever SACCO

It is important to note that, while the channels for distribution have not changed significantly in the off-grid lighting supply chain as it has evolved, the types of products and the volume of sales through each channel continue to evolve as the market develops. In particular, Figure 2 captures the flow of three distinct product types in Kenya's off-grid lighting supply chain. First, there are some forty-seven different pico-products available on the market that have been tested and have met the Lighting Global quality standards.⁹ The second category captures all other off-grid lighting products, including dry-cell torches, grid-charged emergency lanterns, key chain lights,

wholesale distributors typically have formal contractual agreements with a small number of manufacturers and also participate in the marketing and distribution of those products to sub-distributors and retailers.

⁷ Retailers include traditional brick-and-mortar shops as well as informal tables or sidewalk hawking. Retailers are generally stationary and located in urban or peri-urban contexts, whereas village-level entrepreneurs sell products at open-air markets, churches, and savings groups in rural areas.

⁸ In the middle of 2014, M-KOPA transitioned from selling the d.light D20g, which was quality-verified, to selling the M-KOPA III, which is not currently listed on the Lighting Global website.

⁹ Please see www.lightingglobal.org/products for a current and comprehensive list of all Lighting Global quality-verified products. Not all forty-seven products are available in the Kenyan market.

and even non-verified solar lanterns and solar home systems. The final category is actually a unique subset of unverified products: the counterfeit products that have proliferated as successful solar products gain enough popularity to merit mimicry.

Information Flow in the Supply Chain

Access to information about product quality and performance plays a central role in the development, marketing, and sale of off-grid lighting products. **When information flows freely up and down the supply chain, investors and buyers are able to make informed investment and purchasing decisions, and manufacturers are able to develop and improve product design based on customer feedback and outcomes from the field.** In the absence of information about product quality or durability, investors and buyers must rely on direct experience or anecdotal evidence, often arresting the introduction or adoption of new or unproven technologies like solar lanterns. Market spoilage, which was documented in the early development of the Kenya market,¹⁰ occurs when consumers lose confidence in a new technology based on bad experiences with poor-quality products or when manufacturers are disconnected from the realities of how their products perform in the real world.

As a consumer protection mechanism, the flow of information about product quality and performance can be as simple as a word-of-mouth recommendation and as complex as an international quality standard enforced by government regulators and inspectors. In both cases information can reduce risk and uncertainty for buyers and consumers by addressing the central QA questions: **Will this product perform as advertised? Will it last? Is it worthy of investment?**

Information Mediums

Despite sharing the same goal, not all information mediums are created equal. A television advertisement may reach a broader audience, but it does not carry as much weight as a personal recommendation from a trusted acquaintance. For pico-solar products, advertising and promotion through media or on-the-box labeling requirements can help increase consumer awareness, but they may not carry the same weight as word-of-mouth referrals, product demonstrations, or product presence in a trusted retail shop.

The rapid development and proliferation of information and communication technologies (ICTs) like mobile phones and internet services is also creating new channels for quality assurance information to flow more dynamically within the supply chain. A key finding of this investigation is **that information and communication technologies like mobile phones and social media apps can simultaneously expand the reach and impact of QA information by grafting impersonal, institutional messages into personalized, relational networks that carry weight with end-users.** Combined with the increasing digital literacy of rural customers, the channels for information flow that have been opened up by information and communication technologies represent one of the most important opportunities for improving quality assurance in the market.

¹⁰ Mills, Evan, Jennifer Tracy, Peter Alstone, Arne Jacobson, and Patrick Avato. (2014) "Low-cost LED flashlights and market spoiling in Kenya's off-grid lighting market." *Energy Efficiency*.

Reducing Uncertainty vs. Reducing Risk

Despite the increased presence of ICTs, off-grid markets are still particularly vulnerable to information asymmetry, a market failure that occurs when buyers know less than sellers about the quality or performance of products in the market.¹¹ Given the uncertainty or risk associated with the investment, a buyer must rely on a variety of sources and signals to determine the product's relative quality or utility. While **some of these signals reduce uncertainty** by indicating how the product performs or how suitable the product will be for the buyer's needs, **other signals reduce risk** by indicating the product's quality or durability.

For the purpose of this report, signals that reduce uncertainty will be characterized as either direct or indirect. **Indirect signals** like product presence, branding, or word-of-mouth referrals are sources of information that cannot be controlled by the seller but still inform and influence consumer behavior. **Direct signals** like advertising, on-the-box reporting, and sales tools are sources of information that require a specific action or effort on the part of the seller. While both indirect and direct signals reduce uncertainty by communicating information about the product (e.g. its utility, desirability, or performance), this information is not always a reliable indicator of quality. Thus, **quality signals** like quality seals, warranties, or consumer financing play a unique role in reducing risk and safeguarding consumer interests in off-grid markets.

Given the complexities of product and information flows in the off-grid lighting supply chain, an effective QA program must employ a variety of strategies for monitoring the quality of products and communicating QA information to market stakeholders throughout the supply chain.¹² This report will consider the influence of QA information in Creating Quality (prior to market entry), Delivering Quality (impacts on product distribution and financing), Reducing Uncertainty through Indirect and Direct Signals, and Reducing Risk through Quality Signals. Finally, this report will conclude with a discussion of recommendations for the QA program going forward.

Delivering Quality

Quality signals like warranties or branding are useful for distinguishing higher quality products that are already available to end-users, **but the majority of the most important decisions about product design, financing, and distribution are made long before a product makes it to market** (see Creating Quality sidebar). Engagement with key market stakeholders—manufacturers, investors, government regulators, and distributors—is crucial for an effective QA framework because the decisions that are made at the top of the supply chain determine the flow of products, information, and finance through the rest of the supply chain.¹³ As the gatekeepers to the market, these stakeholders not only determine which products are ultimately available to end-users, they also influence how those products are priced, presented, and serviced.

¹¹ See "The Market for Lemons: Quality Uncertainty and the Market Mechanism" by George Akerlof (1970) and "Job Market Signaling" by Michael Spence (1973).

¹² See "Photovoltaic Module Quality in the Kenyan Solar Home Systems Market" by Duke, et al., (2002) for a more extensive description of quality assurance strategies.

¹³ Bloomstein, Carl, and Margaret Taylor. (2013) "Rethinking the Energy Efficiency Gap: Producers, Intermediaries, and Innovation." Energy Institute at Haas.

Financing

Investors and donors often use information about product quality and performance when conducting due diligence to determine whether or not a company merits support. As a result, QA information can play a significant role in determining which companies and products receive support through working capital, consumer-level financing, or social impact investment.

Access to working capital for distributors, sub-distributors, and wholesalers has an impact on how much inventory can be purchased and stocked. Since pico-lighting is more expensive and takes longer to turn over than dry-cell torches or kerosene,¹⁴ sufficient working capital is important for maintaining a consistent in-country supply. Given that pico-solar manufacturers often require up-front payment for production and shipping, and given an elastic demand that fluctuates according to seasonal income cycles, access to working capital is critical for ensuring a consistent market presence for pico-products. This is particularly true for firms that provide financing to consumers (see below), as low-income customer segments often require relatively long loan tenors.

Consumer-level financing can vastly improve product sales and penetration. Consumer-level financing is available in two distinct forms: pay-as-you-go (PAYG) arrangements where ICT-enabled payments are made in installments, and consumer loans made by micro-finance institutions (MFI), savings and credit cooperative organizations (SACCO), or hire-purchase and check-off arrangements. Consumer-level financing is particularly important for solar products like study lamps and solar home systems because the initial cost is often prohibitive for individuals and families with few resources.

Finally, **impact investors and charitable donors** are interested in product quality and salability, but they also want **to ensure that the product will fulfill a particular social or environmental need.** An excellent example of this is the study lamp form factor that now dominates the pico-solar market. While these small solar lamps are increasingly popular due to their low price points and flexible use as a torch or ambient light, their suitability as study lights for children doing homework also makes them popular with investors and donors. Although

CREATING QUALITY

Quality assurance information plays a critical role in informing product design and investment before the product makes it to retail markets. This can include:

- **Product Development:** QA information can reduce risk for the manufacturer by providing information related to customer needs and minimum quality standards. This is especially true when consumer-oriented research is used to inform the standards setting process.
- **Investment:** Investors also depend on accurate product quality and performance information to make lending decisions. Quality verification by a third-party testing organization like Lighting Global can reduce risk for investors that provide initial or working capital for pico-solar start-ups.
- **Performance Testing and Disclosure:** Once the quality of a product has been verified, that information needs to be communicated to key market stakeholders and consumers. This can include the publication of test results as well as customized stakeholder engagement.
- **Regulation:** Government regulators, customs officials, and inspectors also play critical roles in setting and enforcing government mandated minimum quality standards. International harmonization through widespread adoption of standards established by organizations such as the International Electrotechnical Commission (IEC) make it easier for manufacturers to deliver affordable, high quality products to multiple markets.

¹⁴ One distributor indicated that the minimum turnover time is six months: three months for transport from China, plus three months for in-country distribution and sale.

detailed measurements of social impact are beyond the scope of a QA program, pay-for-performance financing through social impact bonds or carbon markets could provide an attractive source of funding for high quality products that can be effectively monitored and evaluated.

Distribution

Distributors, NGOs, and franchises also depend on QA information and exert significant influence on the types of products that are available in the market. Taking into account the ease with which supply-chain actors are able to source low-quality products from generic manufacturers and circumvent customs inspectors with bribes or intra-Africa importing, engaging with product distributors and traders is critical for supporting the availability and movement of quality-verified products in the supply chain.¹⁵ **In this way, the distribution channels that carry counterfeit and unverified products in Figure 2 indicate where information about product quality and performance is most needed.**



Figure 3: Example of a retailer selling a variety of electronic items. (photo: Maina Mumbi)

As an example, the fact that none of the wholesale traders that we talked to in Nairobi had heard of Lighting Africa or seen one of the product specification sheets underscores where quality assurance information is severely lacking: the wholesale markets in the Luthuli Avenue, River Road, Nymakima, and Kamukunji sections of Nairobi where almost 40% of retailers in Kericho purchased lighting products and other wares. In the absence of such information, it is likely that the flow of low-quality and counterfeit products through these markets will continue unabated.¹⁶

¹⁵ Duke, R.; Jacobson, A.; and Kammen D. (2002) "Product Quality in the Kenyan Solar Home Systems Market." Energy Policy.

¹⁶ Given the vulnerability of quality-verified products to counterfeiting and the appearance of quality by many counterfeit products, it is not clear what impact the availability of QA information would have on the prevalence of counterfeit products in the market.

