



REDUCING ENERGY POVERTY

Beyond the Grid Fund for Zambia

Beyond the Grid Fund for Zambia is notable for the scale and speed with which it has provided clean solar electricity. In the space of four years the programme has provided 168,000 households, or 875,810 people – most of whom live in lower-income rural or semi-rural areas of Zambia – with clean electricity, one-quarter of whom are female-headed households. As well as reducing energy poverty and carbon emissions, the programme has generated multiple health, economic and social co-benefits. Scale has been achieved via targeted market transformation policies to incentivize and remove barriers to the provision of clean and affordable energy, including the use of a social procurement fund. The improvements in health and incomes should also help increase people's resilience to future health or economic shocks.

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Cover photo: A company sales staff member shows a customer the SupaMoto lighting system, which doubles as a radio and mobile phone charger. Photo and copyright: Jason J Mulikita/REEEP.

EXECUTIVE SUMMARY

Zambia is a lower-middle-income country where 54% of the population live below the national income poverty line and 70% do not have access to electricity. The Beyond the Grid Fund for Zambia (BGFZ) is a multi-year programme, funded by the Swedish International Development Cooperation Agency (Sida) and managed by the non-profit organization Renewable Energy and Energy Efficiency Partnership (REEEP) in collaboration with the Zambian government, which was launched in 2016 with the aim of expanding access to renewable and affordable off-grid energy to rural Zambians. The heart of the programme is a social impact procurement fund – similar to a government procurement programme – which provides results-based financing to carefully selected private sector companies that offer clean and affordable off-grid energy provision to households in rural and peri-rural areas, where the majority of low-income people live. To date, four companies have been selected for funding under the first round of the scheme. They offer products ranging from home solar systems and efficient cooking stoves to solar mini-grids, which customers can purchase using previously unavailable pay-as-you-go mobile money mechanisms¹ and longer repayment plans, making the services accessible to lower-income households.

As of March 2020, the programme has:

- improved access to energy for over 168,000 households, or 875,810 people, mostly living in rural or semi-rural areas, of which one-quarter are female-headed households, and is on track to connect 1.4 million Zambians by the end of the programme in 2021;
- provided significant **co-benefits** to households and wider society, including cleaner indoor air; better education (85% of surveyed households); financial savings (87% of surveyed households save on fuel bills); increased incomes (255 households are undertaking new income-generating activities and 1,385 jobs have been created); and improved communications by powering radios and charging mobile phones (BGFZ, 2019a).
- reduced carbon emissions by 2,603 tonnes of CO₂e annually; and
- strengthened the country's energy security.

The programme's success to date has led Sida to expand it to Burkina Faso, Liberia and Mozambique, and to create an additional funding cycle for Zambia. The goal of this new programme, titled Beyond the Grid Fund for Africa (BGFA), is to connect five million people to clean energy sources by 2025. In Zambia, while BGFZ has thus far shown promising initial progress on increasing energy access, there is a future opportunity for companies to increase the level of ambition and expand further into hard-to-reach rural communities, offer services to lower-income segments of the population, as well as to offer higher-tier connections serving productive use of energy.

Insights

The programme is notable for the speed and scale at which it has increased access to clean energy in rural areas of Zambia where the majority of low-income people live, while simultaneously generating significant health and economic co-benefits and reducing carbon emissions. The programme has helped incentivize and remove market barriers to the provision of green and affordable energy, thereby also laying the groundwork for future actors to enter the market and ensure the further scaling and sustainability of off-grid energy solutions. The subsidies provided by the social impact fund have helped correct market distortions caused by government electricity and fossil fuel subsidies and externalization of environmental costs, address the lack of access to growth finance for clean energy companies offering off-grid solutions, and helped companies to catalyse additional private investment. The initiative also helped set up the government-led Off-Grid Energy Taskforce, which has clarified regulation for solar home systems and established a regulatory framework for mini-grids.

The majority of people obtaining access to energy through the scheme live in rural and semi-rural areas and 26% of connections are for female-headed households. However, while the four companies involved have been able to expand their operations to all 10 provinces of Zambia (from four previously), a significant share of the connections, particularly during the early growth phase of the companies, is still with people living in the higher-density peri-urban and peri-rural areas, so the programme is yet to reach more remote rural areas where the share of low-income households, as well as the cost of providing services, is higher.

