

# A Place Under the Sun: Solar Energy and the Struggle for a Billion-Dollar Invisible Market

The truth of the hunt, it is said, will never be fully known until the lion tells its story. This is particularly useful in the context of international development; the stories that get told tend to focus on the deeds of the “hunters” – in this case, the international do-gooders – that led to whatever outcomes they desire to highlight. The saying certainly holds true for the development of solar energy in Africa, because the coverage too often tells of expat social entrepreneur efforts to spread the technology. Intentionally or not, these Western actors ignore the work done by local players – the “lions”, who actually built the sector.

To better understand both sides of the story of solar in Africa, a global perspective of solar and the forces that drive demand is useful. Today, the worldwide solar energy sector is valued at more than \$100 billion annually. In 2018, over [100 GW](#) of solar power systems were installed. Yet despite enormous resources on the continent, less than two percent of this solar capacity was installed in sub-Saharan Africa. Africa is, in fact, a backwater for solar investments.

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Globally, solar electricity’s growth spurt came after 2000 when the German government supported the [energiewinde](#) program and Chinese production of solar modules ramped up in response

to sharp spikes in demand. Since the late '90s, solar power projects in developed countries have mostly been grid connected and large scale. Early on-grid developments occurred in Germany and California, where today millions of homes have rooftops covered with solar panels. All over the developed world and in China and India, fields of modules produce gigawatts of power on sunny days. However, though production is over 100 GW per year today, it wasn't until 2003 that global production surpassed 1 GW per year.

While millions of modules were installed in the global North, on-grid solar's potential was almost entirely ignored by African governments. It was seen to be too expensive, unsuited for grids plagued by instability, a novelty without a real future. Africa's power sectors were not ready to experiment with solar, so the line went. But after 1995, in order to placate post-Rio environmentalists, a number of World Bank and UN Global Environment Facility solar projects were set up to fund off-grid rural electrification. If the inattention delayed progress in African on-grid solar by decades, these small projects play an important, if largely undocumented, role in the global solar energy story: they stimulated the use of solar by rural people.

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### **Africa's different solar path: Solar for Access**

Well before grid connected programs were launched in the North, African entrepreneurs were selling off-grid and small-scale solar systems targeted at rural projects and consumers. This goes all the way back to the early days of solar, long before the technology was financially viable or available for grid power.

Today, in Kenya, Uganda and Tanzania, if measurements are made by percentage of households with solar power systems, many

rural parts of these countries have a much higher absolute penetration of solar products than Northern countries. Surveys of Kenya and Tanzania populations show that penetration rates surpass 20 percent of all rural households. But the systems in Africa are much smaller and, until recently, of much less interest to the mega green investors that today drive the industry. Depending on who is telling the story, there are different versions of how such high penetration rates among rural populations have been achieved.

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All of the industry actors would agree on a few fundamentals. First, 600 million people lack access to electricity in sub-Saharan Africa. For the small amounts of energy these populations use – in the form of kerosene, dry cells and cell phone chargers – they thus pay a disproportionately high portion of their incomes.

Secondly, the massive funds to roll out rural grid investments for un-electrified populations are neither available to African governments nor the multilateral groups that support grid electricity development. Conservatively estimating grid connection at \$500 per household, it would cost in the order of \$50 billion dollars to distribute grid electricity to the continent's unconnected rural population. And this does not include the generation and transmission infrastructure.

Because of these costs, and the lowered costs and technological improvements made in off-grid solar over the past decade, the World Bank, investors, donor partners and the private sector agree that off-grid solar energy is the best way to quickly cover a large portion of un-connected dispersed African populations. Nevertheless, governments still focus

their budgetary outlays on grid-based electrification. Their spending has largely ignored the viability of off-grid solar power for rural electrification.

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Finally, as more and more investors line up to finance the solar electrification of off-grid Africa, all players agree that it is the private sector that has done and will continue to do the heavy lifting to provide solar electricity to rural consumers.