Connecting with wholesale traders is particularly challenging though, as there are many more traders than distributors in Kenya, and many of these traders are insulated from the repercussions of selling low-quality products because of the limited availability of QA information in the market and the inability of buyers to seek recourse when they have purchased low quality goods. As one trader put it, "No one [here] cares about quality. They just care about money." Another source of reluctance is due to the fact that, unlike other consumer electronics like stereos, fans, rice cookers, or televisions, many traders think that the retail market in Nairobi for solar products is smaller due to grid availability (even accounting for consumers who purchase products for off-grid relatives). Be that as it may, quality-verified products and solar products in general represent an increasingly lucrative opportunity for the traders who sell to rural retailers, and the wholesale markets can also play an important role in facilitating comparison shopping within the supply chain.

Consequences of Quality

There are two additional challenges facing pico-solar systems in Kenya. First, quality solar lamps are consumer durables (long lasting products) that are forced to compete with cheap, fast-moving consumer goods (FMCGs)¹⁷ like kerosene and dry-cell torches. Given capital constraints, most of the rural poor without electricity purchase domestic goods and energy services in small amounts at regular intervals. In Kenya, kerosene can be purchased by the deciliter (~3.4 oz) to fill inexpensive wick or hurricane lamps. Cheap, dry-cell batteries can be replaced in low-cost torches and key chain lights, and candles provide the least expensive lighting service when the previous options are not available. While pico-powered lighting systems provide a superior lighting service from a renewable energy source, the up-front cost of this service is often greater than what most rural customers can afford. Ironically, the very characteristic that makes pico-solar more attractive—quality—also raises the initial cost and makes it less accessible.

As a result of their greater expense, **consumer durables like pico-solar products tend to be sold in urban and peri-urban markets that are less accessible compared to village-level markets where FMCGs are sold.** For example, FMCGs like candles and torches are readily available at small village general shops (dukas), enabling consumers to purchase what they want, when they need it without having to travel too far from home. In contrast, consumer durables are more expensive to transport and stock, and as a consequence they are less widely available. As a result, consumers are more apt to shop for consumer durables in urban or peri-urban markets where a greater number of shops offer more selection and better pricing.¹⁸

While the distinction between consumer durables and FMCGs is less important for formal distribution channels such as NGOs, franchises, and proprietary supply networks, the impact on retailers is still significant. Almost 40% of the retailers in this study went to Nairobi to purchase

¹⁷ For the purpose of this investigation, FMCGs are defined as products that can be purchased in small quantities at regular intervals to provide a temporary good or service (shampoo or laundry sachet, soap, soft drinks, food items, etc.). Consumer durables are defined as products that provide a service for at least two years (e.g. fan, mobile phone, radio, television, etc.).

¹⁸ Neuwirth, Benjamin. (2011) "Marketing Channel Strategies in Rural Emerging Markets."

their products. Many of these retailers purchase from the wholesale electronics markets where they can comparison shop, receive wholesale prices for small purchases, and pick up other FMCGs for their shops. In contrast, sourcing solar lights from wholesale distributors is considerably less convenient. Wholesale distributor offices are often scattered around Nairobi instead of located in a central market, which results in greater travel costs for small business owners seeking inventory. Minimum orders to qualify for wholesale pricing or free transport are often prohibitive for smaller retailers. And the fact that most distributors carry only one line of products makes it difficult to provide greater variety to customers. In other words, **another consequence of higher quality is that it can restrict the flow of pico-solar products to narrower distribution channels and limit the opportunities for comparison shopping.**

Improving Retailer Distribution

Although Kenya has experienced unprecedented success in selling pico-solar products through institutional partnerships, these institutional sales are not considered a long-term solution. Sales through school campaigns can provide an effective stop-gap measure to accelerate the awareness and adoption of solar products in virgin markets, but they do not provide a reliable long-term distribution channel for sustaining sales or after-sales service.¹⁹ With the greatest variety of products available and opportunities for connecting with customers, retailers figure centrally in strategies for reaching out to customers and communicating information about product quality and performance.

Given that retailers are the primary means by which end-users access lighting products, how does the average retailer decide which products to sell to his or her customers?²⁰ Based on our interviews with retailers, **there are at least five factors that figure into the customer's purchasing decision at the retail level: demand, durability, availability, access to finance, and affordability.**

Demand and Durability: Sixty-three percent of the retailers that we interviewed learned about new lighting products from their supplier, while twenty-six percent found out from their customers (see Figure 4). In other words, before a retailer can purchase a new product, he or she must first be aware of and sense a demand for the product. But retailers also need information about the product quality, as nearly half of all customers focus on durability as a key characteristic when making purchasing decisions (see Figure 5). Retailers have an incentive to sell higher quality products in order to avoid customer complaints or dissatisfaction, and without other sources of information about product quality they often depend on personal experience, feedback from customers, and assurances from suppliers to decide which products to purchase.

¹⁹ For example, SunnyMoney has developed a robust distribution network to continue sales after school campaigns. As of July, 2014, SunnyMoney was selling the d.light S2, S20, and S300; the Greenlight Planet SunKing Eco, SunKing Mobile, and SunKing Pro2; the Barefoot Connect 600 solar home system; and the Marathoner Beacon 290 solar home system through its distribution network.

²⁰ Of all retailers interviewed for this study, 61% were male.

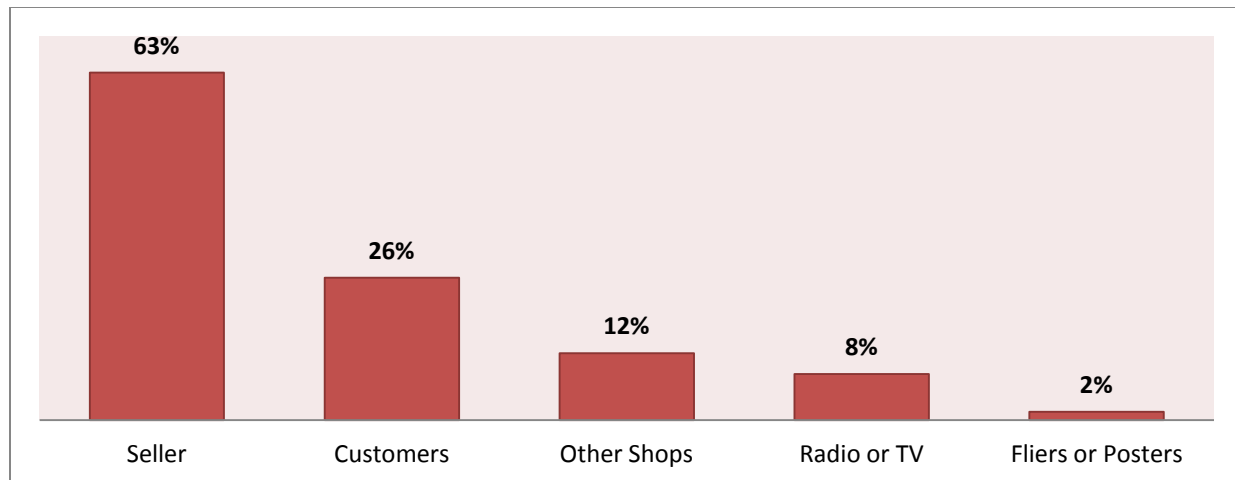


Figure 4: How retailers learn about new lighting products. Retailers could cite more than one source.

Availability: However, awareness and interest are not sufficient: retailers need reliable and consistent access to the product. If the product is delivered, is available from a local sub-distributor, or can be sourced from a trusted trader in Nairobi's wholesale market, then it is much more likely that retailers will be able to maintain consistent stock in their store. If the distributor is hard to find in Nairobi, the cost of shipping is too high, the minimum order for wholesale pricing is too high, deliveries are sporadic or unreliable, or the product selection is limited, then a retailer is less likely to try a new product or technology. From May to June when we were conducting this research, many of our retailers commented extensively on their inability to fulfill consumer demand for d.light products due to the lack of available supply from d.light distributors.

Access to finance and affordability also play important roles in the retailer's purchasing decision. Torches and key chain lights are inexpensive, so it is easy to maintain a steady stock and turn over inventory. Solar lamps are more expensive and sell less quickly, which means that the retailer must either have sufficient working capital to maintain stock or a consistent delivery mechanism for replenishing a small inventory. In some instances, the seller provides informal financing by giving the retailer a three- to fourteen-day grace period before payment is due. However, affordability is perhaps the most important criteria for retailers and customers (see Figure 5). Low quality products continue to thrive in the off-grid lighting supply chain because they temporarily meet a need at a price that customers can afford. One reason for the success of study lamps, including quality-verified versions, is the fact that they are the least expensive solar lamp available.

In sum, **QA information plays a critical role in influencing the flow of products, information, and finance at the top of the supply chain and determining which products are selected by vendors to sell to consumers.** Given that vendors can choose between high quality, low quality, and counterfeit products, Lighting Africa has a strong incentive to continue engaging vendors throughout the supply chain to ensure that they are in a position to make informed decisions that ultimately benefit their businesses, their customers, and rest of the market.

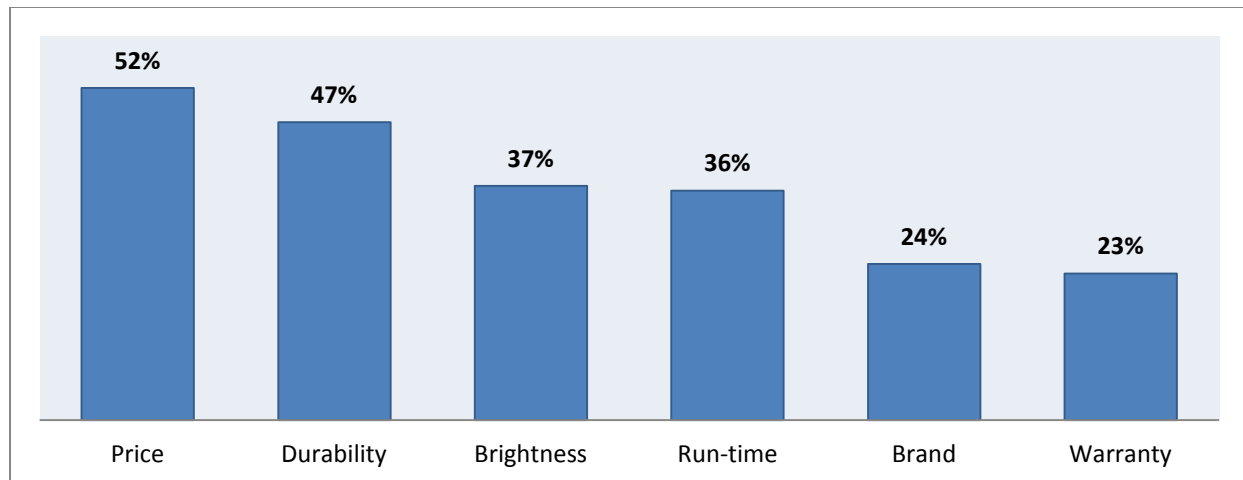


Figure 5: Percentage of retailers that reported receiving requests for particular product information when asked, "What information have customers asked for or used to make purchase decisions in the last week?"