Looking ahead, this raises the question of whether additional measures are needed to expand access, such as targets for connecting low-income households and/or additional subsidies or ring-fenced grants to enable lower tariffs for low-income households. To address such concerns, BGFZ is investigating appropriate financial mechanisms for incentivizing companies to expand further into more remote rural communities and to prioritize affordability. Details of the programme design will be made public at the launch of the next procurement cycle (Q3 2020). One idea could be to make the incentives available to mission-led companies or cooperatives and fund them via a subsidy swap that reallocated some of the government's current fossil fuel subsidies to clean energy.

WHAT HAS CHANGED?

THE CHALLENGE

Zambia is highly vulnerable to climate change in terms of both food and energy supply. About two-thirds of its population depend on rain-fed agriculture for their livelihoods, and hydropower makes up nearly 95% of the electricity supply, so the country is vulnerable to decreased rainfall and drought. The country also suffers from environmental issues connected with the fact that mining is its primary economic activity, such as air pollution in mining towns, water pollution, sub-standard sanitation, wildlife depletion, land degradation and loss of biodiversity (CIA World Factbook, 2017).

Zambia is the second largest exporter of copper globally and was one of the world's fastest-growing economies between 2004 and 2014, with GDP growth of 6.7% per year (Ibid). It is considered a lower-middle-income country. However, growth has slowed significantly since 2014 due to falling copper prices, depreciation of the country's currency (the kwacha, ZMW) and severe drought, the last of which has reduced electricity production from the hydroelectric dams powering the country. As in other economies that depend heavily on extractive industries, the benefits of economic activity have not been distributed equally. Zambia has some of the highest levels of inequality in the world, with a Palma ratio of 5 (UNU-WIDER, 2019). As of 2015, the earnings of 58% of Zambians were below the international poverty line of \$1.90 per day (compared with 41% across sub-Saharan Africa), and three-quarters of poor people lived in rural areas (World Bank, 2019).

Zambian society is strongly patriarchal, with traditional gender roles that deny girls and women access to education, the formal labour market and land ownership. According to the 2014 Labour Force Survey, only 12% of women in the workforce are paid employees, as opposed to 71% of men. The remaining female workforce consists of 'contributing family workers' (CFWs) who support family businesses or farms without payment (Billima-Mulenga, 2018). Sexual violence remains a major issue and conservative views about a woman's place in society dominate the country's laws, as well as the mindsets of both men and women.

Currently, only 31% of Zambians have access to electricity, and that percentage falls to only 4% of households in rural areas (USAID 2018). Expanding energy access in Zambia is particularly challenging because the population are highly dispersed and work primarily in subsistence agriculture. Grid-scale projects, such as building new hydropower plants, would take more than 10 years to reach rural communities and are estimated to cost around \$2,000 per connection. Those without electricity rely on burning wood and charcoal for cooking, compounding problems like deforestation and climate change, not to mention poor air quality, which causes health problems. Furthermore, even the one-third of the

population currently connected to the grid experience regular power cuts because hydropower accounts for almost 95% of Zambia's installed capacity, making its energy supply vulnerable to drought. In 2015, droughts saw the country's power shortage widen to half of peak demand. As climate change intensifies, power shortages are only expected to worsen. At the time of writing (early 2020) Zambia was in the midst of another severe drought.

The Zambian government has historically subsidized electricity; in 2016, for example, electricity subsidies cost it \$26m per month (Bridle et al., 2018). However, these subsidies do not benefit the general population as much as they do the mining sector, because the mining sector uses between 55–70% of the total energy produced. Mining companies purchase energy directly from ZESCO, the vertically integrated state-owned utility, on the basis of longstanding contracts with fixed prices. In 2017, Zambia began the transition to cost-reflective tariffs to comply with the regional targets of the Southern African Development Community (SADC), gradually increasing the price of energy until it is cost-reflective (mandatory by law as of 2020). This has made grid energy even less affordable for those who had grid access.

