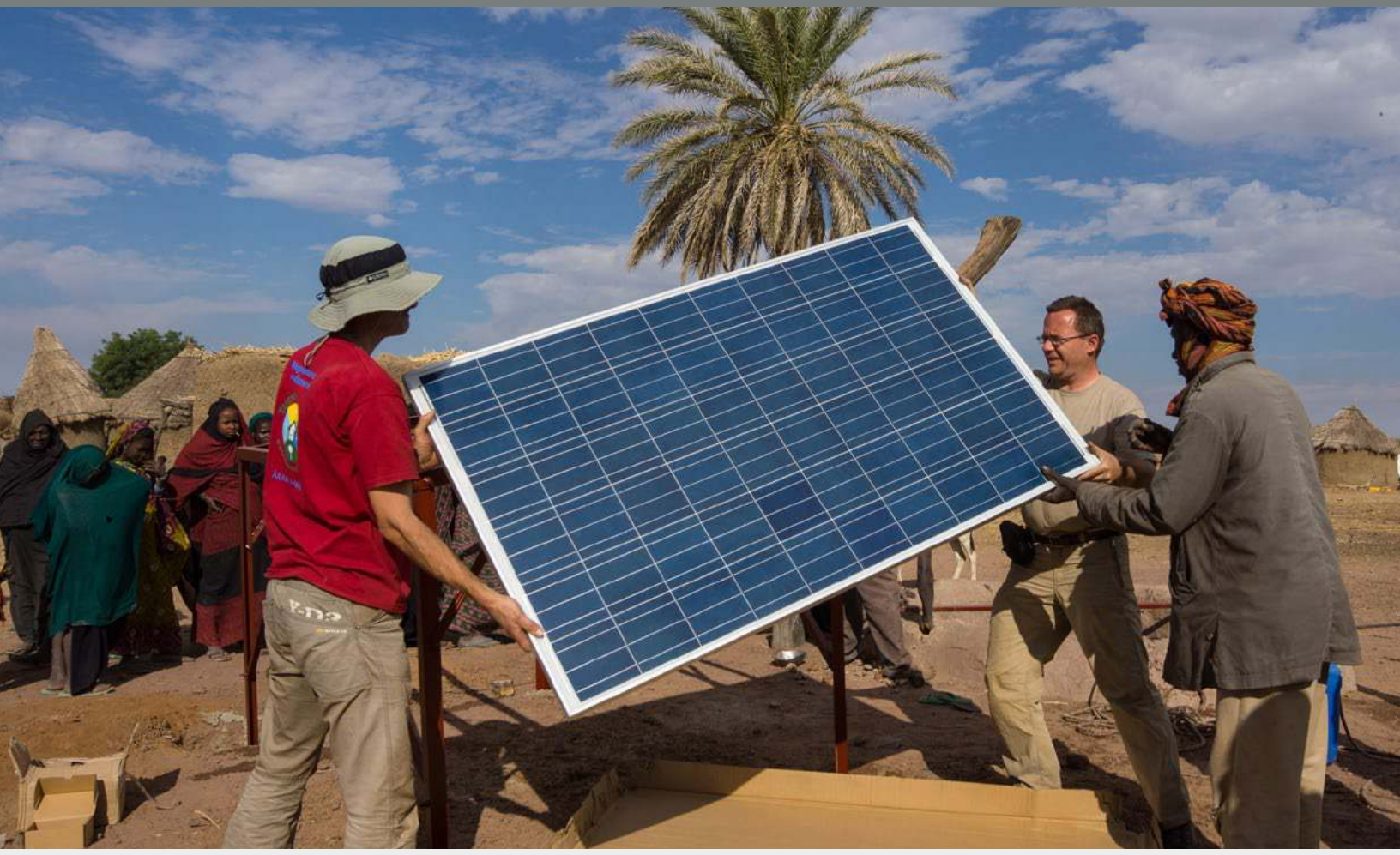
Going Off Grid

A NextBillion E-Book

Building a New Energy Future at the Base of the Pyramid



next billion

Acknowledgments

NextBillion would like to express our thanks to the following individuals who have contributed to our Going Off-Grid Series:

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Judith Pryor was appointed Vice President for External Affairs at the Overseas Private Investment Corporation (OPIC) in the fall of 2010. She oversees the agency's public outreach efforts and its relationships with United States Congress, sister U.S. Government agencies, and the U.S. and international business community. She recently returned from the Africa Energy Forum in Istanbul, Turkey, as the chief representative for OPIC and its $1.5 billion pledged commitments to President Obama's Power Africa Initiative.

Sanjoy Sanyal is the Country Director of New Ventures India. New Ventures addresses the key barriers to "green" entrepreneurial growth by building in-country support networks for environmental enterprises and increasing their access to finance. Sanyal has been involved with New Ventures India since 2009 and has been particularly active in helping green entrepreneurs from India raise funding from a network of investors.

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Patrick Walsh founded Greenlight Planet while studying as an undergraduate at the University of Illinois at Urbana-Champaign, from which he graduated in 2007 with degrees in engineering physics and economics. After spending a summer in rural India with Engineers Without Borders, he designed Greenlight Planet's Sun King™ solar lantern as a an affordable replacement for the kerosene lamp.

Susie Wheeldon is the Campaigns Manager at SolarAid, a London-based international charity that believes in business-based solutions to poverty and climate change. In 2008, SolarAid created a social enterprise called SunnyMoney to run its on-the-ground operations in Africa. SolarAid and SunnyMoney aim to eradicate the kerosene lamp from Africa by 2020.

Cover Image: BudapestBamako via Flickr.

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Introduction

The promise of a gridless future

By Scott Anderson

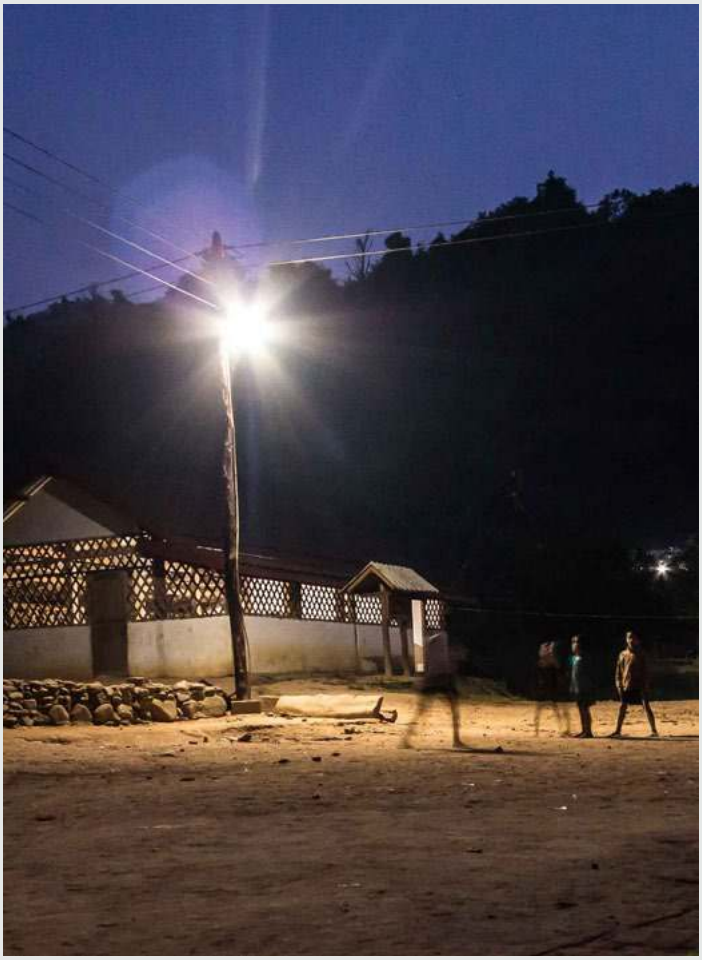
When we launched our "Going Off Grid" series last year on NextBillion, we were optimistic about the future of off-grid energy investment. At that time, the IFC-World Bank's Lighting Africa Program predicted that Africa will become the world's largest market for clean off-grid lamps, with up to 140 million people having access to better lighting by 2015. The market for quality off-grid lighting products in Africa has seen a 300 percent growth in sales since 2009.

And although we have another five or so months to go before we close 2015, our optimism about the future of off-grid energy generation and distribution, as well as consumer products, has only grown. New energy investments continue to pop on what seems like a daily basis. There are major multinational companies like Google, which is hoping to take a stake in the Lake Turkana Wind Power Project, a $700 million, 40,000 acre project in Kenya that would boost the country's energy resources by 20 percent. And then there are smaller players like Greenlight Planet, which recently attracted $10 million in financing to provide solar lighting products to to an estimated 100 million homes of base of the pyramid customers.

The "Going Off Grid" series, which we are proud to present to you here in e-book form, explored new technologies, new business models, and new forms of investing and participation in the developing market of energy infrastructure. In many countries, the once inflexible electrical grid is being reshaped and retooled in a creatively destructive process that offers access and returns on investment with less risk. There are fewer questions about the chicken (demand, last mile delivery, affordability) versus the egg (supply, technology, lack of capital) in this series. Instead, we're seeing much more in the way of business solutions and new pathways for investment.

At the same time, as explained in one of the series' articles by Susie Wheeldon, the International Energy Authority estimates $640 billion of investment over the next 20 years is what's needed to bring sustainable off-grid energy to all who are left off the grid. This represents a 300 to 500 percent increase on the current investment.

In other words, there's a lot of work to be done, but there's plenty of market demand in which to do it. As with all e-book collections of this nature, we know our relatively short series captures just a flicker of what's happening across the developing world. Yet, we hope the stories and insights of investors, entrepreneurs and NGOs will help illuminate a new, cleaner and more accessible way forward.



Building mini-grids in Laos. Image Credit: Sunlabob.

Scott Anderson is the managing editor of NextBillion.net

Ending Energy Poverty?

The solutions already exist

By Susie Wheeldon

This spring the charity SolarAid announced that it had hit a milestone ensuring that 10 million people have access to clean, safe light. The social uplift this will bring is extraordinary – solar lights impact poverty, health, hunger, education, enterprise and the environment. At the same time, the announcement shows much more; that the potential of solar to empower rural African off-grid communities is beginning to be realised.