Reducing Uncertainty through Indirect Signals

Once a product makes it to market, buyers still may not know how it will perform or how well it is suited to their needs. Absent this information, there are a variety of indirect signals like product presence, branding, or word-of-mouth referrals that can reduce uncertainty for the buyer and inform his or her purchasing decision.

A Dominant Presence

With over one million solar lamps sold in Kenya last year, pico-solar sales now represent a dominant share of the total sales revenue for off-grid lighting.²¹ Although the selection of pico-solar products is still growing, **73% of the retailers interviewed in this study were selling a product powered by solar.** In fact, of more than five hundred products recorded, 40% were powered by solar, more than any other energy source.²²

The dramatic growth of the pico-solar market has two important implications. First, **the marked increase of solar products in the market means that pico-solar is not only more available, it is more visible.** Consumers like to purchase products that are aspirational—products that imply a higher standard of living, upward social mobility, or greater status and prestige—and customers with fewer resources are by no means the exception.²³ Therefore, the fact that solar products are stocked in more retail shops, supermarkets, and electronics stores—particularly stores in urban centers where demand is aggregated and consumers prefer to purchase consumer durables—lends to the credibility of solar technology.

²¹ Based on reported pricing and sales volumes, quality-verified products represented roughly 50% of the total sales revenue, while all solar-powered products approximately 80% of the total sales revenue for the retailers interviewed in this study.

²² Other categories noted were: 34% that were powered by dry-cell batteries, 31% with grid-charging capability, and 4% that were dynamo charged. With solar charging, the total numbers add up to more than 100% due to products that were powered by more than one energy source.

²³ Karamchandani, et al. (2011) "Is the bottom of the pyramid really for you?." Harvard Business Review.

Perhaps more importantly, as more solar products are sold, more customers are able to see first-hand how these products perform in their communities. This form of direct, eye-witness quality assurance cannot be understated because, as we will see, **customers are most likely to purchase a product that they have already seen, experienced, or heard-about from a family member, neighbor, or other trusted source.** When we asked retailers if the customers who purchased solar lamps came in looking for a specific product, 82% answered in the affirmative, indicating a dramatic increase in demand for solar products. In short, the increased visibility and availability of solar products in Kenya is one of the main means by which consumers are gaining more trust in solar technology more generally and in solar products more specifically.

The Emergence of Brand

One key observation made during the field study was that the d.light S2 has become one of the predominant products in the market. Representing almost a tenth of all products surveyed, the S2 was the most common product that we encountered.²⁴ Moreover, d.light was the most common brand that we saw in retail shops, representing 17% of all products. Greenlight Planet solar lamps (3.5%) and Tigerhead torches (3.1%) tied for a distant second. Several retailers indicated that they had begun to stock d.light S2 study lamps in response to customer questions and demands. In fact, two hardware stores that did not sell any other lighting products were selling d.light S2 lamps because customers had requested them.

In addition to the increased visibility and availability of d.light products, there was a broad identification of d.light as "the" solar light. Some retailers reported that customers used "d.light" and "solar" interchangeably, and one retailer said that a customer had asked for a "d.light eco."²⁵ However, as we dug deeper we realized that, despite the broad awareness of and demand for "d.light," customers and retailers were often referring to the S2 study lamp when they said, "d.light." In other words, **while in some instances d.light was conflated with solar, in most instances d.light was most broadly identified with the S2 study lamp.**



Figure 6: d.light S2 study lamp. (photo: dlight.com)

This conflation of manufacturer and model illustrates that consumer perception of products includes multi-layered information, including official branding, form factor, and the context of availability. **This could leave popular products like the S2 vulnerable to imposters that can adopt a subset of these signals.** We encountered two striking S2 counterfeits while conducting surveys, and one of them was nearly identical (see Figure 7).²⁶ Given that

²⁴ The closest runner-ups were the d.light S20 at 4% of all products and the d.light D20g sold by M-KOPA representing 2% of all products.

²⁵ The SunKing Eco is a solar lamp that is manufactured by Greenlight Planet and sells at a price similar to the d.light S2. A customer asking for a "d.light eco" is akin to customers conflating "coke" and "soda" in some regions of the United States.

²⁶ The Winning Star TYN 355-372 had the exact same shape, wire stand, and even packaging as the d.light S2. Externally, the only differences were the brand name, a green (instead of orange) rim around the enclosure, and a polycrystalline solar module. (The original S2 solar module was polycrystalline but has since been replaced with a

retailers and customers depend heavily upon the shape and appearance of the product for identification, it was not surprising that several retailers were selling these products and the d.light S2 interchangeably. In fact, when we returned to Kericho to try and locate several Winning Star samples for testing, almost no one knew what we were talking about when we asked for the Winning Star by name.



Figure 7: From left to right: a d.light S2, a counterfeit of the S2, and the Winning Star counterfeit of the S2.

While the growing demand for the S2 indicates that consumer confidence in solar technologies is increasing, it is not clear whether customers are loyal to the form factor or to the brand. In other words, **the prevalence of S2 study lamps may have less to do with the emergence of the d.light brand and more to do with the way that the S2 has been promoted in the region.** This may explain why brand ranked lower than durability, brightness, and even run-time when customers were deciding which product to purchase: even though most customers and retailers refer to the S2 as "d.light," they may not think of it as a brand (see Figure 5). Understanding the drivers of d.light's success has important implications for how products are promoted in other virgin markets. In particular, when customers identify the product by form factor instead of by brand, the product is more vulnerable to counterfeiting and the ancillary benefits of brand-building (warranty servicing, product upgrading, after sales service, etc.) are diminished.

The Power of Referral

As mentioned earlier, SunnyMoney is selling more solar lamps than any other company in Africa. While an analysis of their sales strategy is beyond the scope of this investigation, it is important to highlight how the SunnyMoney model has contributed to the demand for the S2 study lamp in the Kericho area and the flow of information through the supply chain.²⁷

In partnership with the Kenya Ministry of Education, SunnyMoney sells most of its study lamps through head-teachers in public schools. In rural areas with little previous exposure to solar products, head-teachers are recruited and trained to sell study lamps at their schools and in their communities. **The efficacy of this model cannot be understated, as the head-**

monocrystalline module.) It was also interesting to note that the Winning Star had a slightly larger battery than the S2.

²⁷ Please see "SolarAid: Revolutionizing the way to make energy affordable for everyone" by Howe, et al. (2012), for more information.

teachers are an ideal medium through which to share information about solar study lamps.

In talking with parents, students, savings groups, or church members, head-teachers explain the dangers associated with kerosene lighting, the durability and cost-effectiveness of solar lamps, the benefits of switching, and the utility of the lamp for studying at home. With their education and training, head-teachers are generally perceived as a trustworthy source for information, and their high-standing in the community also lends to the credibility of what they share. Finally, although head-teachers often receive a small financial incentive for selling lights, they do not depend on the income for their livelihood like local retailers or village-level entrepreneurs.



Given their commitment to children's education and their desire to keep the sale simple, SunnyMoney only promotes one study lamp in each school, and in the areas around Kericho they have almost exclusively promoted the d.light S2. Thus, the previous trends we observed—customers knowing which product they want when they enter the store, the greater availability of and demand for the S2, and the strong product-loyalty to the S2—may be due in large part to the unique sales model employed by SunnyMoney. In a recent survey of fifty-eight SunnyMoney customers, participants knew an average of six people who had solar lights prior to their purchasing one. Eighty-five percent indicated that their purchase was influenced by a recommendation that they received, and 64% of participants stated that the recommendation of the teacher was the most important or main factor in their decision to purchase a solar lamp, more than their children (37%), friends or family (34%), or any other community leader (2%). In this way the success of the SunnyMoney model, which has made the d.light S2 a best-seller, involves a confluence of three critical factors: **the recommendation of the teacher, the ability to see and experience the product directly in the community, and the critical mass of sales that animate interest and trust in the product.**

Anecdotal evidence from interviews with retailers seems to support this hypothesis. Apparently in areas where SunnyMoney is promoting and selling the SunKing Eco, there are similar trends that are developing with consumer demand and product-loyalty. Also, one sub-distributor indicated that neither the Eco nor the S2 seem to sell very well in areas where there haven't been any school promotions. In this way, indirect signals like product presence, branding, and word-of-mouth referrals can exert a significant influence on consumer behavior, particularly when applied in tandem. While an application of this sales model to other markets is beyond the scope of a QA program, it is worth underscoring how widespread institutional sales have positively impacted the rest of the market through increasing product visibility and consumer awareness. The SunnyMoney model in particular demonstrates how **the quality of the signal—its source, whether it can be readily verified or experienced, and whether it appears to influence others in the community—ultimately determines its efficacy in influencing and informing consumer behavior.**

Reducing Uncertainty through Direct Signals

While the indirect signals described above play a significant role in informing and influencing purchasing decisions, there are also direct signals like on-the-box labeling, advertising, and sales tools that can be used to promote products or facilitate comparison shopping. Thus far, the Lighting Africa QA program has been successful in engaging market stakeholders at the top of the supply chain, and this has had a positive impact on the rest of the market. However, **there are still opportunities to engage traders, sub-distributors, retailers, and customers further down the supply chain to increase opportunities for comparison shopping and improve the overall flow of information about product quality and performance.**

On-the-Box Reporting

On-the-box reporting is one of the most direct means of communicating information about product performance. In early 2015, Lighting Global collaborated with manufacturers to finalize reporting requirements for light output and product runtime. While the presentation of these performance characteristics will be left to the discretion of each manufacturer, these performance reporting requirements will play a key role in facilitating comparison shopping between similar products (see Figure 8).