There was also a weak regulatory framework for off-grid products, including unclear laws concerning land use for mini-grids and inconsistent application of tax exemptions for solar equipment.

Beyond the Grid Fund for Zambia initiative

The Beyond the Grid Fund for Zambia (BGFZ), funded by the Swedish International Development Cooperation Agency (Sida) and managed by the non-profit organization Renewable Energy and Energy Efficiency Partnership (REEEP), seeks to expand access to clean, off-grid energy supplies for rural Zambians. Launched in 2016, the €20m Fund incentivizes small private sector actors in the solar power industry to enter and scale up clean, off-grid energy in rural areas where it was not previously technically or economically feasible.

At the core of the BGFZ programme is a social procurement fund which involves a novel reverse auction process. In the first funding round, companies were invited to outline the level of energy service they could provide through selling their energy services, the number of customers they could reach, and the amount of public funding they would require over a four-year implementation period for scaling their business operations. BGFZ contracted companies that were able to offer the highest energy access outcomes (measured as a proxy value incorporating the total number and weighting of different connections) relative to their financing request from BGFZ as well as a credible, market-appropriate and viable business plan for the Zambian market. Four companies were selected based on these criteria, offering a range of products from small solar home systems that can power two lights and a phone charger (Tier 1) to mini-grid connections, which offer similar capabilities to those of the national grid (up to Tier 5). The majority of connections thus far have been Tier 1 and 2 connections, with an expected average cost of \$37 per connection at the end of the

programme's implementation. The companies, which previously operated in only four provinces in Zambia, are now operating in all 10 provinces and are on track to connect 1.6 million people to clean and reliable energy by 2021.

The project sought to demonstrate transparency and accountability by using a custom-made data hub, the Energy Data and Intelligence System for Off-Grid Networks (EDISON), which tracks each Energy Service Subscription (ESS) in real time and posts the results online (<https://edison.bgfz.org>). Payment from BGFZ is released only upon completion of the connection target and demonstrated progress of business plan implementation in six-month payment schedules. EDISON also tracks the number of jobs created as a result of the new connections, along with the amount of CO₂ mitigated, the number of female-headed households that are connected through the project (currently 26% of connections) and other metrics.

BGFZ has also created the Off-Grid Energy Taskforce, a coalition of public and private stakeholders including the Zambian Ministry of Energy, to improve market conditions through capacity building, technical assistance and stakeholder engagement (BGFZ, 2019a). The Task Force has been particularly active in drafting a policy to regulate the construction and operation of mini-grids, including clarifying land rights regulations, which has allowed one of the companies, Standard Microgrid, to install 10 micro-grids since the start of the project. The Task Force is also working to identify ways to improve the affordability of off-grid technology.



Mrs Joylex Zulu, a small business owner, shows the solar lighting and phone charging solution – a far more affordable light option when compared to batteries or candles. Photo and copyright: Jason J Mulikita/REEEP.

POVERTY REDUCTION

As of March 2020, the programme and companies have:

- reduced carbon emissions by 2,603 tonnes of CO₂e annually;
- strengthened the country's **energy security** by reducing reliance on hydropower, which is vulnerable to lack of rainfall and drought, and fossil fuels, which are becoming less economical;
- improved **access to energy** for over 168,000 households, or 875,810 people mostly living in rural or semi-rural areas, of which one-quarter are female-headed households, and is on track to connect 1.6 million Zambians by the end of the programme in 2021;
- provided significant **co-benefits** to households and wider society (BGFZ, 2019b), including:
 - cleaner air indoors: the companies' products have seen candles replaced with LED lights, and coal and wood replaced with efficient biomass pellet stoves for cooking;
 - savings on fuel bills: 87% of surveyed households said that they were spending less money on power, as the cost of the biomass pellets for stoves is lower than what they paid for coal, and the solar connections are cheaper than access to the grid (for those who had grid access before). The savings are mostly invested in food and feed for animals or used to service loans;
 - more and better education: 96% of surveyed households said that their children had studied more since they signed up for an energy service, and 91% said that their children now attended school more;
 - income generation: 25% of surveyed households said that they were undertaking new income-generating activities, mainly mobile phone charging and lighting of shops (BGFZ, 2019a). Over 2,000 businesses and institutions have been connected and over 1,664 jobs created (ESS real-time tracker updates at: <https://edison.bgfz.org>).
- hired 989 sales agents, of whom over 250 are women;
- improved communications by powering radios and charging mobile phones.