Whilst SolarAid has, through its social enterprise SunnyMoney, sold 1.7 million solar lights – helping African families save over £200 million and creating an extra 2 billion hours of illuminated time for study or work – it is also indicative of an even greater growth in the nascent off-grid solar market. In October last year, Lighting Africa, a joint World Bank and International Finance Corporation (IFC) initiative, calculated that around 5 percent of the African population was using modern LED solar lighting, a dramatic rise from less than 1 percent just five years earlier.

SolarAid's research indicates that across the continent the sector is now benefitting around 50 million people. (Editor's note: The author is the campaigns manager at SolarAid.)

Although there have been huge leaps forward, even in 2015, 20 percent of the world's population still live without electricity. As SolarAid's CEO, Andrew Webb, said:

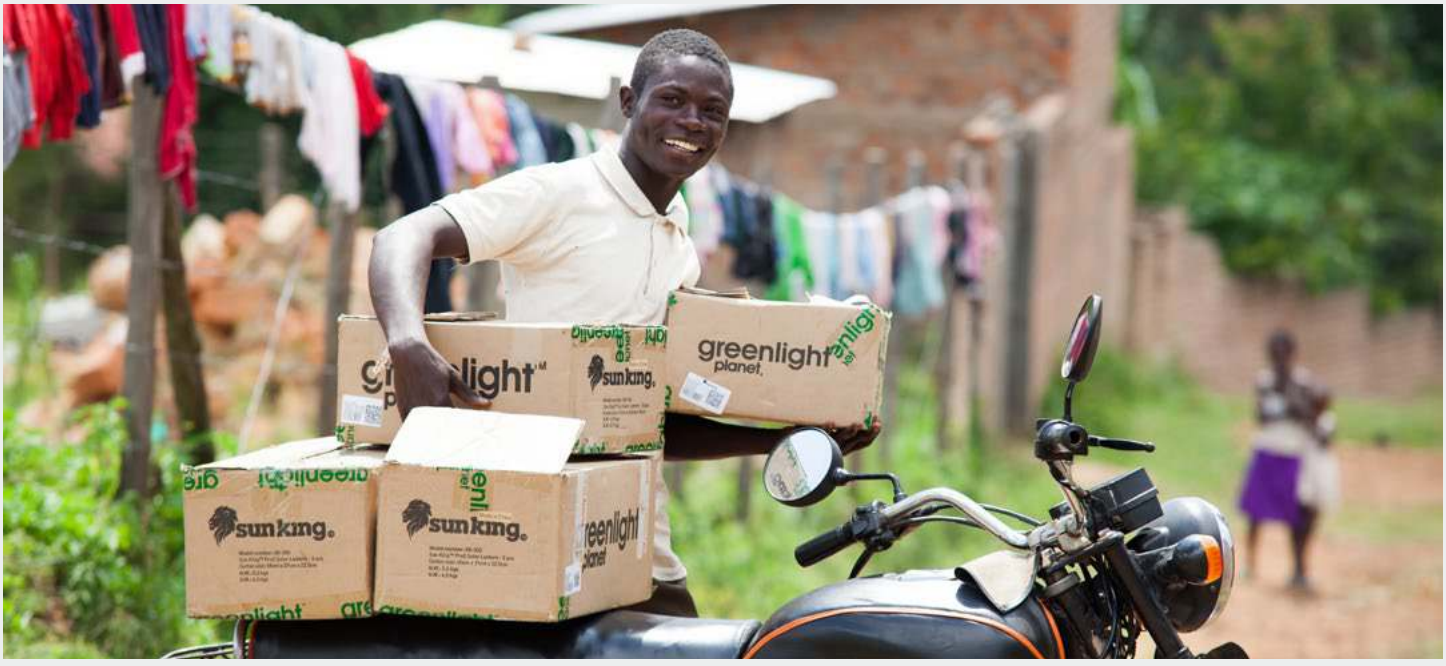
"The off-grid sector reaching 50 million people is fantastic, but there are over half a billion people in Africa still reliant on dangerous and very poor light sources like kerosene. In 2015, this is simply not acceptable. We need more support so that we can continue to give people across the continent the chance of a brighter future."

Given the right support, solar entrepreneurs and decentralised energy solutions could change all that.

In 2011, the International Energy Authority (IEA) estimated that to provide Sustainable Energy for All $640 billion is needed over the next 20 years. This represents a 300 to 500 percent increase on current investment. It's an astronomical figure – likely to be beyond the customer, government and aid agency collective abilities to pay for and provide. Yet in the footnote of last year's Africa Energy Outlook, the IEA noted that:

"Grid-connected renewable projects require a more robust

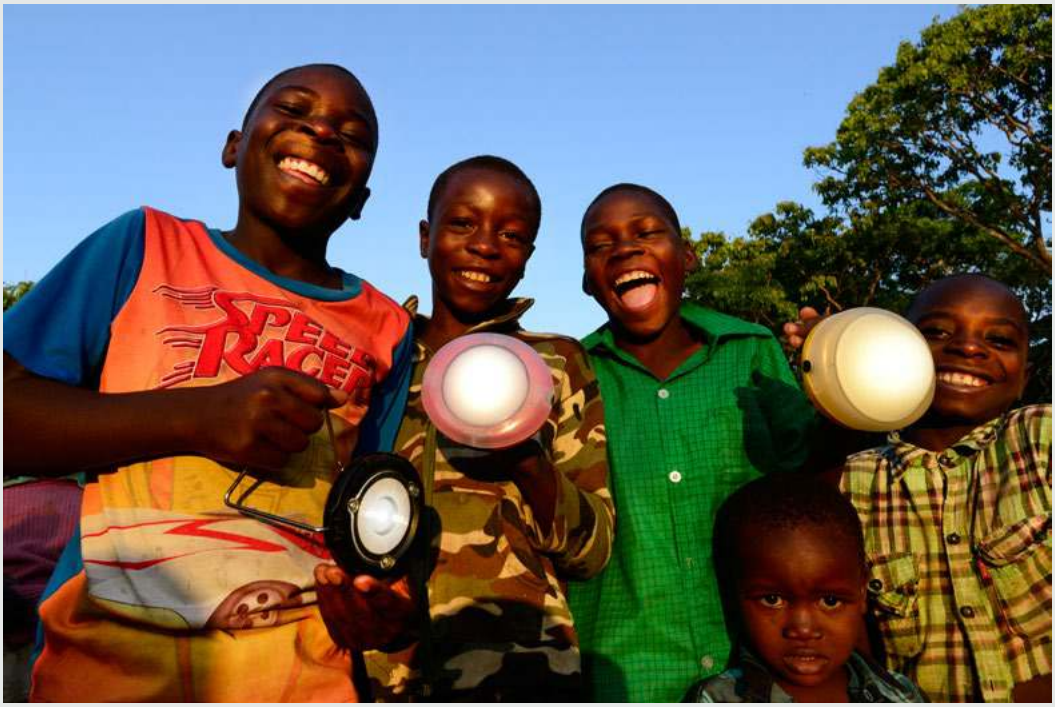
A solar entrepreneur reaches a rural Kenyan community. Image credit: Corrie Wingate / SolarAid



governance framework to succeed, but some smaller-scale and off-grid projects have greater potential to sidestep institutional weaknesses."

Despite huge challenges, we are seeing that some of these smaller-scale initiatives are certainly not waiting for the huge investments needed by larger energy projects, but forging ahead as fast as they can. Incredible customer demand for solar products and the year-on-year growth of the sector is showing that, given access to clean energy products, millions of African people have stopped waiting for grid lines that may never come, and are investing in their own futures.

As one such customer, Imelda Mpiluka from Tanzania, explained, not only did she buy a solar light, but she is sharing the news with her whole community.



Schoolchildren in Zambia with solar lights. Image credit: Patrick Bentley / SolarAid

"I use my time to educate other people about solar lights because it is a good product for home use. I saw it from my neighbour and I decided to buy it. It helps to reduce kerosene expenses," she said.

Indeed, SolarAid's research shows that over 90 percent of solar light customers recommend them to someone else. This increasing awareness of the benefits of solar energy has enabled a number of solar entrepreneurs to prosper, such as Stanley Rogut, or "Solar Stan." Rogut's success means that he has now begun to appoint sub-agents to reach even more customers. And while he is rightly proud of the benefits the lights bring to his community – improving education, home-life and the income of his neighbours – he describes them quite simply as "a good investment."

These good investments are the first step on the "clean energy ladder" and have the potential to catalyse a distributed renewable industry that could provide universal energy access at a fraction of the cost of IEA estimates. Alternative reports, such as the Sierra Club's "Clean Energy Services for All: Financing Universal Electrification," estimate that by focussing on Clean Energy Services, the IEA's figures could be reduced by as much as 71 percent.

Financial institutions and development organisations are beginning to take note. For example, in February, the Triple-A rated IFC and Cordiant Capital invested $7 million in Off Grid Electric, a solar leasing company in Tanzania (adding to the $23 million it received last year). Meanwhile, the Swiss asset manager ResponsAbility announced a huge boost to off-grid financing last month: the first dedicated debt fund, totalling around $30 million. Increased financial backing of solar manufacturers, such as Greenlight Planet and d.light, is also enabling the extension of product lines and new innovations, such as larger home systems and pay-as-you-go technologies. In total, the rapidly developing off-grid sector saw about $90 million of publicly announced investment in 2014, with the rate of investment accelerating in early 2015.

This growing support for off-grid solutions means that for many living in off-grid in Africa, the future is looking decidedly brighter. Yet for millions, the chance to switch to solar has yet to come. While the successes are many, the challenges remain. Much of this rapid growth has been concentrated in a few countries, with Lighting Africa data showing that 78 percent of unit sales on the continent between July and December 2014 came from just three countries: Kenya, Ethiopia and Tanzania. Launching into new – and potentially more complex – markets will require not only more philanthropic and investment finance, but more support for the policy and advocacy work needed to unlock the sector's extraordinary promise.

SolarAid's news is another reminder that the solutions already exist to lift families from energy poverty, improve education and catalyse enterprise in some of the world's poorest regions.

The challenge now, though, is how the market for these solutions can reach its potential – enabling millions to reach theirs.

Susie Wheeldon is the campaigns manager at SolarAid, a London-based international charity that believes in business-based solutions to poverty and climate change.

The Energy Map

Lessons learned from over 60 distributed energy enterprises

By Jack Bird

Editor's note: This is the first of a two-part post by the author as part of NextBillion's 'Going Off Grid' series. In part two, the author delves into the business models that are seeing the most traction in energy distribution for the base of the pyramid.