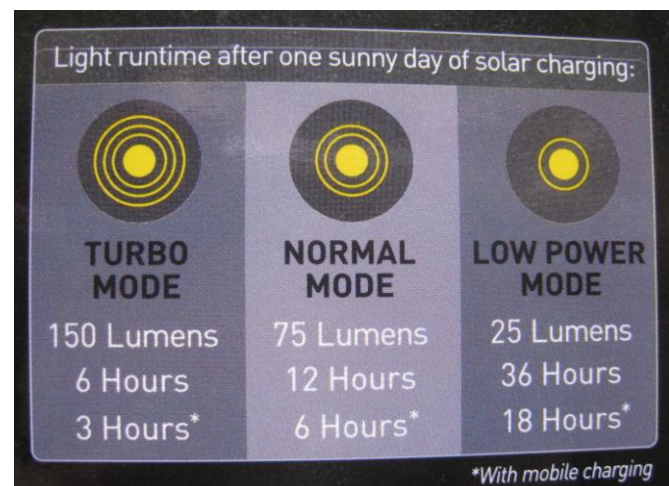


Figure 8: Example of on-the-box reporting for a pico-solar product.

Advertising and Promotion

Lighting Africa has worked hard to promote quality-verified solar products in Kenya through road shows, television advertisements, radio advertisements, and marketing materials like posters and fliers. **When we asked retailers what they thought were the most effective ways of promoting solar products, 48% indicated that radio advertisements in the local language would be the most effective**, followed by road shows (24%, see Figure 9), television advertisements (18%), and fliers (10%). With greater penetration of radios and televisions into rural markets, it is likely that these mediums will become increasingly popular for promoting solar products.



Figure 9: Example of Lighting Africa road show in Kenya.

Tools for Promoting Solar

In each of our interviews with retailers who sold solar, we also presented four different promotional tools and asked them which they thought would be most useful for learning more about solar technology, training employees, or selling more solar products to customers. The first was an example of a product specification sheet from the Lighting Global website. The second was a graphic representing a quality seal on the box of a solar product. The third was a printed excerpt from a flip book that describes solar technology with pictures. The fourth was a picture of a YouTube video that we explained would provide an audiovisual description of solar technology.²⁸

As seen in Figure 10 and Figure 11, **the specification sheets and flip books were overwhelmingly preferred by retailers, both as tools for internal knowledge building and as a means of selling more solar products to customers.** Very few retailers had seen one of the Lighting Global specification sheets before, but most expressed interest in the graphical header that displays the brightness and solar runtime for different settings and product features like mobile charging or additional light points. In one case a retailer reported being able to sell more SunKing Eco study lamps by showing customers that it was brighter and had a longer run-time than a similar lamp.

²⁸ Please see the Annexes for examples of each tool.

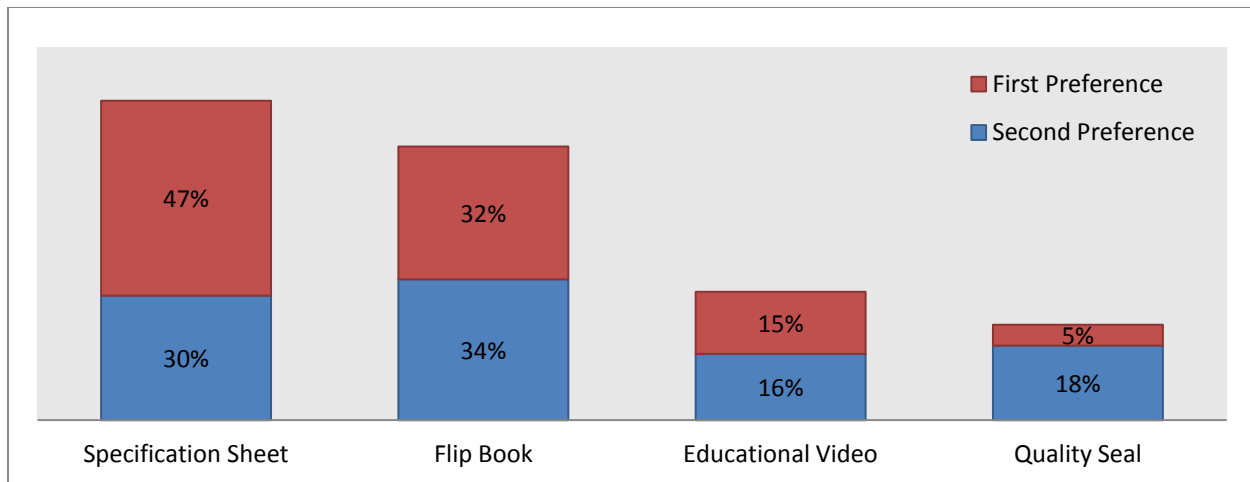


Figure 10: Retailer's most useful tools for learning about and training employees in solar technology (N=94).

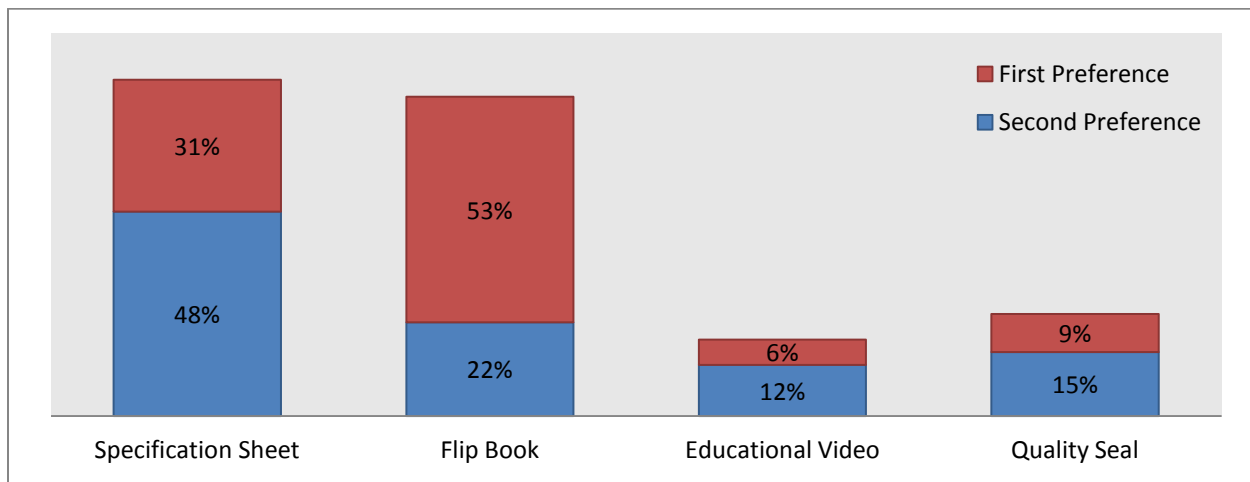


Figure 11: Retailer's most useful tools for selling more solar lamps to customers (N=94).

Of course, while retailers figure prominently because they are closest to end-users, they are ultimately vulnerable to the decisions that are made further up the supply chain by distributors. During this investigation, we also conducted semi-structured interviews with fourteen distributors in Kenya, representing a variety of manufacturers and distribution channel strategies. Since the decisions of distributors affect the rest of the supply chain, we also wanted to ask them their opinions about the tools described above (see Figure 12 and Figure 13). **While the distributors represented a smaller sample size, they thought that the specification sheets and educational video would be most useful for training their sales staff, but that the flip book and quality seal would be most useful for selling more products to retailers and sub-distributors.**

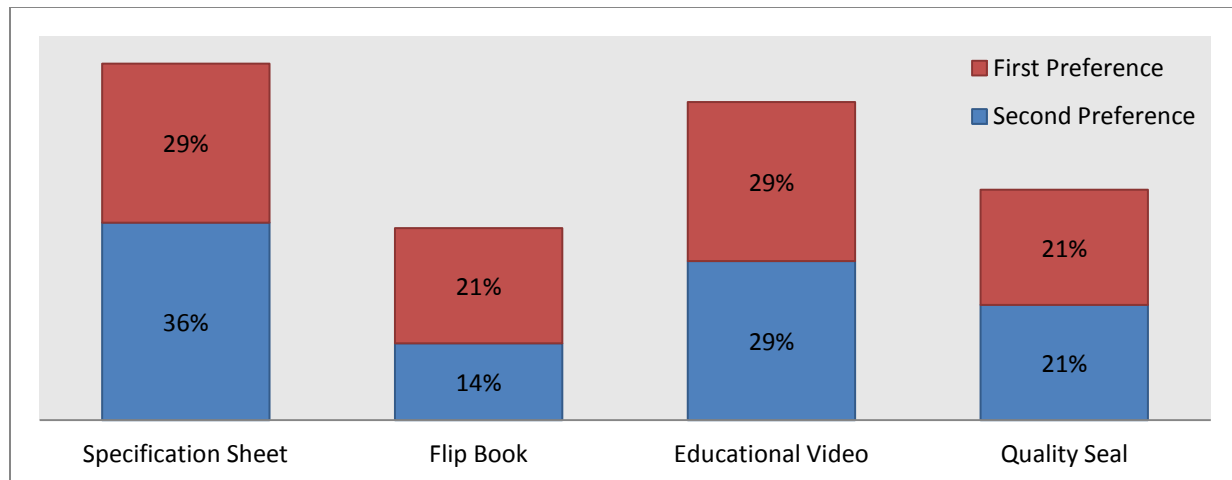


Figure 12: Distributor's most useful tools for learning about and training employees in solar technology (N=14).

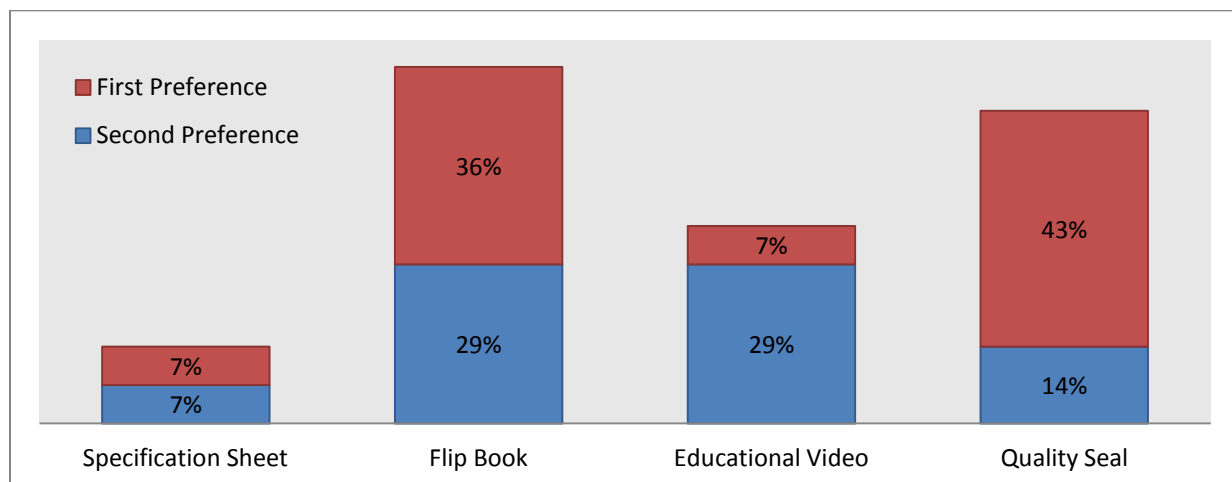


Figure 13: Distributor's most useful tools for selling more solar lamps to customers (N=14).