It is here that the story diverges. Who should be given the credit for the widespread use of rural solar in Africa? And, more importantly, how should future investments be made in the sector? The answer depends on who you ask.

### **The African Pioneers**

Off-grid systems were a critical part of worldwide solar sales early on and many ended up in Sub Saharan Africa.

But these days, this remarkable story of the early players is not often told.

In the 1970s, though still expensive, solar became cost-effective for terrestrial applications (as opposed to NASA satellites). In Africa, national telecoms and international development players began using solar to power off-grid applications such as repeater stations, WHO vaccine refrigerators, communication radios in refugee camps and later, lighting in off-grid projects. Solar panels and batteries replaced generators – and the need to expensively truck fuel to remote sites. Because of this demand, traders in cities such as Nairobi began to stock and sell solar systems

for these specialized high-end clients.

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On the back of pioneer demand, a much more lucrative market opened up when television signals spread across cash-crop growing regions of East Africa. Rural people with coffee and tea incomes realized that they could power black-and-white "Great Wall" TVs with lead acid car batteries. Especially in Kenya, traders selling DC TVs quickly realized that car batteries could be charged with solar panels. Since they already had strong rural distribution networks, they added solar to their rural lines and a new industry selling, solar systems, TVs, lights and music systems was born. In the 1990s, East Africa's off-grid solar market was a small but important slice of global solar demand.

After 1995, when Nairobi traders such as Animatics, NAPS, Telesales, Chloride Solar and Latema Road shops introduced lower cost 10-watt modules and 12-volt lights to the market, demand increased exponentially. Hundreds of technicians were selling systems to rural farmers and teachers. By the turn of the century, this market pioneered by African traders was selling – and even financing – tens of thousands of single panel solar systems per year in off-grid areas of Kenya, Tanzania and Uganda.

These established businesses exploded with the emergence of cell phone markets in the mid-2000s. Suddenly, millions of rural cell phone owners needed a cheap, convenient way to charge their phones. Distribution chains, with over-the-counter sales of solar electric systems already in place, simply added the required kit for charging phones to the wares they offered. Cell phone charging, a business worth tens of millions of dollars per year, tied into the groundwork laid by

small retail indigenous companies and businesses. By 2005, enterprises had sprung up in rural areas all over East Africa that were selling these systems – and village SMEs were charging cell phones, video-cinemas and kiosk refrigerators with solar.

*Business exploded with the emergence of cell phone markets in the mid-2000s.*

Difficulties arose as demand grew. Competition brought poor quality and counterfeit products. Dodgy traders, a lack of skilled technicians and insufficient consumer awareness began to spoil the market. Without standards or regulatory systems in place to police the industry, the reputation of off-grid solar suffered. In those early days, uneducated consumers bought poorly-designed systems and were discouraged. The reputation of solar, especially among policy makers whose energy priorities lay elsewhere, was badly tarnished.

### **Enter the international development community**

Recognizing a market of over 600 million off-grid people, multilateral and national aid agencies (World Bank, DFID, GIZ) realized the potential of solar to support energy access. They saw that rapid changes in technology were making off-grid solar more viable. Prices of solar modules were falling. Super-efficient LED lights were becoming available. Solid state-of-the-art electronic controls, inverters, dc appliances, lithium-ion batteries and well-designed products were coming into the market. These changes, together with rising awareness, did much to improve the choices of consumers.

In 2008, the World Bank and its investment arm, the International Finance Corporation, set up [Lighting Africa](#) to support the development of off-grid solar. Lighting Africa raised awareness of solar among African policy makers, developed quality standards and laid the groundwork for

corporate investment in solar companies. It stimulated a transition of the sector from NGO/donor domination to foreign investor-based models. By developing a platform that recognized the enormous opportunities for solar businesses, Lighting Africa helped roll out standards for the sector, grew in-country awareness and stimulated investment in a new generation of off-grid solar companies that designed truly innovative products. It also helped set up a trade group – the Amsterdam-based Global Off-Grid Lighting Association, GOGLA – for companies selling approved solar products.