In today's technology driven world, one in six people still live without access to clean, safe and reliable energy. That translates to approximately 1.3 billion people suffering from the effects of energy poverty. These people are underserved by traditional markets and government programs, and are in need of innovative solutions surrounding the provision of energy.

The Center for Science, Technology and Society at Santa Clara University has been working with social enterprises from around the world for over a decade, helping to incubate and accelerate innovative business models, many of which have become industry leaders. In 2009, the Center began to focus on clean energy more thoroughly, recognizing its centrality to social development. In 2011, we launched the Energy Map to share the findings that grew out of the work with over 60 distributed energy enterprises working across the world, including Africa, India, South East Asia and Latin America. The technologies being used include everything from solar home systems to gasifiers using animal or agricultural waste.

These enterprises are attempting to deliver innovative energy solutions to the 1.3 billion people suffering from energy poverty. While this sector is exciting and has the potential to radically improve the lives of those being served, research indicates that very few of these enterprises have achieved meaningful scale. In fact, many promising enterprises have folded as a result of the various barriers that exist for companies attempting to operate in the challenging markets of the developing world.

Since its inception, the Energy Map has focused on identifying the common barriers faced by distributed energy enterprises as well as the various strategies being employed to overcome them. Of all these issues, three business model challenges stand out: organization financing, product affordability and distribution.

Organization Financing

Because profit margins are generally low and developing world markets are unstable, securing funding is essential for any distributed energy enterprise. Even though the beneficiaries are generally purchasing or renting the distributed energy products, the enterprises need additional capital to cover their startup costs, early growth and—in many cases—their ongoing operations. The major funding mechanisms identified on the Energy Map are grants/donations, debt/equity, self-funding and carbon credits. Most of the enterprises have multiple funding sources.

Of course, the source of funding depends largely on whether or not the enterprise is a for-profit or not-for-profit, but grants and donations play a large role across all types of enterprises. Of the 60 enterprises featured on the Energy Map, 27 identified as non-profits and 24 as for-profits, with the remaining nine being hybrid models. All the non-profits and hybrids rely on grants and donations for substantial portions of their ongoing funding. Further, six of the for-profit enterprises also rely heavily on grants and donations, generally with the goal of eventually becoming profitable without reliance on grants.

The majority of the for-profit enterprises rely on debt/equity to fund their business, although not all do. A small number of for-profits rely on self-funding and grant money. A total of 33 enterprises rely on loans and equity to acquire funds, meaning that several non-profits also turn to this model.

In terms of self-funding and carbon credits, only 21 enterprises rely on one or both of these sources. Self-funding is generally conducted only on small scales and depends

A worker installs solar panels as part of a Peruvian off-grid energy project. Image credit: GTR PUCP via Flickr

largely on the affluence of the founder. Unfortunately, self-funding an enterprise is not a scalable option and therefore is limited. Carbon credits are essentially certificates that companies in more affluent nations purchase in exchange for the right to emit higher levels of CO2. These certificates are sold by enterprises that reduce global carbon emissions by distributing clean cookstoves and solar energy systems. This has created a market for carbon credits that helps to regulate worldwide emissions. Because of the required certification processes, however, it is not cost-effective for small enterprises to participate in this trade. Many of the more established distributed energy enterprises, such as Nishant Bioenergy, which produces biomass industrial cookstoves in India, have been certified and sell their carbon credits to other polluting companies. Unfortunately, the carbon credit system is subject to price fluctuations and simply cannot be relied on to provide all of the funding for an enterprise. At best, carbon credits and self-funding can be used to provide supplementary or bonus funding, but are ultimately unsustainable and unreliable financing strategies.

These findings reflect the nature of the distributed energy market in several ways. First, high startup costs often require businesses to access large amounts of capital right from the start. This is the reason why so many enterprises, even those intending to eventually turn a profit, rely on grants and donations. Second, as mentioned before, small profit margins lead many organizations to enter the market as non-profits, which account for nearly half of all of the enterprises featured on the Energy Map. And while non-profits have strong local impact, only in exceptional cases (like Bangladesh's Grameen Shakti, which has sold over a million solar home systems) are non-profits able to scale. Of course, the Energy Map is only representative of a small sample of enterprises using particular funding strategies, meaning that there could be others out there that we simply have not discovered. Nevertheless, the geographical and technological diversity of these enterprises is a good indicator that these strategies are representative of the larger distributed energy sector.

Product Affordability

Another major challenge faced by distributed energy enterprises is the affordability of their products. Poor customers are unable to pay high upfront costs and do not have the credit to take out large loans that are often associated with many of the technologies sold by distributed energy enterprises. From among the enterprises on the Energy Map, five affordability models have been identified, although many enterprises make use of two or more of these.

The first involves low-cost products that are purchased upfront. Twelve of the enterprises featured on the Energy Map use this affordability model. For example, THRIVE, based in Hyderabad, manufactures low-cost solar LED lighting systems that cost between $2 and $5 USD. This is the simplest model, in that it does not require the enterprise to develop any financing services and the customer is responsible for paying the full cost. This works best for enterprises offering small products that do not require extended servicing or maintenance.

The second model, in-house financing, involves the enterprise covering the upfront cost of the product. Customers then pay back the enterprise in small payments, or buy purchasing credits. Fourteen of the enterprises featured on the Energy Map use this method to make their products affordable. One example of an enterprise using this model is South Africa-based Alternative Energy Development Corporation, which sells 12V zinc fuel cells at far below the market value. Customers sign a two-year contract whereby they make small payments each time they have their fuel cells recharged. This method works well when the enterprise is capable of leveraging the customer's willingness to pay. For example, some companies have the ability to cut power for non-paying customers.

The third affordability model takes advantage of partner financing through banks or microfinance institutions. Another 18 of the enterprises on the Energy Map make use of this affordability scheme. This works best with enterprises that are supplying larger, more expensive products in that it makes the product affordable, thus enabling the company to focus on distribution rather than financing. For instance, SELCO India sells solar home systems that are initially priced at $150. By partnering with banks, SELCO enables its customers to receive reasonable loans in order to buy these systems.

A fourth affordability scheme makes use of business-to-business or institutional sales. In this case, enterprises sell their products to other organizations or companies that work directly with the poor. Twelve of the enterprises on the Energy Map use this model in one form or another. This model takes advantage of NGOs and other organizations that have more money than poor customers, thus allowing them to sell in larger volumes and at a higher price. For example, WE CARE Solar sells solar powered "suitcases" equipped with medical equipment for pregnancies and birthing operations to medical institutions already working in the developing world.

The final model is subsidization, whereby the enterprise absorbs a portion of the total cost of the product to make it affordable to customers. In many cases, subsidies are used to cover the costs outside of, but attached to, the product, such as maintenance and/or training. Subsidization is used by about 19 of the enterprises on the Energy Map to make up for the extra costs of different products. This is a useful way to drive down customer costs, but is ultimately unsustainable for the enterprise and can distort markets. For instance, Light Up The World relies on donor subsidies to cover the costs of their LED village lighting systems. Customers simply pay a small price to cover the costs of maintenance. Unfortunately, relying on subsidies is both unstable and unsustainable. Enterprises can only rely on subsidization up to a certain point.

Ultimately, the affordability scheme is dependent on the technology being used by the enterprise, with smaller products generally being able to fit into the simple low-cost product category, and larger ones needing more complex strategies. Furthermore, it is likely that several schemes are used simultaneously.

Jack Bird is a recent graduate of Santa Clara University, currently living in the Bay Area and working as a research assistant for the Center for Science, Technology and Society's energy sector.

Postive (and Negative) Charges

Which business models are surging

By Jack Bird

Operating in the developing world means that distributed energy enterprises must overcome the distribution issues associated with isolated communities and poor infrastructure. Distribution not only involves the physical movement of the product to the end user, but also things such as installation, servicing and maintenance that require an ongoing relationship. Often, the social impact theory of the enterprise will determine the distribution model. For instance, an enterprise with small products focused on reaching a large number of people may choose a low contact distribution model, whereas an enterprise dealing with large systems that require maintenance will focus on a higher contact model. We identified seven major distribution models from the enterprises on the Energy Map.

Perhaps the simplest model is one that does not involve the transfer of products, but of knowledge instead. For instance, The Center for Rice Husk Technology at the Central Luzon State University in the Philippines focuses on developing rice husk gas technologies and sharing this information with other enterprises in the form of handbooks and manuals. About five of the enterprises on the Energy Map focus on free and open sharing of knowledge, although the word "enterprise" may not be the best descriptor for them, in that they are more akin to think tanks and non-profits that align with other businesses.

The next model makes use of existing retail channels, and although it involves the movement of products, as far as the enterprise is concerned, this is a low-touch model. Six of the enterprises on the Energy Map make use of this model. The enterprises seek to partner with wholesale distributors that already have established retail systems. This works best for enterprises that are selling a small, simple product that does not require a lot of maintenance, such as a solar lantern. For instance, VidaGas sells liquefied petroleum gas through retailers that already are selling in grocery stores in Northern Mozambique. This way, VidaGas does not have to worry about reaching buyers on its own.

Similar to the previous model, the next focuses on partnering with distributors – but only those that can provide the right

Women in Rwanda show off their solar-powered educational radios from Lifeline Energy, which works with NGOs and charities to improve rural education. Image credit: Lifeline Energy

training or service to customers. There are 19 enterprises on the Energy Map that partner with other organizations to make their sales. This works best for enterprises that want to reach a large number of people, but have a product that requires a certain level of training that a wholesale distributor cannot provide. For example, re:char makes use of an on-the-ground network of salespeople and demonstrators to get their bio-char kilns out to customers and provide the necessary expertise to operate them. They also partnered with ACO, a Kenyan development non-profit that helps train users.

The next model involves contract sales and is usually associated with larger products, or products that are used for things such as education or health care. For example, Lifeline Energy contracts with government or non-profits that are working to improve rural education. Lifeline sells its solar powered educational radios to these institutions, which then take care of distribution. There are ten enterprises on the Energy Map practicing this distribution model. This model is best for enterprises that want to ensure a long-term relationship with whatever organization is implementing their technology, such as governments, schools or health clinics. These relationships help to ensure that the product is used appropriately without requiring the enterprise to be responsible for operating the systems.