As previously mentioned, Lighting Africa's quality assurance program has had effective engagement with Kenya's solar distributors, so communication and information from Lighting Africa already played a significant role in the purchasing decisions for most of the distributors that we interviewed. For example, two thirds had used the Lighting Global website to find out information related to product quality and performance, and ten of the fourteen had already seen or used a specification sheet before.²⁹ In addition, five of the fourteen indicated that they used direct communication with the Lighting Africa team to access information related to the quality or performance of the products that they purchase.³⁰ Not surprisingly, ten of the fourteen indicated that they felt that it was easy to compare the quality and performance of different lighting products. When asked which mediums are most effective for communicating QA information to buyers, online publishing, on-the-box labeling, and radio advertisements were identified as the most effective mediums (Figure 14).

²⁹ Two had used it to compare competitors' products, one had used it to decide whether or not to order a product, and one had used it to convey information to his customers.

³⁰ Five indicated that they use feedback from customers, five indicated that they do internal testing, and six indicated that they use the internet to access information related to product quality and performance.

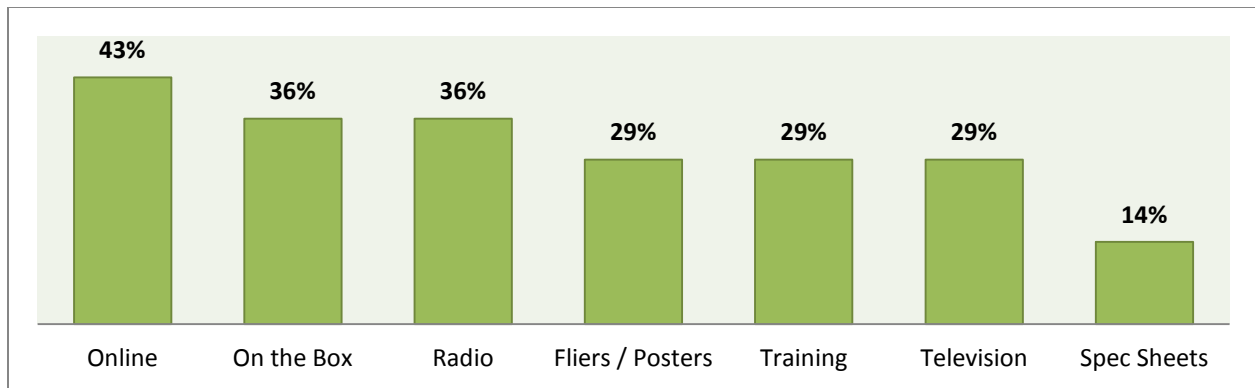


Figure 14: Distributor's most effective mediums for communicating information about product quality or performance (N=14).

Finally, Figure 15 displays the information about product quality and performance that was most important to customers, retailers, and distributors. During our interviews with the retailers, we asked what information customers asked about or used when purchasing products. The majority of retailers reported that **price** was the most important consideration for customers (52%), followed by **durability and quality** (47%), **brightness** (37%), and **run-time** (36%). Similarly, we asked distributors for information that vendors asked about or used when purchasing products. In this case the most common concern was whether or not the product had a warranty (71%), followed by price (57%), durability and quality (36%), run-time (36%), and brightness (29%). When we asked the distributors what they considered the most important information about product quality or performance, the majority indicated durability and quality (43%), followed by the price, the warranty, and the run-time (21%). While it is interesting that brand was not mentioned explicitly by the distributors, this is probably due to the fact that most distributors deal exclusively with one manufacturer. It is also worth noting that distributors receive a lot more questions about warranties from retailers than retailers receive from customers. Besides these two anomalies, **the responses from the different stakeholders were fairly congruent, with price, durability, run-time, warranties, and brightness figuring prominently in each stakeholder's purchasing decision.**

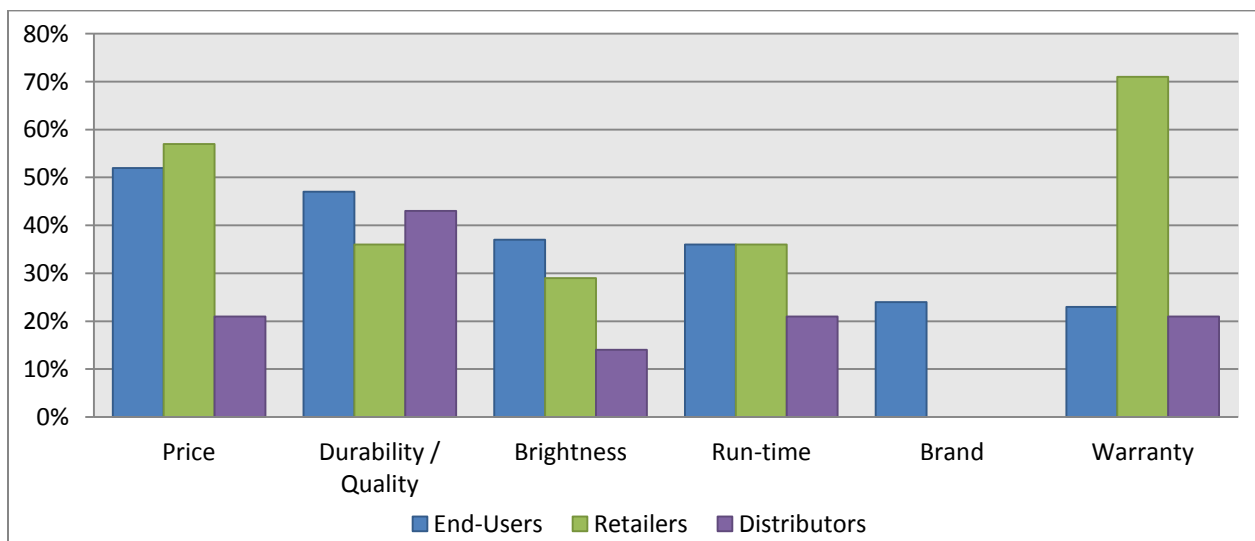


Figure 15: Most important product information for end-users (N=132), retailers (N=14), and distributors (N=14). The customer preferences are as indicated by retailers, the retailer preferences are as indicated by distributors, and the distributor preferences are self-reported.

Digital Literacy and New Communication Channels

Another important finding from this investigation is that mobile handsets and services were widely utilized throughout the supply chain. As seen in Figure 16, the sophistication of mobile technology increased further up the supply chain, with the vast majority of pico-solar and solar home system (SHS) customers using basic phones, retailers having an even split between basic phones and smart phones, and the majority of distributors using smart phones.³¹ The rapid penetration of smart phones and feature phones with social media applications could be particularly useful for increasing connectivity throughout the off-grid lighting supply chain. As seen in Figure 17, both rural customers and retailers are increasingly comfortable with a variety of mobile services like text messaging, mobile money, and social media applications like Facebook and WhatsApp. **The rapid rise of mobile coverage, access to mobile devices, and digital literacy in rural areas highlights the important role that information and communication technologies are playing in increasing connectivity, facilitating financing, and channeling information flow in off-grid markets.**

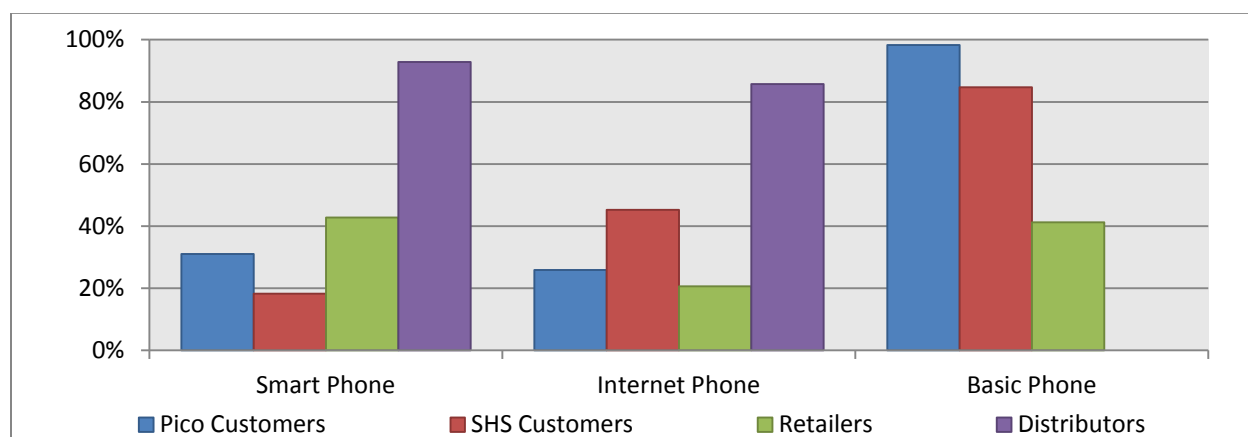


Figure 16: Types of phones used by pico-solar customers (N=58), SHS customers (N=170), retailers (N=130), and distributors (N=14).