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Lighting Africa did much to bring on board local policy makers, to help improve equipment quality and to increase market size. With the involvement of the donor partners, investment flooded in and new players, predominantly Western, entered the market. Companies such as D.Light, Greenlight Planet (owner of the Sun King brand), Solar Now, Bright Life, fosera, Mobisol and Solar Kiosk brought innovative high-quality products and services. The new generation of companies revolutionized consumer choice by using professional product designers, manufactured in China and elsewhere in South East Asia, sophisticated business models and Silicon Valley investment to roll out. An industry that had largely been indigenous and self-financed had become an opportunity for big money international investors.

The disruptions accompanying the arrival of Lighting Africa were felt almost immediately. Newly agreed quality standards

mostly worked for manufacturing companies with deep pockets. Companies located further down the supply pyramid – the ones near the consumers, and which had built the markets – were by and large shut out as the big money began to flow in. As far as the donors and impact investors were concerned, there were two categories of players; their money would target the first, the international manufacturers. These were the established disruptors, represented by GOGLA members and led by savvy expat social entrepreneurs from Europe and the USA.

The other category, which GOGLA now described as the “grey market”, is composed of “thousands of small businesses and technicians in Africa”: local traders, rural wholesale dukas, small-scale integrators, technicians, import-exporters, ambitious lone wolf entrepreneurs. This group, grappling with the day-to-day of basic survival and incapable of preparing grant proposals for donors or business plans for impact investors, is largely unrepresented in the international conversation. It was this group, rightly or wrongly, that was held responsible for market quality problems that, according to the new narrative, the GOGLA members would solve.

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If the positive product and marketing innovations of Lighting Africa and GOGLA members demonstrably benefitted millions of rural consumers, their market disruption also affected the ‘grey market’ players. In donor-supported conferences, convened mostly in the West, where energy access is discussed, the [narrative](#) is that the African solar industry passed from locals to international social entrepreneurs. Even if the international social entrepreneurs had the best intentions of

serving African consumers, they were also strategically positioning themselves to win the hundreds of millions of dollars of grant and impact investment finance that was coming to the sector. And *everything* changed with Pay As You Go.

## **The Birth of PAYG**

Pay As You Go (PAYG) was developed on the back of mobile money. Simply put, PAYG systems are small off-grid solar systems with embedded SIM cards that enable companies to remotely collect incremental payments from consumers. The embedded SIM card can accept payments, monitor the solar system and switch it off if payments are not made. The spending history of each PAYG customer can also be tracked online, much in the same way that credit card customers are tracked.

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When Nick Hughes, one of the developers of M-Pesa for Vodacom, Safaricom's UK parent company, looked to the future he saw how mobile credit among poor consumers would enable them to access a variety of products. He recognised that solar electricity for phone charging, TV and lighting would be the most sought after rural product. With Jesse Moore, he established [M-Kopa Solar](#). Once they tested their product, M-Kopa launched outlets in Kenya, Tanzania and Uganda, where solar demand was already well-developed.

The difference between PAYG and over-the-counter sales is that PAYG can reach a lower strata of customers and, importantly, the business can be scaled. PAYG enables companies to collect payments from thousands of Base of the Pyramid (BoP) customers – and it enables consumers in turn to finance systems over much longer time periods.

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Before PAYG, virtually all transactions in solar were cash over the counter. The PAYG business model had the potential to disrupt the old model in the way that cell phones invalidated landlines. Payments could be tracked on-line in real time. Once PAYG technology was in place and investible models established, hundreds of millions of dollars of investment flowed into off-grid companies.