The next model, microfranchising, is similar to the model using existing distribution channels in that it uses local retailers. But it is better suited for enterprises that have a stake in the region in which they are operating, and that provide products or services that require customers to return. About 12 enterprises on the Energy Map practice this model. This distribution strategy works best for businesses that rely on a monthly fee or a pay-as-you-go system for things like rechargeable batteries or rental systems. Microfranchising helps to build a local economy, and can standardize the distribution system for enterprises using this model.

One step up from microfranchising is the use of in-house salespeople. There are 14 enterprises on the Energy Map that hire their own employees to sell their products. Often these enterprises have branch offices from which they base their regional distribution channels. This model is well-suited for high-tech or relatively expensive products that require the enterprise to be involved in maintenance and financing operations. For instance, Ilumexico focuses on a last-mile distribution system and local branch offices to reach isolated communities. These branch offices are run by Ilumexico employees who help to sell and maintain the products, and train buyers.

The highest touch distribution model, employed by 14 enterprises on the Energy Map, relies on community based implementation. In this model, the enterprise—typically a non-profit—is actively involved in the communities in which it operates and often has a community development mission much broader than providing distributed energy.

This model is suited for enterprises that require extensive training and long-term financing or maintenance operations. Many of these enterprises focus on holding workshops and helping to train community members to either produce or operate the systems themselves. Often these enterprises have complex products that require a lot of attention, and therefore they focus on a holistic impact approach rather than a numbers-reached approach. Although expensive, this strategy ultimately provides the highest quality service to the end use customer.

A worker installs a rooftop solar panel. Image credit: Ilumexico

So What Business Model Works Best?

The answer to this question is entirely dependent on the technology, the target market and the resources of the enterprise. No one model is the silver bullet for providing the 1.3 billion people suffering from energy poverty with clean, reliable and affordable energy. In fact, most of the enterprises featured on the Energy Map make use of several of these strategies simultaneously to achieve their objectives. The complexities of energy poverty are mirrored by the diversity of business models being used to overcome the many barriers that exist. There are, however, a few takeaways from the information presented here.

- Increasing the number of people reached often means sacrificing the depth of the impact. Enterprises must clearly define their objectives and scope in order to avoid running into too many costly barriers.
- Debt and equity are good, but grants are still critical. Even the most established for-profit enterprises on the Energy Map still rely in part on grant money, making it a crucial funding mechanism for this space.
- The more complex the technology, the more involved the distribution model must be. Although complex solutions often offer a more holistic impact, they also require more training and a larger commitment from the enterprise.
- The leader can only do so much. Although subsidies and self-funded endeavors have few strings attached, they are ultimately un-scalable and risky once the enterprise has surpassed a certain level of growth.

Although there is much work to be done to bring innovative solutions to those suffering from energy poverty, the experiences of the enterprises on the Energy Map can shed light on how different strategies can be used. It is unlikely that one enterprise will scale enough to end energy poverty, but these business models are primed for replication in other areas of the globe.

Jack Bird is a recent graduate of Santa Clara University, and is working as a research assistant for the Center for Science, Technology and Society's energy sector.

The View from OPIC

Why U.S. companies are investing in lighting Africa

By Judith Pryor

Africa has seen significant economic progress in recent years, with many of its countries enjoying growth rates among the highest in the world. This progress is even more remarkable considering that vast regions of the continent are without electrical power. According to the Electrify Africa Act of 2013, nearly 30 African countries face endemic power shortages, which present a key constraint to growth. It is believed that with a plentiful electric supply, Africa would enjoy an additional 2 to 5 percent of economic growth annually – a robust figure for any part of the globe.

In Sub-Saharan Africa almost 600 million people — about 70 percent of the population – lack a regular source of electricity. That's roughly equivalent to the entire population of Western Europe, plus Japan and South Korea. That such a vast population lives without power clearly affects their quality of life – limiting the production of goods, agricultural output, the delivery of quality health care, commercial activity and many other aspects of life and work – yet at the same time offers tremendous upside potential should electrical generation and distribution become widespread across Africa.

What's more, recent history shows that powering Africa is not only possible, it has become a major business opportunity for U.S. companies which are achieving success through innovative projects in a number of African nations.

For example, in Hell's Gate National Park, Kenya, the Olkaria geothermal power plant – built and operated by Nevada-based Ormat Technologies Inc. – was recently expanded. The park contains volcanoes and abundant hot springs, which are tapped to produce electricity. The hot steam is transported from the site through a pipeline, which has been elevated in several places to accommodate giraffe migration. Ormat uses a proprietary technology to re-inject cooled water into the reservoir to minimize the impact on the environment. In 2011, OPIC approved up to $310 million in financing for the plant's expansion.

Since Ormat's expansion from 48 megawatts to 100 megawatts, the plant has been able to deliver more than 5 percent of Kenya's total power consumption. Geothermal already accounts for 13 percent of Kenya's electric generation, and is expected to top 25 percent by 2030. In addition to bringing much-needed power to the region, Ormat's plant is creating jobs in both Kenya and the U.S.

Meanwhile, just outside of Togo's capital city of Lomé, Delaware-based CountourGlobal has built a 100-megawatt thermal power plant which can readily switch between natural gas and fuel oils based on availability and cost. The plant provides a reliable source of electricity to a country that had one of the lowest rates of per capita energy consumption in the world. The completion of this plant in 2010 tripled Togo's electricity generation capacity – the construction itself was a major undertaking in one of the world's least developed countries. The project was completed with the support of $250 million in OPIC financing and $37.8 million in political risk insurance.

In Kigoma, a rural area of Tanzania, only 6 percent of the population has access to electricity. NextGen Solawazi Limited is addressing this deficiency through plans for the construction and operation of a 5-megawatt photovoltaic solar generation plant. The use of clean solar technology will reduce regional carbon emissions by replacing diesel power generation.

Tanzania is also making progress in another renewable energy sector, with Washington, D.C.-based KMR Infrastructure's development and operation of two distributed biomass generation plants. The construction and operation of these small-scale renewable energy projects is expected to be highly developmental for the people and economy of Tanzania. (OPIC's projects are scored on a development matrix for development impact. "Highly developmental" is a level of this matrix. Find out more here). The plants will displace diesel generation with green energy – from bamboo – in underserved rural markets, while offering new revenue opportunities to local landowners through fuel supply arrangements. The innovative and scalable model for power that these plants provide will generate power that is decentralized from the country's primary grid.

Renewable power projects like wind, solar, geothermal and biomass, combined with traditional thermal power sources, will be essential to illuminating the continent. As these ingenious projects demonstrate, there are multiple ways to bring power to Africa. This is a tremendous opportunity for the public and private sectors in the United States to come together to create a brighter, sustainable future with and for the people of Africa.

Judith Pryor is the vice president for External Affairs at Overseas Private Investment Corporation (OPIC).

A 'MEGA' Project

In Malawi, turning the wheel for affordable micro-hydropower

By Glen Burnett

If we want to bring energy access to the 1 billion-plus people living without it today we know where the focus needs to be: off the grid. In fact, according to the World Energy Outlook, 60 percent of new investment in rural electricity generation will need to be focused on mini-grid or stand-alone decentralized options to meet demand. Grid-based extensions are cost prohibitive in many cases, yet low population density and limited returns reduce the incentives for private sector, donor and government actors to engage in decentralized energy options.

"Fewer than 13 percent of rural Malawians have access to grid electricity. The Mulanje Electricity Generation Authority (MEGA) aims to change that and to create a far more cost effective solution than expanding the grid. MEGA is Malawi's first independent power producing company, a mini-grid system that uses hydropower to bring power to remote areas where a grid is unlikely to arrive.

MEGA is a multi-site social energy business in southern Africa, based on 10 planned micro-hydro schemes on the fast-moving rivers of Mount Mulanje, Malawi. But the main thing that sets MEGA apart is our enterprise model. Where many approaches use public or community ownership, MEGA is run as an enterprise that employs a clustered approach to mini-grid management. And the way we use our pre-paid system allows for different levels of consumption.

Clustering several schemes under a single enterprise drives down organizational, managerial and operational costs.

MEGA will build and retain capacity through meaningful employment and long-term financial viability ensures the systems are maintained (and expanded) sustainably.

Prepayment metering ensures poor families can connect and pay for electricity on a sustainable basis (experience shows that post-payment leads to unpayable debt) and helps ensure the financials of the systems. This approach allows people from different income levels to access the energy the system provides. (More on this below.) Analysis of current and forecast household energy expenditures in the region shows that, on average, 15 percent of rural household income will be saved by those accessing MEGA electricity for lighting and other household uses.

MEGA grew out of a Practical Action-implemented project. Our work takes a total energy access approach to policy and practice, recognizing the full range of energy services which people need, want and have a right to. It also promotes the concept of technology justice, ensuring equitable access to energy services for the poorest and marginalised.

Since 2010, Practical Action has developed reports on Poor People's Energy Outlook. Making energy work for the poor requires an ecosystem dependent on more than just the market actors themselves.

At Practical Action, we developed the "energy access ecosystems" framework into a useful tool to measure and understand the "health" of a specific country's energy system. It can also be used to assess the potential for making rapid progress toward universal energy access. MEGA has been built around partnerships that include all three sectors in this framework: capacity, policy and finance.

In addition to providing low-cost energy to populations that have traditionally depended on inferior fuel (such as charcoal), MEGA will also enhance upstream watershed catchment management and protect the fragile ecosystems at the base of the mountain. The total market size in the area is 520,000, of which we expect 9,600 people will be connected. We also expect MEGA to become a financially self-sustaining operation within six years, after our fifth generator comes online. At this point, our first generator is ready; we are just waiting for the Malawi Energy Regulatory Authority to supply us with our license to operate.

MEGA operates as a not-for-profit social enterprise, with any profits returning to a community development activity. Our social mission has led it to follow a policy of price minimization instead of profit maximization, and as a result, we envision different customer types will pay different rates for energy. MEGA manages this on the household level through a prepaid PAYG metering system, with community vendors selling credits that households can use to buy energy services. This ensures that households can afford to purchase electricity in relation to their income, but also facilitates easy revenue collection by allowing customers to pay in advance. Businesses, business centers and social facilities (such as schools and clinics) have a separate payment arrangement to allow enhanced access to health services and education to the wider community.

Quick MEGA summary:

Technical stats: Generates electricity from a 40-100 kilowatt micro-hydro turbine and distributing to customers via mini-grids, with aims to develop 10 sites by 2023.

Inclusive throughout its value chain: Communities participate in the ownership and governance structures of the organization; in-site construction, operation and retail; and form the key target customer group.