There is no current comprehensive data on the extent to which the companies have reached people at the bottom of the income scale or the most rural communities. In 2018, shortly after the programme started, an evaluation was conducted by a consulting company called CEEEZ (Phiri, 2017) which surveyed 164 households in three provinces (not yet published). Using the more conservative, asset-based measurement of poverty – the Proxy Means Test (PMT)² – the survey indicated that in the initial growth phase of the companies (1–1.5 years into implementation), 6.7% of the surveyed households were classified as poor (2.4%) or moderately poor (4.3%). About a quarter of the connections made under BGFZ are for female-headed households, which corresponds to the

26.6% of female-headed households overall in Zambia, last estimated by the World Bank in 2014 (World Bank 2020).

STRUCTURAL CHANGES

SIDA has been supporting efforts to expand rural electricity access in Zambia for over 10 years. In 2003, it helped to found and finance the Rural Electrification Authority (REA), a government agency tasked with designing and implementing a strategy to electrify rural areas. The REA strategy, however, focused primarily on extending the national grid, which proved extremely costly and time-consuming. Progress on this strategy was slower than expected and alternative approaches had started to emerge elsewhere. Within the framework of Power Africa, a USAID initiative started under the Obama administration in 2013, Sida noted that off-grid solar companies had gained momentum in East African markets, but that Zambia was not yet part of that market.

While there were some private sector actors in the country working to provide solar solutions, the private sector was hindered by a lack of funds. Even today, Zambia's financial sector continues to experience high interest rates and a severe shortage of liquidity. According to the Global Competitiveness Report 2015–2016, companies in Zambia consider access to financing to be the main constraint on growth (World Bank, 2017). Loans to off-grid energy companies are constrained by collateral requirements, interest rates of above 35% and the dominance of short-term capital. Therefore, Sida made the decision to direct funds towards incentivizing off-grid private sector solutions.

By providing public subsidies, the programme successfully addressed two key structural constraints on the provision of clean energy, namely the market distortion created by existing fossil fuel subsidies and the lack of access to growth funding for off-grid energy companies. The presence of fossil fuel subsidies creates an unequal playing field for clean energy providers. Additionally, because of the high costs of newer technology and technical training, clean energy projects can have extensive upfront costs and can struggle to compete against established energy suppliers.

The programme also helped companies to catalyse additional private investment. BGFZ's four-year funding commitment has allowed the contracted companies to leverage four times the amount of the original funding from other actors, such as impact investors and private companies³ (full list of third-party financiers listed here: <https://edison.bgfz.org/bfgz-impact/financials>). As such, the work of BGFZ is not displacing other economic activities or actors, but instead is augmenting local capacity and ensuring sustainability beyond the initial investment.

By helping clarify regulation for off-grid products, namely solar mini-grids, the programme enabled energy companies to enter the market and provide clean energy infrastructure and services, thereby expanding energy access and laying the groundwork for future scaling. The

availability of new technology and payment mechanisms also enabled companies to expand access.

Inclusivity

BGFZ has also sought to ensure inclusive solutions. Its focus, and the companies' primary target market, are rural areas, which is where the majority of people living in poverty reside. The programme's subsidy weighting and evaluation criteria for selection of the companies are designed to reflect this goal. As noted above, the majority of households connected to date live in rural or semi-rural areas and a quarter are female-headed households. However, the programme has not yet achieved adequate energy access for the most remote rural and lowest-income households.

Although the programme and the selected companies seek to achieve a positive development impact, their initial business models focused on expanding the customer base by serving higher-income customers in the peri-urban areas. This was not unexpected as it has been important for building portfolio health and the financial sustainability of the business. Affordability and the high cost of servicing remote rural areas are proving, as elsewhere, to be a challenge for scaling. In 2018, one study suggested that current energy services were unaffordable to an estimated 50–75% of households in Zambia (SAEP, 2018).