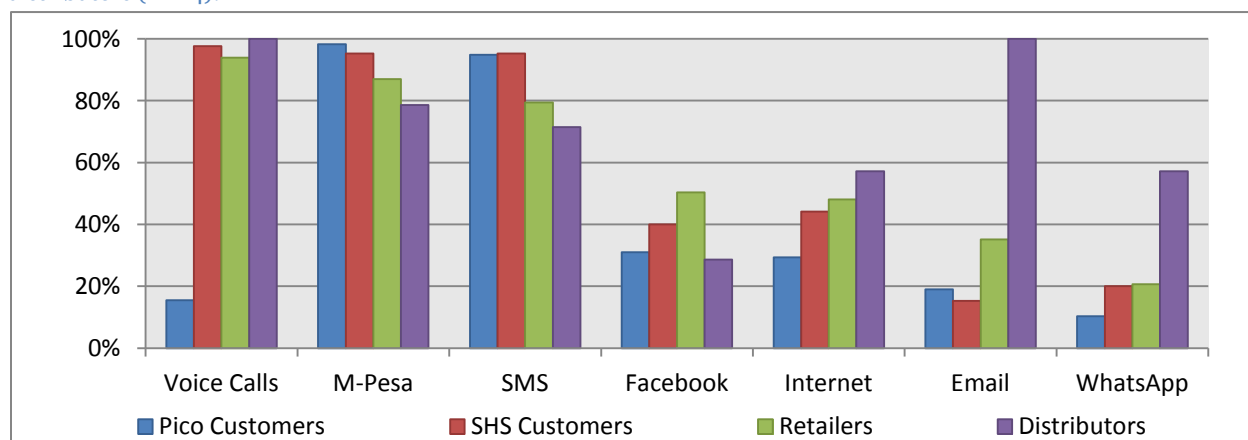


Figure 17: Mobile services frequently used by pico-solar customers (N=58), SHS customers (n=170), retailers (N=130) and distributors (N=14).

³¹ For the purposes of this investigation, smart phones were defined as mobile phones with touch screens or QWERTY keyboards and the ability to download and manage different applications; feature or internet phones were defined as mobile phones with access to the internet and fixed applications like Facebook, Twitter, or WhatsApp; basic phones referred to the least expensive phones with no internet access or applications.

Reducing Risk through Quality Signals

While indirect and direct signals can reduce uncertainty for buyers, they are not always reliable indicators of quality. For example, manufacturer advertising can increase consumer awareness and brand recognition, but that doesn't guarantee the product's quality. Similarly, a standardized format for reporting product run-time can improve comparison shopping, but it doesn't indicate how long the product will last. Quality signals like warranties, quality seals, and consumer financing play unique roles in reducing risk for buyers in the off-grid market. As such, their support and implementation merit particular consideration for the Lighting Global QA program.

Quality Seals

The idea of creating a quality seal for products that meet the Lighting Global Quality Standards has been discussed at length within Lighting Global and with Lighting Global stakeholders. Western markets have provided a positive precedent for quality seals in the electronics and appliance industries, including both business-to-business (B2B) and business-to-customer (B2C) quality labels. Examples of B2B labels include the Underwriters Laboratory (UL) certification, the Conformité Européenne (CE) certification, and the external power supply quality label. Examples of B2C labels include Energy Star labels or the Eurovent Certification (see Figure 18).

Although these quality labels have been highly successful in OECD countries where there are protections against counterfeiting, it is not clear whether a B2B or B2C quality label would be as successful in an off-grid market like Kenya. In addition, effective marketing of a B2C label would require a substantial investment in promotion and advertising and strong partnerships with local regulatory agencies to ensure that practices conform to national regulations. Furthermore, implementing organizations may have to adapt B2C quality labels for local languages, which would be challenging in countries like Kenya where there are over 60 languages.³² **Although a B2B label would still be vulnerable to counterfeiting, it would cost a lot less to promote the label among distributors, investors, and retailers in the supply chain and could have a positive impact on purchasing decisions.** The possibility of investing in a B2C label could be contingent on the perceived success of a B2B label, its resilience against counterfeiting, and the availability of funding for marketing.

³² Ethnologue: Languages of the World. Available online at <http://www.ethnologue.com/country/KE>.



Figure 18: Different quality labels. Clockwise from top right: Conformité Européenne (B2B), Underwriters Laboratory (B2B), External power supply (B2B), Eurovent (B2C), Energy Star (B2C).

Warranties

Currently, products that meet the Lighting Global Quality Standards must offer and present a consumer-facing warranty. Warranties signal quality by providing a guarantee of repair or replacement in the event of malfunction during the warranty period (usually one or two years for pico-solar products). In theory, this guarantee holds manufacturers accountable for faulty products and also protects consumers from cheap products being dumped in the market. In practice, it is not always easy for customers to obtain after-sales service because not all retailers honor warranties, there is often an ill-defined process for assessing manufacturing defects versus customer misuse, and determining the exact warranty period is also difficult.³³ Overall, we found that only 8% of retailers offered warranties on all products, 38% offered warranties on products that had manufacturer warranties, and 54% of retailers did not honor any warranties. However, given that only 20% of the products that we encountered in the market had known manufacturer warranties, **it was encouraging to hear that, for 78% of products with manufacturer warranties, the retailer claimed that their business would honor the warranty.**³⁴



Consumer Financing

Similar to warranties, **consumer financing can provide a quality signal for customers because the customer can stop paying if the product breaks or performs poorly**

³³ Please see "Warranty Practices in Tanzania Retail Markets: Market Intelligence Note 4," for more information.

³⁴ There were sixteen of 130 retailers that indicated that they did not honor any warranties, even though they sold products with manufacturer warranties; those un-serviced products represented 22% of the products with manufacturer warranties that we saw in the market.

during the payment period. Although this method for signaling quality is more abstract than a warranty or a quality seal, several of the customers that were part of our phone interview sample indicated that they thought a PAYG product would be higher quality than a similar product with an up-front payment. The customers that participated in the four focus groups also indicated that "they would like PAYG...because the customer has surety that it cannot be a fake product." One respondent thought that a PAYG product would be higher quality because the additional PAYG technology (e.g. keeping track of energy captured) indicates that it's an improved product. As this customer put it, "When you pay in cash, you can't know what the quality of the product will be...PAYG wants to help you—it shows some concerns."

Perceptions of Quality

While customers may initially be wary of new products, brands, or technologies, over time these products, brands, and technologies can prove their durability and utility, thereby reducing uncertainty for customers trying to make informed purchasing decisions. Given the rapid growth of pico-solar products in Kenya's off-grid lighting market, it was not surprising that retailers thought that solar products in general were much more durable than grid-charged or dry-cell battery products. When the retailers were asked the expected lifespan of each of the lighting products available in their store, **solar products had the longest expected lifespan on average (23 months) compared to grid-charge lanterns (6.2 months) and dry-cell battery torches (4.5 months)**, see Figure 19).

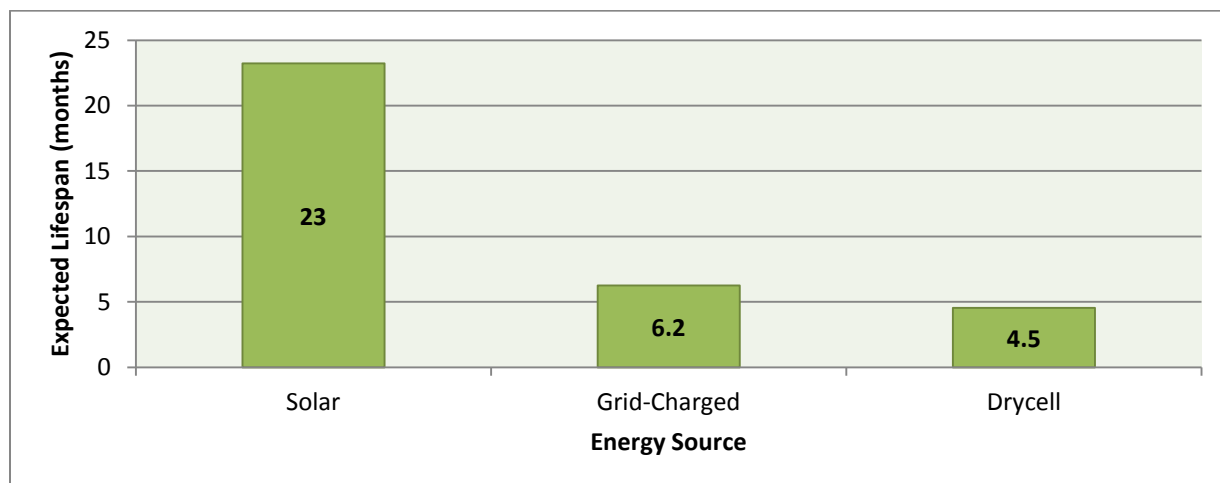


Figure 19: Expected lifespan for lighting products by energy source (N=473).

Conclusions and Opportunities

There are a variety of ways that information about product quality and performance is accessed and shared in the off-grid lighting supply chain. The flow of information at the regional and global levels of the supply chain in particular plays a key role in determining how products are designed, whether or not they receive financing, how they are regulated or supported by institutional stakeholders, and ultimately whether they are purchased, promoted, and distributed by distributors. Further down the supply chain, there are indirect signals like market presence, brand recognition, and word-of-mouth referrals that can help retailers and customers make informed purchasing decisions when comparison shopping is possible. There are also

direct signals like on-the-box reporting, in-store sales tools, and advertising and promotion that simultaneously promote consumer awareness in the market while accelerating pico-solar sales. Finally, there are quality signals like product warranties, quality seals, and consumer financing that reduce risk for buyers by ensuring a minimum level of service life.

As demonstrated by the almost exclusive flow of quality-verified products through proprietary, wholesale distributor, franchise, and NGO distribution channels, Lighting Africa and Lighting Global have been highly successful at engaging market stakeholders further upstream in the off-grid lighting supply chain. With Lighting Africa activities beginning to transition to a second phase in Kenya and beginning to ramp up in other Sub-Saharan African countries, there are several opportunities for the Quality Assurance Program during the next phase of growth in the off-grid lighting market. This final section addresses the types of content and mediums that Lighting Africa and Lighting Global could employ to improve the flow of quality assurance information throughout the off-grid lighting supply chain.

Communicating Quality Through the Supply Chain

In addition to engagement with key market stakeholders at the top of the supply chain, our team identified a variety of opportunities to improve access to QA information throughout the supply chain. As of 2014, mobile network coverage has increased to almost 96% of the population of Kenya, with 70% SIM penetration³⁵ and 11% of the population connected to the internet over 3G. The proliferation of mobile phones and services has contributed to dramatic increases in rural connectivity, digital literacy, and mobile-enabled banking and financing. Rapid penetration of smart phones into rural markets has also increased internet connectivity, enabling a whole host of web-based applications like email, Facebook, Twitter, and WhatsApp. Improved access to information and communication technologies (ICTs) combined with a rapid rise in digital literacy in rural markets has significant implications for Lighting Africa's quality assurance program.