Private approach to community-based energy generation: Instead of site development followed by "handover" to communities, MEGA runs all sites to achieve economies of scale but engages closely with communities throughout.

At this point, MEGA is in its early stages. Part of what influences our speed of launch is connected to our desire to teach other actors how to replicate MEGA experiences in Malawi. We hope this model is useful for development actors that are not in the energy sector so they can start mainstreaming energy access in their programs. There are many areas where development activities would be improved with better access to energy, such as providing power for health centers, or connecting irrigation systems for agriculture activities (this sometimes is referred to as productive use).

Related: For more, check out this 2013 case study from the Business Innovation Center.

MEGA's Challenges

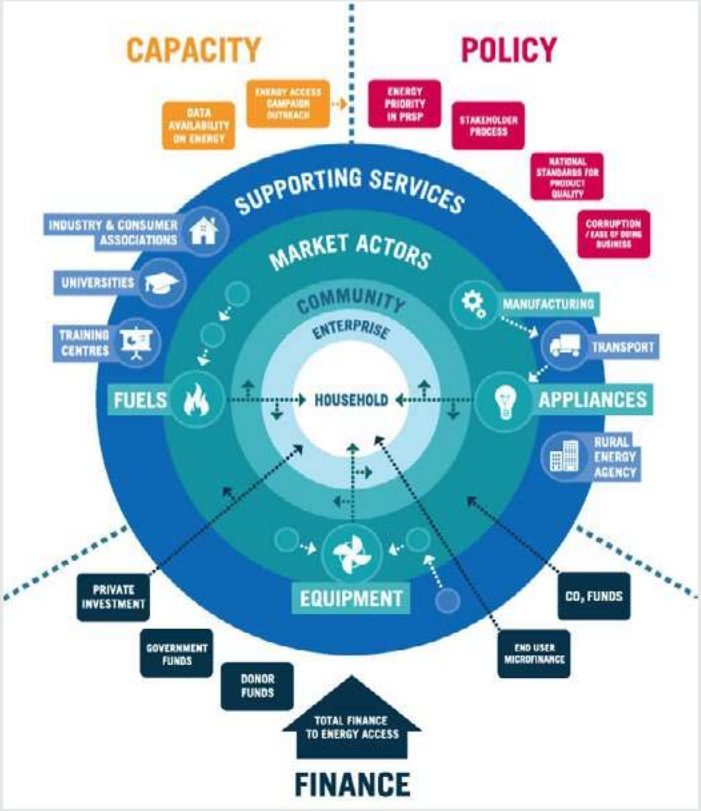
MEGA's initial activities have been promising but are not without their own challenges.

Capacity development and retention issues – Technical skills needed by minigrid operators are scarce outside cities. Universities and colleges are adapting and adopting courses for renewable energies, but the pace needs to be accelerated.

Government awareness and regulation – National grid expansion is often subsidized and risk is underwritten by governments. Bureaucratic delays (such as obtaining licenses) undermine the return on investments. Even if tariffs are not set by regulators, low national grid tariffs set up unrealistic expectations for off-grid tariffs.

The import/local production dilemma – Importing is expensive, undermines the development of local industry and doesn't allow for the development of skills necessary for the maintenance, diagnosis and repair of systems. On the other hand, current imports are higher quality and usually highly efficient. For example, with micro-hydro, the primary energy resource is limited by the nature of the river, so any inefficiency will reduce the possible total power output. With solar, that is different, because another photovoltaic panel could always be added. Locally manufactured components tend to be lower quality with lower efficiency, but deliver on the softer issues that importation doesn't (repairability, local control, etc.).

Community ownership – In some places, we've used a share-based approach where individual community members have been allocated "shares" depending on their level of unpaid input during construction. In other places we have established community trusts to own and operate. We have seen that community engagement is absolutely critical for the success of a scheme. One of the questions we grapple with now is how to blend part community ownership with part social enterprise, spread over various endeavors. We are exploring options for ownership that could mix private or social enterprise ownership with community ownership. Making this decision on final ownership is a current focus of the MEGA board.



Long-term funding and financing – Although donor funds (European Commission, Practical Action and the OPEC Fund for International Development) have supported initial scale-up, MEGA runs as a social enterprise. The challenges currently faced by MEGA continue to be start-up funding challenges, including funding for initial capital and technical challenges related to micro-hydro installations and maintenance that has affected revenue collection.

The Future

Although we have shown models indicating we will break even six years after launch, finding investors can be a challenge while adhering to our social mission. This also comes back to the question of local engagement and how grant funding, loans and equity are accounted for in a mix that includes community investment.

We have depended more on donors who can supply start-up capital in the form of grants, and grants are a good thing. In fact, the difference between a government subsidy and a grant is often not that great, and government subsidies have been integral to the development of energy systems around the world. But as we grow, we also need to shift to identify more private sector funding. The value proposition for the private sector and a donor, though present in both cases, is often different, and we have to consider that when looking for growth capital.

The MEGA project is both an experiment in terms of a new type of energy generation, coupled with nontraditional forms of customer delivery/payment and new ways of sourcing capital. But if we will make good on our promise on bringing new off-grid sources to market for rural, low-income consumers, new ways of thinking will be necessary. We think we are up to this task.

Glen Burnett is director of U.S. Operations for Practical Action.

The Coca-Cola Model

Selling entrepreneurship, not solar lamps

By Meaghan Cassidy

A little over ten years ago, there weren't that many more mobile subscriptions than landlines in Sub-Saharan Africa. It was expensive to lay the groundwork to get the lines to homes and businesses, and the only available payment subscriptions were expensive. All that changed when the concept of pay-as-you-go was introduced to mobile phone plans. Subscribers could now pre-pay and stretch out their minutes as long as they wanted. There are now over 650 million mobile phone subscribers in Africa — just about the same number of people who lack adequate, affordable access to energy.

In the same way that mobile phones took the lead over capital-intensive land lines to revolutionize communication in the developing world, we at KARIBU Solar Power believe that pay-as-you-go will revolutionize energy.

The scale that we work on is small — watts, not kilowatts or megawatts. And our pay-as-you-go solution does not necessitate capital-intensive installations up-front — in fact it can be carried anywhere. It's mobile. And it can be passed on from rural community to rural community.

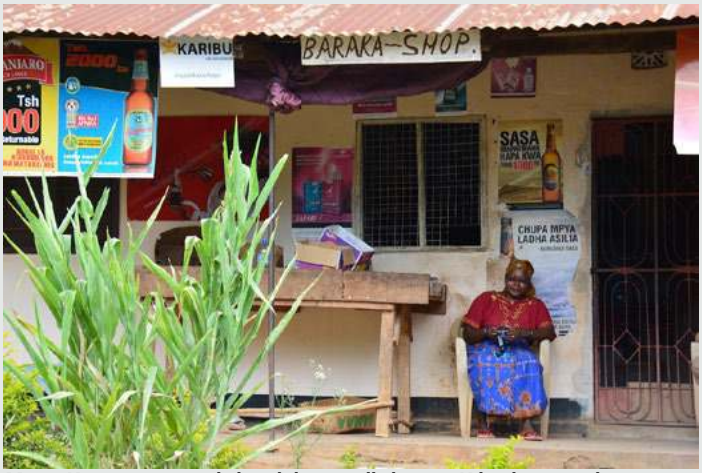
KARIBU Solar Power sells a solar lamp business-in-a-box kit to small shop owners in East Africa. Compared to most other solar companies, we're different in three ways:

- Product: An income-generating asset, like a cow or a goat, not a one-off personal purchase
- Customer — the person who actually pays us for our product: A small shop owner, not a BoP consumer
- Business model: B2B, not B2C

From the customer perspective, our model works like this:

- Our customer buys a business-in-a-box kit, which contains:
  - One solar panel
  - Two rechargeable solar lamps, which also charge mobile phones
  - Two wire handles to allow hanging or propping each lamp
- She resells one of the solar lamps in the kit to a consumer in her community for about the price of a kerosene lamp. They take it home to use it for light and to charge their mobile phone.
- When its battery is empty, they return to the shop and swap out the empty light for a fully charged one that the shop owner has charged with the solar panel in the kit, paying about the same as they would for kerosene.

So BoP consumers are able to access solar for the same price as kerosene, with the added benefit of mobile phone charging. And our product incentivizes our customer to eliminate kerosene, because she stands to benefit by continuing to sell these recharges, recouping her up-front investment in the kit. After that, it's all profit for her—profit that she can reinvest in more kits, providing even more people with affordable solar.



Mama Kosta sits outside her duka (small shop) in Kibosho, a rural community on the slopes of Mount Kilimanjaro near Moshi, Tanzania. She holds one of the solar lamps that she rents out to her customers to earn income. Image credit: Sameer Dosa

There is no need for BoP end users to save up for a solar lamp, and we don't finance any of our products for our customers. Our customers pay us up-front for the kit and can begin making money on day one.

Coca-Cola doesn't sell sugar water, they sell "happiness". Likewise, we're not selling solar lamps, we're selling entrepreneurship. We're starting small. We've just completed product development based upon lessons that we've learned from target customers. We tested our business model with them to find out what worked, what didn't, and how we can make it better. We're working with manufacturers to complete our first production run of lamps, which will be sold in a pilot project based in Moshi, Tanzania, in the shadow of Kilimanjaro.

We're learning as we go, but we're hopeful that this model will work to welcome even more people to affordable solar power.

Meaghan Cassidy is vice president, operations for KARIBU Solar Power.

Clean Energy Mini-grids for Rural Customers are Here to Stay

How to ensure power flows for the long-term

By Evan Scandling

Building mini-grids in Laos. (Images courtesy of Sunlabob).

Editor's note: This post is the sixth article in the NextBillion series Going Off Grid. To read other contributions in the series, click here.

In recent weeks we've seen big global development players drum up much-needed attention for renewable energy in Southeast Asia. The Sustainable Energy for All (SE4ALL) regional hub for Asia-Pacific was launched by the United Nations and partners, and within a week the International Off-Grid Renewable Energy Conference was hosted in the region for the first time.

Despite the headlines and events, for those who look at the statistics, it has never been a secret that Southeast Asia holds massive potential for renewable energy growth, particularly in the form of decentralized solutions.

An estimated 130 million people in the ASEAN (Association of Southeast Asian Nations) region still live without access to centralized grid electricity. Considering that many of those people live in remote, isolated communities – such as one of Indonesia's 18,000 different islands or in inaccessible areas of Laos – extending grid-connected electricity oftentimes isn't economically or physically realistic.