Donors had funded the pilot experiences and multilaterals had established the financial and policy framework for off-grid energy access. Now international patient capital could be enthusiastically invested in PAYG solar. Indeed, since 2015, on the order of a billion dollars of impact investment has been placed in PAYG companies in Africa. M-Kopa Solar alone has attracted well over \$100M in venture capital and grant money. They are not alone. Others include [Off-Grid Electric](#) (now Zola, in Tanzania, Rwanda, Ghana and Ivory Coast), [Fenix](#) (Uganda, Zambia), [Mobisol](#) (Tanzania, Rwanda, Kenya), [Azuri](#) and others.

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Taken together, these PAYG companies have connected millions of customers and brought much needed resources to the energy access sector. The point of this article is not to belittle their accomplishments. In fact, building PAYG companies can only be done with deep pockets, good planning and strong teams. To succeed, companies must build market share quickly and raise multiple rounds of investment. Though PAYG players start as technology and marketing companies, they quickly become finance providers. Snowballing cash demands force PAYG

companies to pass through what some call a financial “Valley of Death”. Before they have enough revenue to support a viable business, they have to spend millions on equipment and sales staff to expand their base. It is a risky, high-roller business.

Competition is stiff. Many consumers are unwilling to pay the extra costs of branded PAYG products and will regularly privilege price over international standards. In fact, most products being bought in Africa are *not* from GOGLA members. Shops operating in “Buy-em-Sell-em” trading streets stock a large array of equipment, much of it substandard. Moreover, PAYG companies that finance Base of Pyramid customers can lose them at any time. Drought, political disturbance or economic downturn will shut down income streams. When there is no money in the economy, vulnerable populations simply stop paying bills for solar gadgets.

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A further problem faced by PAYG companies is that their products provide electricity services unsuited to the elastic needs of rural families. A typical PAYG solar kit comes in a neat box with a 20W module, a few lights, a charger and a battery. A consumer might be happy with such basic light and cellphone charging service initially, but consumer needs and aspirations evolve quickly. A consumer that wants a 20W system one month might desire a system twice that size six months later. The boxed set units sold by PAYG companies struggle to grow with the aspirations and needs of much of their customer base.

Today, despite the potential of the PAYG model to scale, many of the first generation of companies are in trouble, languishing in the face of ruthless competition and the challenges described earlier. In 2017, Off Grid Electric, a

company that pledged to electrify one million Tanzanians, virtually pulled out of their foundation country and rebranded to attract more rounds of desperately needed finance. In Kenya, M-Kopa had to downsize and [restructure](#) its business in late 2017. Smaller companies in less lucrative markets also struggle to scale. Fenix, the largest player in Uganda, was able to avoid financial issues by [selling](#) majority shares to the global utility company Engie.

Few if any investors are making financial returns on their investments.

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In a way, the PAYG players want to have their cake and eat it too. They claim that they offer quality products and they like to say that their data-based business model is best able to deploy resources to the 600 million 'base of the pyramid' consumers unserved by the mainstream energy market. Their complaints, mostly to do with quality, are directed at the 'grey market'. But they are the first in line for Western grant money and super easy-term financing to grow their companies. At international conferences, almost exclusively convened in the West, it is their polite, white faces that own the conversation.

### **African Traders in the Over the Counter Market Still Dominate**

PAYG entrepreneurs do not acknowledge a self-evident truth: the so-called "grey market" *is the market*. In Africa, for bicycles, sofas, consumer electronics, dishware and roofing tiles, there has always been a range of products for consumers to choose from. Providing consumers with choice is what drives capitalism – those companies that provide the best choices for consumers at the best prices win out. The market for off-grid products was never being ruined by poor quality products any more than the market for cell phones was. Consumers learn,

traders improve their product offering and manufacturers innovate.

*PAYG entrepreneurs do not acknowledge a harsh truth: the so-called “grey market” is the market.*

Today, the same local traders that built the supply chains in the 1980s and `90s still dominate the consumer off-grid solar market. But they do not feature in the international solar discussion. Their sales are invisible to consultants and undercounted in global reports (The [GOGLA annual report](#), now the sectors’ bible, does not count the “grey market” and off-handedly considers it a threat to the “quality” market).