Opportunity #1: Use radio advertisements in the local language to promote quality-verified products. Retailers and distributors both indicated that this would be one of the most effective mediums for reaching new customers.

Opportunity #2: Create a simplified specification sheet that can be accessed easily on the Lighting Global website for each product and encourage manufacturers and distributors to reference and disseminate the simplified specification sheets when interacting with vendors. Also explore the publication of an illustrated flip book that explains how solar technology works, what the benefits are, how to maintain solar products, and how to service a warranty. These flip books could be shared with distributors to facilitate training and promotion higher up in the supply chain, and they could also be piloted among select retailers to test their impact on sales.

Opportunity #3: Make the Lighting Global and Lighting Africa websites compatible with smart phones, starting with the product page. While a broader promotional campaign of the

³⁵ GSMA Intelligence, 2014. SIM penetration is a measure of the total SIM connections divided by the total population. Since some subscribers may have more than one SIM connection, it is not necessarily an accurate representation of unique mobile connections.

Lighting Global website would be required to substantially increase consumer visits, a mobile-friendly website and specification sheet would be an appropriate complement to verification letters, B2B quality labels, retailer specification sheets, flip books, or B2C quality seals. In a similar vein, Lighting Global could acquire lightingglobal.com and redirect it to lightingglobal.org in order to capture traffic from both domains.

Opportunity #4: Create a Lighting Global or Lighting Africa Facebook page. With 50% of retailers and 30% to 40% of customers using Facebook, a Facebook page could be an easy way to connect with stakeholders throughout the supply chain to provide updates on products, information on best-practices, or potential tips and tools for selling and promoting solar. Similarly, Lighting Global could consider exploring Twitter or WhatsApp as a means of connecting with distributors and retailers or facilitating referrals.

Signaling Quality to Buyers

Once a product is available in the market, there is also a need for quality signals that help inform customer purchasing decisions and facilitate comparison shopping.

Opportunity #5: Work with Lighting Global stakeholders to develop a B2B quality label to facilitate product entry and movement in the market. While customs and inspections vary from country to country, an on-the-box quality label could complement the verification letters that are currently used to demonstrate that a product has met the Lighting Global Quality Standards. In addition, a B2B quality label could be easily promoted among the distributors and sub-distributors already connected with Lighting Africa, potentially saving a lot of time and expense as products are updated or replaced with newer versions.

Opportunity #6: Depending on the success of the B2B quality label, its resilience against counterfeiting, and the availability of funding for marketing, consider promotion of a B2C quality seal for retailers and customers further down the supply chain.

Improving Availability and Choices

Before a product can be sold to a customer, the vendor has to be aware of it, sense a demand for it, have reliable access to it, and be able to purchase sufficient inventory. Since most pico-solar products are competing with fast-moving consumer goods like kerosene, candles, and dry-cell battery torches, solar products will need to emulate the movement of FMCGs through the supply chain as much as possible in order to reliably reach rural customers.

Opportunity #7: Engage with wholesale traders in Nairobi. Based on conversations with Lighting Africa staff, there has already been discussion of performing a road show or consumer awareness campaign on Luthuli Avenue in Nairobi in order to connect with wholesale traders. Increasing the presence of solar products in the Nairobi markets could significantly improve comparison shopping for the retailers who travel from rural areas to purchase their electronic and household wares in the wholesalers markets. This is particularly important for smaller retailers who cannot purchase large orders, pay for shipping, or source solar products from the variety of distributors that are scattered in and around Nairobi. In this way, promoting pico-

solar in Nairobi would not only increase the desirability of pico-solar products; it would also increase their accessibility for pico-retailers.

Opportunity #8: Support financing and distribution strategies that enable good-quality pico-solar to compete with FMCG lighting products and increase opportunities for comparison shopping in the supply chain. This can include providing working capital for distributors and sub-distributors that have a hard time maintaining a consistent in-country inventory of products. It can also include facilitating financing for larger companies that have reliable payback rates but need additional capital in order to incorporate or expand PAYG financing.

Opportunity #9: Support strategies for consumer-level financing that help customers get over the initial-cost barrier and signal quality through extended payment periods. This can include researching best practices for PAYG financing, collaborating with micro-finance institutions (MFIs) and savings and credit cooperative organizations (SACCOs) to improve product selection, and exploring a wider array of mobile-enabled repayment methods. This could also include data sharing partnerships with PAYG providers for remote product quality testing, PAYG customer phone surveys, and broader market analysis.

With over seven million quality-verified products sold in Africa as of 2014, the Lighting Global Quality Assurance Program has been able to support and participate in an exciting transition in global energy access for off-grid households. As pico-solar products becoming increasingly familiar, available, and affordable to end-users, the need to safeguard consumer interests with reliable QA information will only increase as the market rapidly and dynamically evolves. While Lighting Global prepares for the next iteration of growth in more mature markets like Kenya, we hope that the lessons learned will facilitate and accelerate the penetration of pico-solar products into new markets.

References

- Akerlof, George. (1970) "The Market for Lemons: Quality Uncertainty and the Market Mechanism." *Quarterly Journal of Economics*.
- Alstone, Peter, Dimitry Gershenson, Nick Turman-Bryant, Daniel M. Kammen, Arne Jacobson. (2015) "Off-grid Power and Connectivity: Pay-as-you-go financing and digital supply chains for pico-solar." Lighting Global Website.
- Blumstein, Carl, and Margaret Taylor. (2013) "Rethinking the Energy Efficiency Gap: Producers, Intermediaries, and Innovation." Energy Institute at Haas Website.
- Dahlberg Consulting. (2012) "Lighting Africa Market Trends Report." Lighting Global Website.
- Duke, R.; Jacobson, A.; and Kammen D. (2002) "Product Quality in the Kenyan Solar Home Systems Market," *Energy Policy*, v30, pp. 477 -499.
- GSMA Intelligence. (2015) GSMA Intelligence Website.
- Harper, Meg and Arne Jacobson. (2013) "Warranty Practices in Tanzania Retail Markets: Market Intelligence Note 4." Lighting Africa Website
- Howe, C., Lawrence, J., & Patel, H. (2012). "SolarAid: Revolutionizing the way to make energy affordable for everyone." Hult International Business School Publishing.
- Karamchandani, Ashish, Mike Kubzansky, and Nishant Lalwani. "Is the bottom of the pyramid really for you?." *Harvard Business Review*. 89.3 (2011): 107-111.
- Mills, Evan, Jennifer Tracy, Peter Alstone, Arne Jacobson, and Patrick Avato. (2014) "Low-cost LED flashlights and market spoiling in Kenya's off-grid lighting market." *Energy Efficiency*.
- Neuwirth, Benjamin. (2011) "Marketing Channel Strategies in Rural Emerging Markets." Kellogg School of Management. Available Online 22 November 2014: <https://www.kellogg.northwestern.edu/~media/Files/Research/CRTI/Marketing%20Channel%20Strategy%20in%20Rural%20Emerging%20Markets%20Ben%20Neuwirth.ashx>.
- Ribot, Jesse and Nancy Peluso. (2003) "A Theory of Access." *Rural Sociology*. June 2003; v68, no2, pg. 153-181.
- Spence, Michael. (2002) "Signaling in Retrospect and the Informational Structure of Markets." *The American Economic Review*. Vol. 92, No. 3 (Jun., 2002), pp. 434-459.

About Lighting Global

Lighting Global is the World Bank Group's platform to support development of commercial markets for modern energy services for the [more than 1.2 billion](#) people in the world without access to electricity. Through Lighting Global, IFC and the World Bank collaborate with the Global Off-Grid Lighting Association (GOGLA), the solar energy services industry and development partners to spur growth of markets for clean, affordable, modern energy services.

The Lighting Global product quality assurance program sets the global standard for quality off-grid solar devices and kits. Under the program, Lighting Global presently lists over fifty quality verified solar products from more than 20 manufacturers. The Lighting Global platform provides support to a broad portfolio of country-based regional market development programs - Lighting Africa, Lighting Asia and Lighting Pacific, which work along the supply chain to reduce market entry barriers and first mover risks in key off-grid solar markets.

Lighting Global is a key element of the Global Lighting and Energy Access Partnership (Global LEAP), an initiative of the Clean Energy Ministerial (CEM). The World Bank Group implements Lighting Global in partnership with the Africa Renewable Energy and Access (AFREA) grants program, Denmark, the Energy Sector Management Assistance Program (ESMAP), the Global Environment Facility (GEF), Italy, The Netherlands, and the United States of America. For more information, visit www.lightingglobal.org.

About IFC

IFC, a member of the World Bank Group, is the largest global development institution focused exclusively on the private sector. Working with private enterprises in about 100 countries, we use our capital, expertise, and influence to help eliminate extreme poverty and boost shared prosperity. In FY14, we provided more than \$22 billion in financing to improve lives in developing countries and tackle the most urgent challenges of development. For more information, visit www.ifc.org.

About World Bank

The World Bank, a member of the World Bank Group, is a vital source of financial and technical assistance to developing countries around the world. Our mission is to fight poverty with passion and professionalism for lasting results and to help people help themselves and their environment by providing resources, sharing knowledge, building capacity and forging partnerships in the public and private sectors. For more information, visit www.worldbank.org.

Annexes

Distribution Channels Observed

The following table summarizes the different distribution channels that were observed during our field investigation from May through June of 2014.

Table 2: Distribution channels observed in Kenya's off-grid lighting market.