It's no surprise then that the market for electrification of off-grid households in the region recently was estimated to be $16.5 billion.

If the market analyses about decentralized energy opportunities aren't convincing enough, the world's preeminent voices on energy issues also agree: the International Energy Agency (IEA) says that if universal electrification is to be achieved, 55 percent of all new power between now and 2030 must come from off-grid energy, 90 percent of it being renewable.

In short, off-grid renewables, particularly in the form of mini-grids, are here to stay.

Why renewable energy mini-grids?

What decentralized solutions are expected to be deployed to help close the energy access gap? "Pico" technologies like solar lanterns and standalone solutions such as solar home systems will certainly continue to play an important role in providing basic lighting, phone charging and powering fans and the occasional television.

But if the IEA's predictions are accurate, mini-grid systems – fully powered by renewable energy or paired with diesel generators for reliability – will supply nearly half (42 percent) of new electricity if universal electrification is to be reached by 2030.

Mini-grids can be implemented faster than a centralized grid, can easily expand capacity to meet a community's increased energy demands and can sync with the national grid if necessary.

Further, off-grid clean energy is the "fastest, cheapest, and most effective means of ending energy poverty – and is going to create a $12 billion annual industry by 2030," according to a recently released report by the Sierra Club.

It's hard to argue otherwise: renewable energy-based mini-grids are a prime choice for how electrification efforts in the developing world can best be targeted.

Understanding the community

Before a mini-grid developer can even begin to think about which solar panels to use or how much battery capacity should be included, a first – and likely the most important – question must be investigated: what does the community want? And how will it use the energy?

Collaboration from the beginning between the mini-grid developer and the community of end-users is an absolute requirement in order to understand both the social and technical contexts. As the Alliance for Rural Electrification states, "Developers should not design the system based on pure technological considerations, but instead adapt to the specific social and economic characteristics of the rural community."

Community surveys and pre-feasibility studies need to explore questions such as:

- **Current and future load profile:** How much energy will the community actually use, now and in the coming years? Do community members plan to use the new source of electricity to begin new energy-intensive activities like rice milling or refrigeration? It's also important to manage the expectations of end-users regarding supply: the mini-grid will have limits and an unending amount of electricity won't be available.

- **Realistic pricing:** What is the ability, and also willingness, of villagers to pay for electricity? Is the pricing on-par with other electrified communities in the area?
- **Population density:** How close together are houses? Is a mini-grid really the best technology for that specific community? Or would standalone solutions like solar home systems be a smarter choice?
- **Know the central grid:** Are there existing plans for the national grid to arrive in the near future?

Community-based operational models

While a multitude of operational models exist, one common ingredient in operating a mini-grid is community involvement. Within the context of a rural village — where most mini-grids are built — a community-centric approach in which locals are incentivized to maintain and manage the system can be a major contributor to a project's longevity.

Providing villagers with technical training to maintain the system on a daily basis, as well as basic accounting skills to collect payments, can empower villagers to manage the mini-grid on a day-to-day basis. When paired with village-based governance in which respected members of the community provide supervision (what we at Sunlabob call a "Village Energy Committee"), the new skills are a key element to a self-sustaining model.

Energy access, human capacity building and community-driven management can be a potent enabler of long-term success.

Opportunities for income-generation

A major selling point of a mini-grid is the ability to catalyze "productive uses" of energy — uses of electricity that increase productivity or income — that cannot be enabled by standalone solutions like solar home systems. (After all, if lighting and phone charging are the only objective, why even consider a mini-grid?).

An Energy Sector Management Assistance Program (ESMAP) position paper rightly contends, the most efficient way to enable long-term impacts through rural electrification is to ensure energy access programs have "a direct impact on livelihoods and revenue generation, in addition to impacts on standards of living. Increasing revenue generation can be accomplished by improving productivity or reducing production costs in an existing production process."

In summary, access to energy isn't the end-goal — continuous, impactful economic and social development is.

Anchor client partnerships

The majority of people living without electricity also live in poverty — an estimated 80 percent of the world's un-electrified population earn less than $3 a day.

Considering that renewable energy technologies — particularly those of high-quality standards — are not cheap, it means that those who are in most need of such solutions are also least able to afford such options. The equation, unfortunately, doesn't always balance: a $3 per day income can't cover the costs of new energy access necessary for impactful social and economic advancement.

While it's not a panacea, the "anchor client" approach has gained momentum in recent years as a way to bring balance to the affordability and long-term viability of rural electrification programs.

With a more stable base load demand from a reliable, regularly paying client, energy providers can, in essence, de-risk their electricity sales to individual villagers, who are poorer and oftentimes more unreliable in their payments.

The "anchor client" approach is ripe for application across a variety of industries in off-grid areas, ranging from the telecommunications industry (tower base stations), agriculture (milling, water pumping), fishing (ice storage) and mining (extraction and processing).

The telecommunications industry, thanks in part to the efforts of the GSM Association's Green Power for Mobile program, likely is the most successful adopter of the "anchor client" approach, particularly in countries like India with high mobile phone penetration and low electrification rates.

Companies like OMC Power, which sells power from its rural micro-grids both to mobile phone network towers and rural communities in India, are proving that new business models are transforming the viability of rural electrification.

For the next wave of "anchor client" implementation, keep an eye on Myanmar, the Southeast Asia country with more than 15,000 telecom towers planned for construction, yet an electrification rate of less than 30 percent. Could there be a more perfect scenario for tapping tower power for community electrification?

Context, context, context

Ultimately, there is no "one-size-fits-all" approach to developing a mini-grid and preparing it for long-term success. What works for a company in the mountains of Laos likely won't be the best approach for a mini-grid developer on an island in the Philippines.

Despite the abundance of insightful, comprehensive literature about renewable energy mini-grids currently available (good examples, here and here), a mini-grid developer must intensively coordinate with, and therefore, deeply understand its end-users.

Social, environmental, political, economic and cultural aspects are unique to each community, and therefore demand an individualized, tailored approach from energy providers.

"Know your customer" is a phrase likely coined by an advertising executive or shoe salesman, but it couldn't be a more appropriate mantra for mini-grid developers to live by today.

Evan Scandling is Sunlabob's regional director for Southeast Asia, focusing on developing partnerships and new business opportunities related to renewable energy and rural electrification.

This post was adapted from an article that originally appeared in Solar Business Focus. It is republished with permission.

Decisions, Decisions

How do enterprises choose their markets for clean energy products and services in India?

By Sanjoy Sanyal and Pamli Deka

The off-grid electricity market in India is large, with more than 300 million people living without access to electricity. With such a large market, how do enterprises decide upon which small geographical area to focus? Is the market selection based on a robust methodology or more of a blindfolded dart game? Should companies focus on a small niche market or is there a need for diversification from day one of operations?

From our experience, a matrix of choices determines where enterprises choose to work. Some choose areas where they have strong family ties. Some are directed to areas designated as "un-electrified" villages. Some entrepreneurs focus on the poorest areas to create impact. We, on the other hand, advocate a strong analytical approach to choosing the geographical area of operation. Rural areas are remote and in need of electricity, but this need does not often translate to demand. The penetration of Distributed Renewable Energy (DRE) products and services is limited.

We believe enterprises should focus on relatively small areas at the district level (administrative units within a state) where there is a clear demand and capacity to invest in these solutions. In our Micro-Markets analysis, we have identified these target geographical markets and districts.

Our initial focus is on states where the majority of rural population lives in darkness. The states of Uttar Pradesh, Bihar, Jharkhand, West Bengal, Orissa and Assam had rural un-electrification rates (un-electrified rural households/ total rural households) between 50-90 percent in 2011. Un-electrification rates were as high as 90 percent in rural Bihar in 2011. But rural solar penetration in these states was less than 1 percent. The central India belt of Madhya Pradesh, Maharashtra, Chhattisgarh and the western state of Rajasthan was slightly better off. They had rural un-electrification rates between 25-50 percent with equally low solar penetration rates.

Since no one is queuing up to buy a solar home system, identify the early adopter micro-market

The early adopter market for DRE products will be un-electrified areas where access to finance already exists, where there is relative economic buoyancy but where the grid growth has been sluggish. We use this set of criteria to identify our target districts within each state. (For economic buoyancy, we checked how asset ownership data for television and motorized vehicles has changed over 10 years, from 2001-2011). Access to bank finance is critical as most Solar Home System (SHS) companies use bank loans to finance consumer purchases. The grid expansion rate is important, as the reluctance to invest in DRE products is related to the risk associated with the redundancy of these products once the grid comes in.

There are 321 districts (with 67.6 million households across these 10 states where the rural un-electrification rate was more than 25 percent). But that is not the market. Applying the criteria that we have developed, the addressable market encompasses 80 districts with 15.9 million households, or 23 percent of the 67.6 million households. The battle for clean energy will be won or lost in these 80 districts.

Focus on the district/micro-market to achieve meaningful revenue

In our experience, enterprises that start looking at villages to begin operations spread too quickly to new geographies across multiple districts or even across states. As a result, they end up spreading their resources too thin.

We strongly advocate that companies should focus on one district at a time, which we refer to as the "micro-market." There are enough opportunities and challenges in any one district.

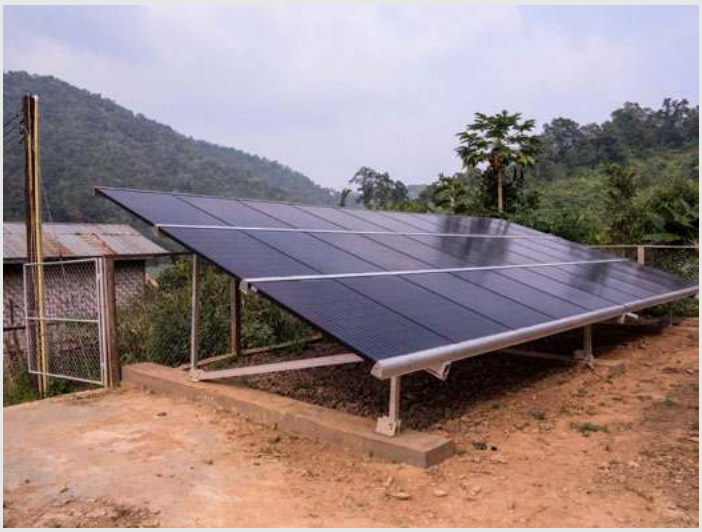


Photo credit: Steve Petrucelli, via Flickr

Take (just arbitrarily) the district of Gorakhpur in Eastern Uttar Pradesh. The rural un-electrification rate was as high as 68 percent in 2011, with 380,000 rural households living in the darkness without access to the grid and solar systems. Seventy-nine percent of the rural households in Gorakhpur had access to banking services and the district exhibited strong economic growth between 2001-2011 (by our parameters). Un-electrification fell by only 4.9 percent over this period, but the penetration of solar systems was less than 1 percent.