Rural people buy most of their solar from grey market traders. I’ve followed markets and conducted field research in Africa for 20 years and have the data to back it up. In Tanzania, a 2016 national census indicated that over 25 percent of the rural population own some type of solar device – this is more than a million PV systems installed almost exclusively by “grey market” traders. Recently, when conducting demand surveys in Uganda’s Lake Victoria islands, I found that 80 percent of the island populations had purchased solar systems from over-the-counter traders – virtually none had PAYG systems. In Zambia, I conducted surveys of 20 off-grid villages and found that upwards of 60% of households had grey market solar systems. In Kenya, Somalia and Ethiopia, the story is the same.

Of course, Chinese solar modules and batteries dominate over-the-counter trade. But local manufacturing also plays a major role. Kenyan battery manufacturer Chloride sells on the order of 100,000 lead acid batteries per year to the off-grid market. Its partner Solinc, which manufactures 6MW of solar modules per year in Naivasha, provides its modules to Kenyan, Ugandan, Tanzanian and Rwandan over-the-counter players in the

region. This commerce, of course, is driven by hundreds of traders and solar technicians.

The driving force for the success of local traders is rural consumers. Rather than being “manipulated” by unsavoury traders, consumers have absorbed lessons; they have become more shrewd. Over decades, they have learnt about solar products and, in true do-it-yourself fashion, they have become better able to put solar systems together. They value price and short-term functionality over quality. They understand that when they want larger systems, over-the-counter players are more responsive to their needs than PAYG sellers. OTC traders can provide larger systems for growing households at a lower cost. In short, rural retailers and their largely Chinese suppliers are still more responsive to consumer needs than PAYG companies. And they are lighter on their feet.

In 2019, solar is holding its own against grid-based rural electrification. Off-grid solar is growing because the technology has numerous advantages over grid extension. If governments have been slow to invest in solar for rural households, rural consumers are voting with their pocketbooks. Solar systems work, there is an infrastructure to supply and rural consumers understand the technology.

Expat social entrepreneurs, using impact investment and international aid assistance, advanced the international agenda for off-grid solar, raised financing, developed new technology and innovated new business models. But despite hundreds of millions of dollars of investment and grant aid, PAYG companies are still losing to local players. Why? Rural traders move more product because they *inhabit* the markets they work in.

In a market of 600 million consumers, there is plenty of room for different business models and players across the supply chain. But the untold story of local solar traders raises a number of questions about how we should build the coming solar

industry.

First, is the issue of ownership and funding opportunities. Many here are uncomfortable with the idea of an industry predominantly owned and controlled by foreigners, even if they are well-intentioned social entrepreneurs. For each successful expat social entrepreneur, there are 20 local entrepreneurs equally capable but lacking support to finance even a modest start-up. Much more can be done to level the playing field for local start-ups if these budding players are given the opportunities that have been handed to PAYG pioneers.

Second is business size. Decentralized and off-grid power is exciting because it democratizes opportunity and lowers entry costs for small players. East Africa is a region where small and medium sized entrepreneurs create the biggest opportunities and drive dynamic economies. Investor interest in scalable businesses worth hundreds of millions of dollars is driven by greed, not by common sense. Smaller players would make for a more exciting and lively solar sector. There is no reason why scores of million-dollar companies shouldn't be supported in a healthy sector, instead of one or two behemoths.

Finally, planners should reconsider the policy focus which has thus far trained the solar market on poverty alleviation and energy access. Base of the Pyramid off-grid electrification is a race to the bottom. Unless the same subsidies that underwrite most grid-based rural electrification is made available, off-grid BoP solar will remain too risky for real finance. In Africa people are moving into cities and looking for urban-based opportunities. Many who are concerned about climate change know that getting solar on-grid and into urban energy planning will do far more to fight climate change than off-grid solar. These small-scale on-grid opportunities are where the real long-term future for solar is in Africa.