Distribution Channel	Organization Observed
Institutional Partnership	SunnyMoney / SolarAid and Kenya Public Schools
Wholesale Distributors and Retailers	Distributors of pico-solar products (Nairobi)
	Retailers (Kericho, Brooke, and Talek)
	Last Mile or VLE Distributors
	Open Air Markets
Wholesale Traders (Nairobi)	River Road / Luthuli Avenue
	Nyamakima
Proprietary Channels	d.light
	SunTransfer (SunTransfer and Niwa)
	Barefoot
PAYG Companies	M-KOPA (d.light)
	Angaza (GLP)
	diviLite
	Azuri
Franchise	Total
NGO Partnerships	SunnyMoney / SolarAid
	Brighterlite (Fosera, Exide, BBoxx)
	One Acre Fund (GLP)
	Ecozoom (GLP)
MFI Partnerships	K-REP (Orb)
	Rafiki
	Faulu (Ecosmart)
	KWFT (Thrive)
	Simba Chai SACCO (Barefoot)

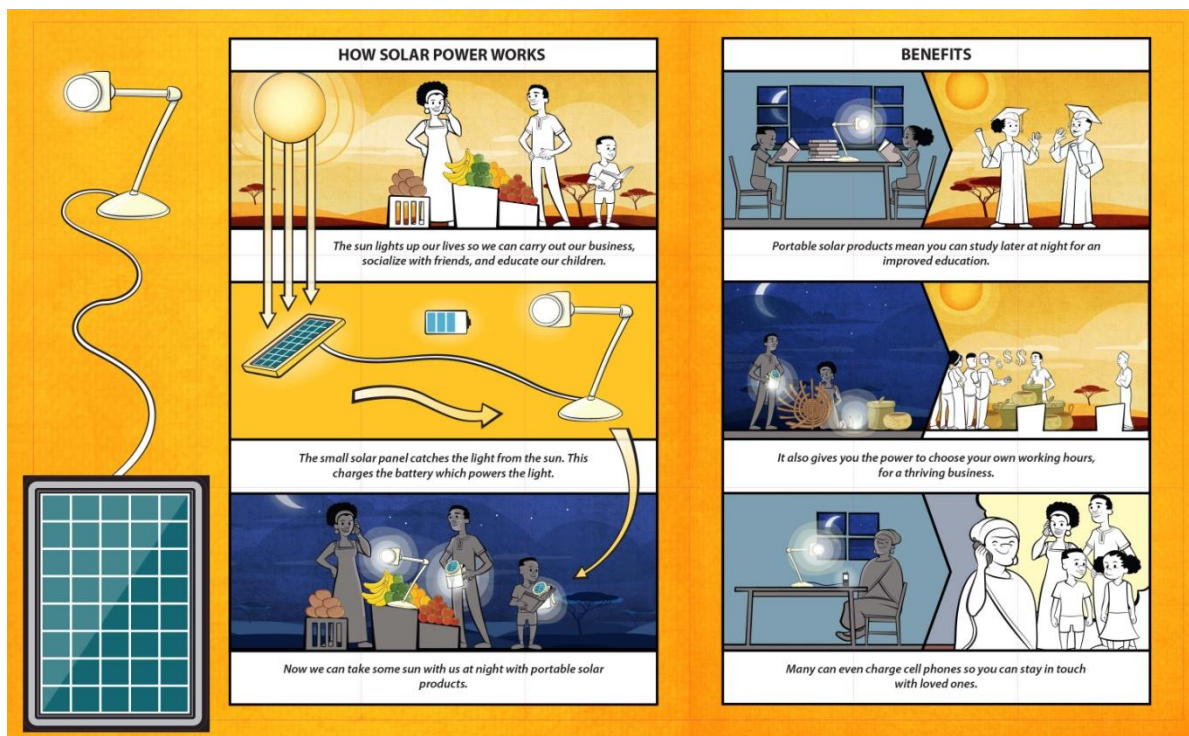
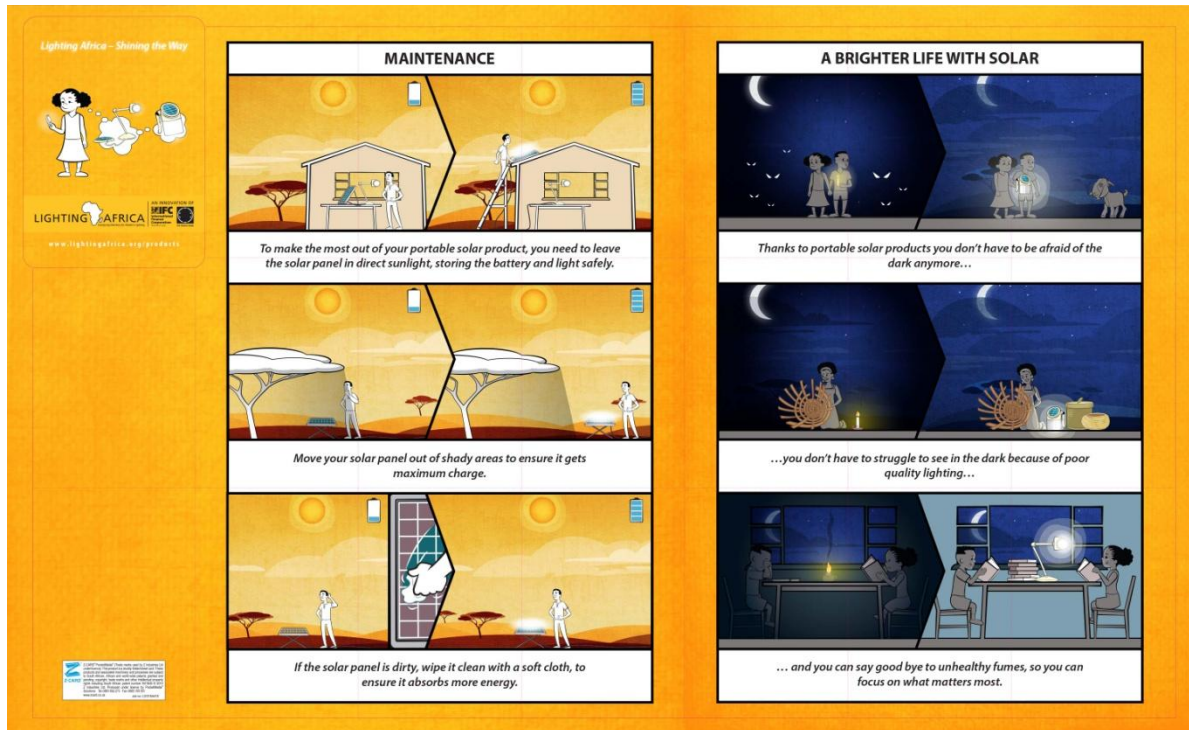
Four Sales Tools

The following four tools were shared with retailers and distributors to determine which would be most effective for sharing information about solar technology, training employees, or reaching out to customers.

Quality Seal on the Box

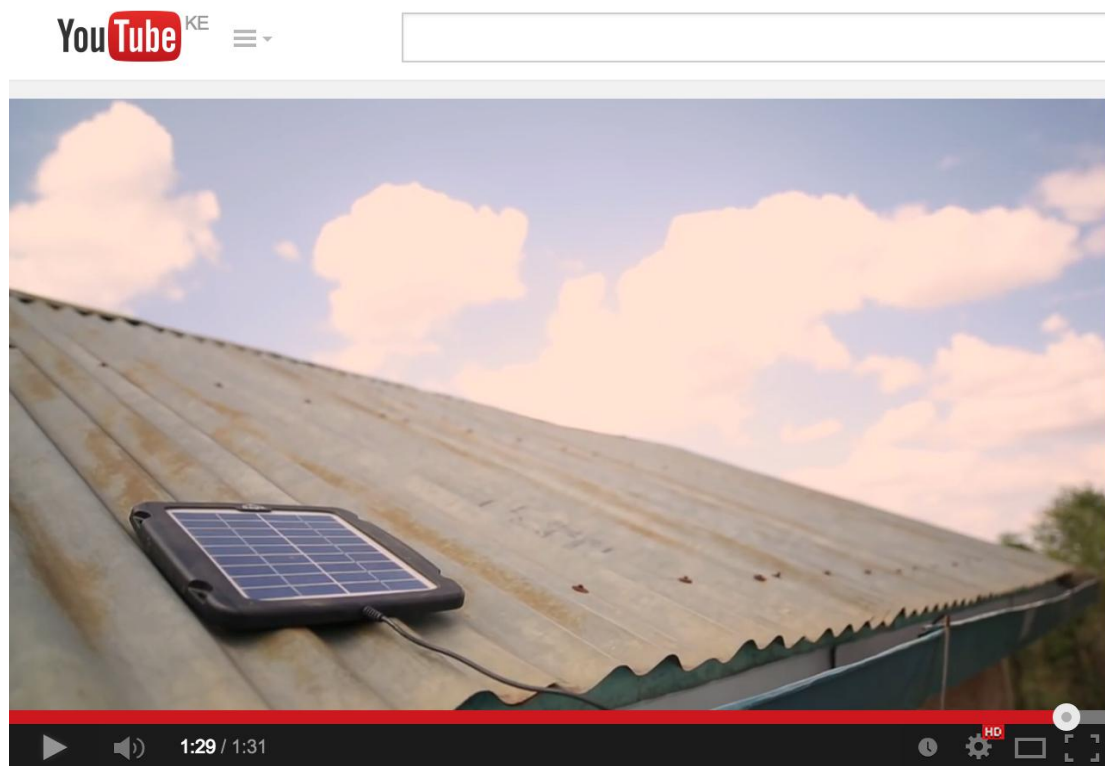


Educational Flip Books / Flyers / Calendars



Internet Video

- What is solar lighting?
- How to buy it.
- How to use it.



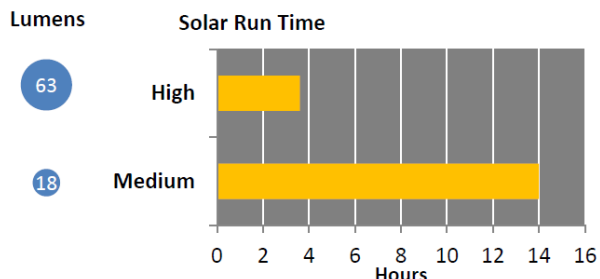
Firefly Mobile

Barefoot Power

Results based on test procedures detailed in
IEC 62257-9-5, ed. 2.0

Verify Online: www.lightingglobal.org/products/bf-fireflymg25

Valid Until: September 30, 2016



Meets Lighting Global Minimum
Quality Standards



Mobile Charging

1

Light Point



Warranty Information

A 1-year warranty for replacement of defective parts.

Performance Details

Performance Measure	Brightness Setting***	
	High	Medium
Full battery run time* (hours)	3.6	14
Run time per day of solar charging* (hours)	3.6	14
Total light output (lumens)	63	18
Total area with illumination > 50 lux** (m ²)	0.17	Not measured
Total lighting service (lumen-hours / solar-day)	230	250

* Run time estimates do not account for mobile phone charging or other auxiliary loads; the run time is defined as the time until the output is 70% of the initial, stabilized output.

** Total area with illumination > 50 lux is determined by the maximum area with adequate illumination at a 0.75 m distance and at the distance from which the product would normally provide task lighting service.

*** Additional brightness settings (not tested): Low

Lighting Details

Lamp type	LED
Description of light points	Single unit on gooseneck with 10 LEDs
Colour characteristics	CRI 74 CCT "Cool" (5000-7000 K)
Distribution type	Wide
Lumen maintenance	100% of the original output remains after 2,000 hours run time