Ten percent of the un-electrified rural households translates into a market of ~ 38,000 solar systems in the Gorakhpur district alone. The size of a solar system will vary by household. At an average price of INR 10,000 for a 20-watt system with two LED bulbs and one mobile charger, the market size is equivalent to INR 38 crore, or U.S. $6.3 million. This is a conservative scenario where we have assumed that the penetration of solar products is limited to 10 percent. We have also discounted the fact that villagers may opt for the costlier, larger SHSs instead of smaller 20-watt systems. Even with these very conservative assumptions, an enterprise can generate INR 38 crore from one micro-market or one district.

In our experience, there is one enterprise that has been working with this strategy to develop a sharp focus on one district. Mera Gao Power has been developing its micro-grid market and scaling up operations within two blocks of the Sitapur district. This is a clear example of adoption of the micro-market strategy.

Partnerships can be developed in the micro-markets to reach scale

The district level micro-market approach allows companies to identify and foster key partnerships specifically with managers of lead PSU and Regional Rural Banks who are located at the district town level. It allows companies to develop partnerships with local administrative layers and with community organizations. The district town is the place to locate dealers and service centers. Finally (and perhaps most importantly) it allows these companies to sharply focus their tiny budgets on marketing. The products have to be sold, for which companies need to spend money on advertising in local cinemas, village markets, hoarding and cable television inserts.

Identify a micro-market within a cluster

In most of the states we analyzed, the highly un-electrified districts are concentrated in a region forming a cluster. In Orissa, four districts form a cluster in the northern part of the state. The rural areas of southern Madhya Pradesh across 11 districts, starting from Ratlam in the west and stretching to Jabalpur in the east, form another cluster. Clusters also exist across 10 districts in southern Maharashtra (stretching from Jalna to Kolhapur) and three districts in southern Chhattisgarh.

One giant cluster sprawls across the states of Uttar Pradesh and Bihar. Twenty-eight districts (starting from Faizabad) in eastern Uttar Pradesh and western Bihar (starting from Gopalganj in the north to Gaya in the south) form one giant cluster with 9.7 million rural un-electrified households. This cluster alone accounts for 61 percent of our target market.

While thinking of where to pick that "one" micro-market/ district to bet their fortunes, clean energy enterprises should assess the access to banking institutions in these clusters and the political, economic, behavioral issues that impact the market.

This is perhaps the only way innovation works

Geoffrey Moore in his book, Crossing the Chasm, identified the need for early adopter markets. The challenge for clean energy enterprises is to find early adopter markets of aspiring households in what are very challenging areas. It is by no means an easy challenge, but the parameters that we propose could be among several to use. From a micro to a mainstream market, the only way is to navigate across a cluster.

Sanjoy Sanyal is the country director, and Pamli Deka is a research consultant at New Ventures India.

Solving the Energy Access Problem

In-house distribution + in-house product design

By Patrick Walsh

We founded Greenlight Planet to offer rural, low-income families a clean, affordable and safe alternative to traditional kerosene lamps. We developed a robust range of solar-energy consumer products to meet the needs of the 1.5 billion people who live off the energy grid: our award-winning Sun King™ brand of portable solar lanterns and phone chargers.

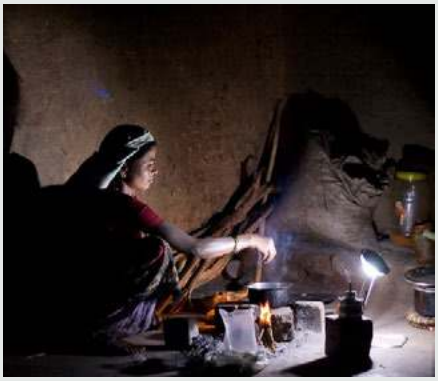
But we quickly discovered that producing a great product gets you only halfway home.

We needed to get our solar lanterns into people's hands – no easy feat when the consumer lives off the energy grid, isolated from traditional distribution networks. To address that challenge, we developed a two-pronged approach. Predictably, we developed distribution partnerships with organizations around the world. But, uniquely among our competitors, we in parallel developed our proprietary "Direct to Village" micro-entrepreneur-driven direct-sales network.

It's going well now, but when we first launched our "Direct to Village" sales concept, it was a real struggle. For years, we agonized month after month over depressingly low sales figures and ongoing agent recruitment problems.

But we believed that direct sales would become a powerful platform for sustainable growth, so we stuck with it. And in the summer of 2011, things started to click. Small areas populated by low-income farmers in northern Bihar started to show promising results. For the first time, our agents began to report multiple new customers per week. We noticed that some of our most successful sellers were becoming local celebrities, based on the visible impact they were having on livelihoods in their communities. And our sales agent count began to skyrocket as individuals in neighboring villages began to see an opportunity to earn money for their own families while doing good for their neighbors. In no time at all, our network grew from 50 agents to 350 agents, selling more than 3,500 Sun King™ solar lights to off-grid families each month. In the next two years, our sales network grew from five district branches to more than 50 branches in three states in India, reaching 3,000 active sales agents and more than 30,000 new homes each month.

As our sales have continued to grow exponentially, we are often asked what has been the key to success. We see our prime advantage as the difficult-to-replicate synergy between our in-house product design function and our in-house direct-to-consumer sales and partnership platforms. The combination of these two functions as core business models, working in tandem within the same company, has proven critical. Each has provided critical inputs to the other, making it difficult to imagine either model having been successful on its own.



A woman uses a SunKing lantern while cooking. (Image courtesy of Greelight Planet)

(Above: Members of Greenlight Planet's sales team, which number in the thousands across India.)

Our internal direct-sales network allows us to collect consumer feedback more efficiently and thereby improve our product designs more rapidly. At the same time, our product design capability allows us to quickly tailor our products to both the needs of our sales force and the needs of our target consumer. Thanks to our in-house distribution network, sales of a product can be measured in real time without any delay from a channel partner, letting us immediately understand the consumer's response. To us, this synergy seems to be critical for companies targeting rural, low-income customers – a consumer segment whose true needs are often misunderstood. As a point of comparison, product designers and marketing teams at a company like Apple can use the staff as a virtual test target for developing new products. But unearthing the unique and sometimes complicated needs, desires and mindsets of the rural consumer is not easy to do unless you're actually living (and selling) in that environment.

Another way to examine the power of this combined in-house-distribution and product-design model is how well it addresses the challenge of product quality and reliability. For wealthy consumers, product defects and reliability problems are relatively tolerable: Consumers are less risk-averse, and the logistics of repair or replacement is a mostly simple matter. Rural, low-income consumers have little tolerance for a broken

product, and will (rightly so) vilify the company at fault in their community. So an organization that both operates its own direct-sales network and designs its own products has a key advantage – any issue with product quality or reliability can be immediately fixed or even replaced. Product reliability problems may not be obvious to companies that sell through multi-tiered, external distribution partnerships. And distributors who lack their own design function may not be able to react effectively to problems, even if they know problems exist. When launching a new product, we can pilot large-scale sales though our proprietary distribution channels before offering the product to external distribution networks. We need not wait for a distribution partner to report a problem before taking action.

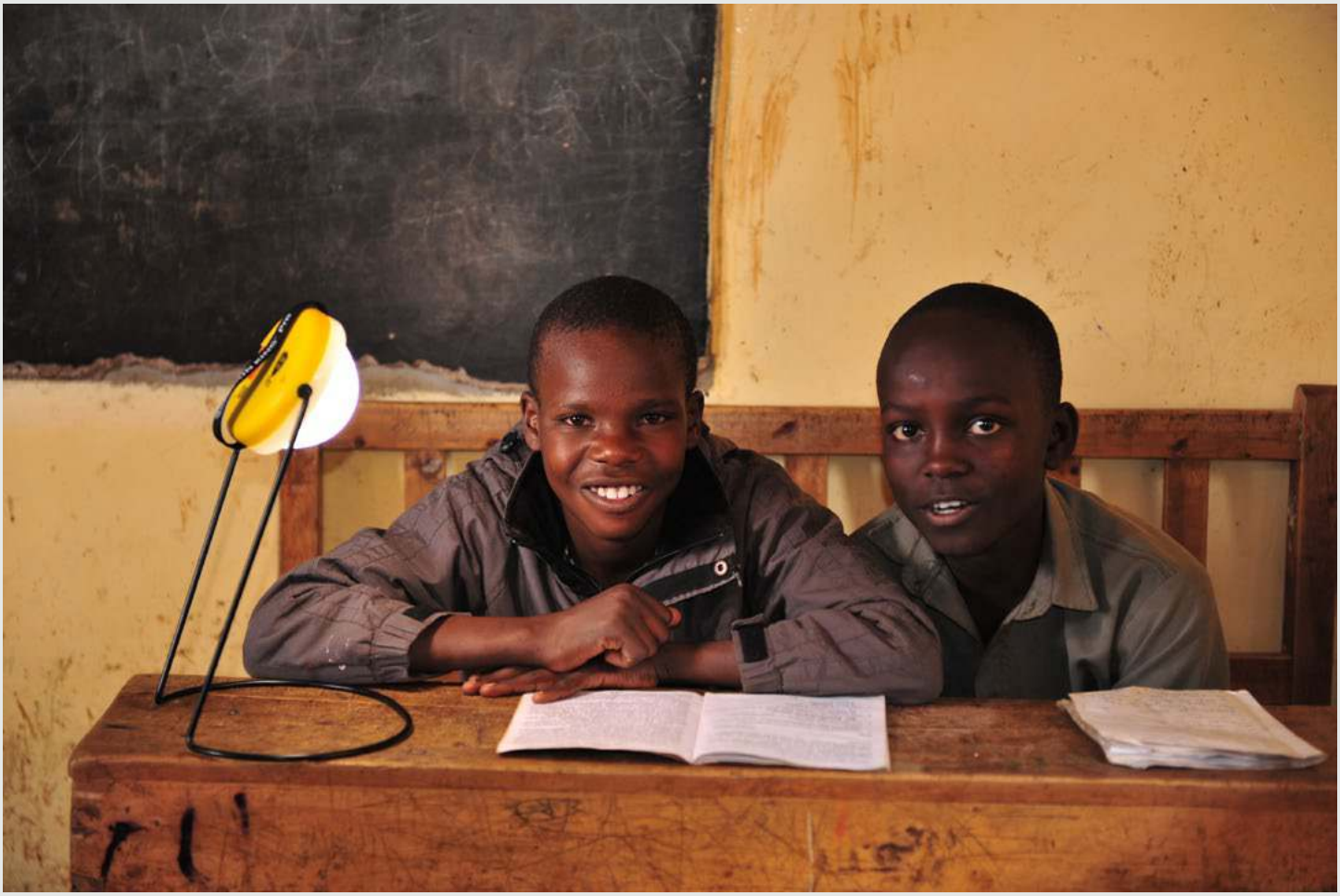
When we start thinking of off-grid households not as disenfranchised families but as potential consumers who are empowered to vote directly with their wallets, everything changes. As an organization, we are competing for consumers' hard-earned income. Products must deliver immediate, honest and measurable value for the family; they have to last, and we, as a for-profit business, must deliver the best long-term customer service.