But there are now opportunities to reach beyond the initial customer base to more rural and lower-income households. The programme has built flexibility into the system to cope with challenging market environments such as in Zambia. The companies were given flexibility of 20% on targets and their progress is assessed against a four-year trajectory, giving them ample opportunity to test provision to low-income groups or make up for a bad quarter, such as during a serious drought.

Additionally, there are opportunities for companies to build long-term relationships with lower-income customers who are likely to upgrade their services over time. In particular, the pay-as-you-go (or PayGo) delivery models allows the companies to address the affordability gap by connecting previously 'unbanked' households. These are households who previously had no access to traditional financing mechanisms. Enrolling in an energy service and making regular payments under this programme allows families to build a formal credit history, giving them an opportunity to access additional formal financing in the future.

Customers are able to take advantage of PayGo delivery models, longer-term repayment plans, and the option to gradually upgrade from lower (and cheaper) tiers of energy to higher tiers (described as 'climbing the energy ladder'), making off-grid energy affordable to low-income households for the first time. Previous off-grid energy projects, implemented by both the Zambian government and the private sector, did not have these options and required customers to pay upfront for the technology, which proved to be prohibitively expensive and led to limited scaling up. For companies, PayGo financing requires substantial upfront

funding to purchase stock and recoup the costs from clients in the future, so international start-up funding was crucial for all four companies.

There are opportunities for companies to target ‘productive use’ customers, such as those who use an energy service to open a business and by building long-term relationships with customers who are likely to upgrade their services. To date, the vast majority of connections made under BGFZ have been lower-energy connections: Tier 1 (enough for two lights and a phone charger) and Tier 2 (the same as Tier 1, plus a radio). Lower-tier connections are key to improving livelihoods through improved education (e.g. children studying at night) and communications (especially important since poor families are less likely to receive vital information about severe weather events and political upheavals that have a disproportionate impact on them). However, institutions such as hospitals require higher levels of energy (Tiers 3 and up), which to date make up only about 1% of total connections. BGFZ conducted research to identify appropriate mechanisms for incentivizing these higher-tier, ‘productive use’ connections, so as to generate more economic activity and create more indirect benefits for poorer households, such as improvements in health outcomes due to better-functioning hospitals. However, targeted incentives addressing affordability are still required to ensure direct benefits to poorer customer segments.

BGFZ also faced some criticism from local solar companies who were unsuccessful in winning the bidding in the first round. As active members of the nascent Solar Industry Association of Zambia (SIAZ), they argued that local companies should have received preference over international companies, and that they had greater need of technical assistance and capacity building than these better-established businesses. However, a key focus of the programme’s design was to choose companies most likely to succeed to get to scale fast – those that could prove their financial and management capabilities and demonstrate the ability to secure additional investment. While BGFZ did not intend to be exclusive, one of the consequences of the procurement process was that some local companies had difficulties in competing. As such, support programmes tailored to early-stage local companies as well as creating an enabling environment to foster cooperation between international and local companies would be useful steps towards increased diversification of the off-grid market sector in Zambia.

Looking ahead, BGFZ is responding to the inclusivity challenge for the next cycle of funding. The details of the programme design will be made public at the launch of the next procurement cycle (Q3 2020).



Steven Miyoba shows the solar panel positioned on top of his home's roof. Despite living in an area close to Lusaka that is earmarked for grid expansion, he says it will be a number of years before his house eventually joins the grid. Off-grid solutions have made a positive impact on all areas of his life – including his finances, as the ReadyPay system is substantially cheaper than traditional lighting methods. Photo and copyright: Jason J Mulikita/REEEP.

Durability

The Off-Grid Energy Task Force laid important foundations for the future development of off-grid solutions by creating a regulatory framework for solar mini-grids and bringing together a variety of stakeholders to discuss options for how to make off-grid solutions more affordable to poorer households, such as VAT exemptions on LED lights.

The capital-intensive nature of an equipment-leasing business using a PayGo model requires ongoing sources of funding through debt and equity to raise working capital. A company's potential to secure additional funding, beyond what BGFZ provided, was therefore a key point of assessment in the tender. The four companies chosen proved capable of securing additional funding early on in the project (the bulk of it in the first year). In addition to the \$11m invested by BGFZ, as of January 2020, the four companies had been able to leverage an additional \$36.4m of investment.