By working to answer big social problems like energy access through distributed entrepreneurship, we have precisely aligned a diverse international team to efficiently deliver value for consumers. This is a powerful mechanism for large-scale, sustainable impact. Families that lived each night without a light bulb are no longer powerlessly waiting for infrastructure, but now have a voice, telling us how they will solve their own energy needs. Because of Greenlight Planet's combined strengths in product design and last-mile direct distribution, we understand in specific detail why more than 2 million households have chosen Sun King™.

And with that understanding, we see a bright future for the 1.5 billion kerosene lamp users who are quickly gaining access to solar products.

Patrick Walsh is chief technology officer and co-founder of Greenlight Planet.

Children in rural Africa doing their homework by the light of a SunKing lamp. (Image courtesy of Greelight Planet)



Impact Investing Nepal's Biggest Hydropower Project

The $142 million investment could power 10 percent of the country

By Annemiek Planting

Editor's note: *This article was originally published on Upsides, an online platform focused on responsible finance and sustainable development in emerging markets. Upsides is an initiative of FMO and Triodos Bank, which are investors in the hydroelectric project that is the focus of the interview.*

In April, construction will start on Nepal's largest private sector energy project to date: the Lower Solu River hydroelectric generating station. This run-of-the-river power plant is to provide reliable, clean and low-cost electricity to Nepal. With a total installed capacity of 82 megawatts, it should provide electricity to 3 million people or roughly 10 percent of the population. For a country that has faced a perennial shortage of power, the project is a significant step in alleviating Nepal's power shortages.

The project sponsors include Clean Developers (at 23 percent), a Nepalese infrastructure company, Essel Infraprojects (49 percent), an Indian conglomerate active in the infrastructure sector, and four Nepalese companies. Upsides had the opportunity to speak with Ashish Garg, executive director of Clean Developers, who heads the project management team.

Annemiek Planting: Can you tell us a bit more about the energy landscape in Nepal?

Ashish Garg: It is true that Nepal has faced a huge power shortage for years. Due to demand growth and a lack of domestic power generation at the same time, this energy shortage is unlikely to change in the near future. And the demand is still increasing. Only 42 percent of the population has access to electricity to begin with. Ninety percent of the installed generation capacity comes from hydropower. Especially in the dry season this is a problem: with 20 percent of our population living in Kathmandu, the city regularly faces 12-hour power cuts during the dry season.

And yet Nepal has a tremendous hydropower potential of over 80,000 megawatts – if installed, it will become the second-highest hydropower capacity in the world. However, we only use one percent of this potential while we continue to rely on fossil fuels. Significant amounts of petrol are imported from India. Altogether, this is not a recipe for sustainable economic growth.

AP: With so much potential for hydropower, why does it take so long for these projects to come off the ground?

AG (pictured left): Even if we combine the credit appetite of all Nepalese banks, this will not be enough to fund Lower Solu. However, on the international financial market it is really difficult to win the trust of the lenders: we don't have the proper structural framework in place, Nepal does not have the long-term funds required for projects of this size. With our politically unstable climate and an underdeveloped currency market – the Nepalese Rupee is not widely traded in the international market – liability is a concern to foreign investors. Along with the European development institutions including FMO, DEG, OFID, BIO and GuarantCo, this project has an inclusive approach with involvement of Nepalese banks as well. It is a marriage of two different worlds. It was quite challenging to achieve the many "firsts" and pave the way for the next era of hydropower development in Nepal.

Currently, 80 percent of the electricity from hydropower in Nepal is generated by the government. Lower Solu is our largest private energy-sector project to date, but also the first independent power producer (IPP) in Nepal to be financed by domestic and international lenders. The $142 million funded by international banks is the largest foreign investment in Nepal in decades times.

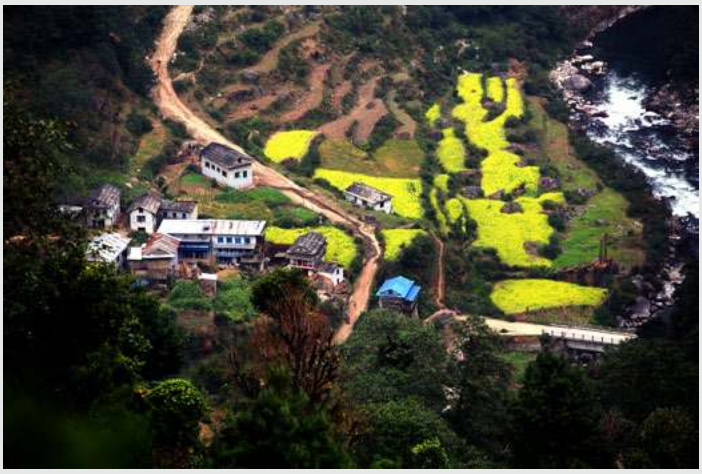
AP: How was the project initiated?
AG: That's an interesting story. One of the major reasons why Nepal's immense hydropower potential has not been tapped is that we had a faulty licensing regime. It was not based on qualities like financial standing or technical expertise. You simply obtained a license on a 'first-come-first-served' basis. Unfortunately, the wrong people got hold of these licenses. When a real developer comes along with the money and the expertise, he has to buy these licenses from the license holders. With Lower Solu, it was the first time that the government decided to evaluate the bidders via a stringent competitive bidding process. In 2010, the Nepalese government decided to evaluate bidding parties: those who were technically sound and had positive numbers on their balance sheet could make a bid. Additionally, they set a minimum bidding price of $1 million USD on the license. This way the government hoped to attract investors who were actually committed to developing

the project.

And it worked! Eleven bidders from outside the country participated in the transparent bidding process. Clean Developers and Essel Infraprojects (in a join venture) won the project with our bid of USD $2.6 million. We evaluated the project with our own engineers and technical experts, making some modifications before putting it on the international market for financial exposure. And here we are, ready to start construction by the end of April 2015. The project should be operational in four years from now.

AP: Do you believe that this project may pave the way for other investors and future projects? Or do you see other hurdles to overcome?
AG: Well, someone has to take the plunge. Lower Solu may be doing just that for Nepal. The last sizeable foreign investment in hydropower was way back in 2000. Hydropower projects are long-term infrastructure projects that require a stable licensing policy and support from both the state and the all-round system. We have political instability in Nepal, so due to frequent changes in our government, a long-term, stable policy for the further expansion of hydropower projects could not be developed. India is a very important factor in our chances to further develop the sector as well: with a huge power demand in the dry, hot summers, we could export surplus production from Nepal to India, while importing from India during our dry season. Recently, a power exchange between India and Nepal was signed after a pause of 17 years. We are still not sure how stable we will be in the long run, but commercially we have a good proposition. If Lower Solu can happen, other projects may prove to be possible as well. There is a feel-good factor involved in this project. Another crucial issue is that along with the competitive bidding process, the government guaranteed to serve the interests of the banks by providing the necessary transmission lines from Lower Solu to the national grid. All electricity from Lower Solu will be sold to Nepal Electricity Authority, the state-owned monopoly electricity provider.

A high angle view of Salme village beside the Solu River in Nepal. Image credit: Asian Development Bank, via Flickr Creative Commons



AP: Who will benefit most from Lower Solu?
AG: One could say that the entire country will benefit from the project. The electricity is strictly produced for Nepal; it cannot be exported. It adds 10 percent to the power capacity of the country, providing electricity to roughly 2 million households. Around 100,000 people live in the area where Lower Solu will be built. The power plant will offer employment both during its construction and thereafter when it is operational. Altogether it will improve the economic development of the region. Last but certainly not least, the project will have a positive impact on the investment climate in our country.

AP: What are the downsides? Will people have to be relocated?
AG: The beauty of the location of the project is that the population density is not high and both river and water are not used for households. Not a single household will need to relocate. Land will have to be bought locally, but the compensation price is higher than the market price. So in general people are happy to sell their land. We could not have had a more ideal site than this. People's standard of living will improve as well.

AP: Were there unexpected hurdles in the project?
AG: When the government invited us to participate in the bidding process, we soon found that we had to get everything in place very quickly, meet the requirements of international lenders, etc. The government supported us in this, making sure we could start developing the project in 2012. However, due to frequent changes in the Ministry, Nepal Electricity Authority (NEA) and other key figures, due to the political instability I mentioned earlier, the project was delayed by two years. And yet we are much faster than other large-scale projects in Nepal.

AP: What made this project appeal to both domestic and foreign investors?
AG: Development banks like FMO and impact investors like Triodos Investment Management look for private sector projects with a high development impact. Lower Solu is just that. FMO took the lead in arranging a consortium of international and Nepalese lenders to finance the debt. We from Clean Developers were looking for a green, not-too-large project with international funding.

After the journey had started, liability concerns arose among international banks. When the Indian Essel Infraprojects came on board as the financial powerhouse, a good, solid backing was provided that encouraged both foreign and domestic parties to join in. Now we have a perfect mix of sponsors.

The loan financing documents were signed in December 2014, the commitment is there. It is a showcase for other investors in future projects.

Annemiek Planting is managing editor/advisor and journalist at Scripta Communicatie.


next billion