However, to improve long-term sustainability, the incentives offered by BGFZ should be made available to a wider network of companies, ideally mission-led, in order to build a competitive and inclusive market for clean energy. Otherwise, the risk is of growing market concentration – as one analysis points out: 'Over the last five years, the world's three biggest off-grid solar businesses each received at least as much funding as all their peers outside the top 10 combined [\$120m]' (Lamb, 2019). The four Zambian companies that won BGFZ tenders represent only a fraction of the number of off-grid energy companies operating in Zambia, 'which [one source] estimates to be around 20, not including the numerous

small solar engineering and installation firms that are not actively represented or engaged in the country's industry associations. Many of them are still in the early stages of market development' (Brent, 2019). Ideally, some of these companies will succeed in securing tenders in the next cycle of funding to benefit from the subsidies and infrastructure put in place by BGFZ, and therefore to create a more competitive market for solar-powered energy in Zambia. This would theoretically further drive innovation and bring down prices for the end consumer, as well as create more local employment.

In the future, it is expected that the underlying technologies of off-grid energy, in particular those involving energy storage, will improve, thereby reducing costs and increasing profit margins. This should create a virtuous cycle in which companies are increasingly able to access commercial financing to keep scaling up. Currently, however, there still exists a viability gap between what clean, off-grid technologies cost and what people are able to pay for them.

USAID's mapping of Zambia's electrification potential suggested that it would cost \$4bn to achieve universal access by 2030, and that consumers using solar home systems would foot most of the bill (\$3.3bn of the total) (USAID Southern Africa Energy Program, 2018). But there is also potential for the Zambian government to engage in what is known as a 'subsidy swap', reallocating resources from existing electricity subsidies to more progressive subsidies that would encourage off-grid solutions for rural communities, thereby shifting the financial burden of energy transition away from consumers.

A subsidy swap that reallocated fossil fuel subsidies to clean energy could accelerate the deployment of clean energy technologies in Zambia (Merrill, 2017). In the meantime, international public funding like that of Sida is vital in catalysing the private sector to provide off-grid energy, providing financial incentives and a mechanism to bring together stakeholders to formalize regulation.

HOW CHANGE HAPPENED

SCALING PATHWAYS AND STRATEGIES

Scaling was initially mainly achieved vertically via the use of public subsidies, which were necessary to de-risk investment into areas that were previously not seen as economically viable and to attract additional investment needed for the heavy upfront costs of PayGo solar systems. When launching the programme, BGFZ implemented a 'reverse auction' procurement process, whereby energy companies were invited to submit proposals outlining the level of energy service they could provide, and projects were chosen based on their 'value for money' and the long-term sustainability of the business model.

As well as seeking to horizontally expand their customer base via conventional sales methods and the PayGo solar systems discussed above, the companies have sought to engage female sales agents to help ensure they reached women headed households. In practice, it proved difficult to recruit women sales staff due to patriarchal views about women's participation in the labour force (Roy 2019), but as of the June 2018 impact update by BGFZ, 30% of sales agents across the four companies were women. It is also likely, although there is no hard evidence, that information spreading via word of mouth and personal social networks has contributed to horizontal scaling.

Continuous monitoring of and reporting by companies and review by stakeholders should contribute to adaptation and improvement of the programme, such as its company selection criteria, and hence help to ensure its functional scaling. As stated on the BGFZ website: 'Because delivery of energy services at scale will take time, REEEP puts special emphasis on evaluating and testing the capabilities, track records, and business plans of bidders, so as to minimise the risk of failures throughout the programme period. REEEP monitors each Awardee closely throughout the programme lifecycle and tracks the deployment of every single ESS electronically to ensure compliance with the procurement' (BGFZ, 2019c). The tracking of connections and demographics, for example, has created a valuable resource for future policy making and regulation related to off-grid products.

DRIVERS AND CONSTRAINTS

Drivers

In 2013, under the leadership of the Obama administration, USAID launched the Power Africa initiative, bringing together governments, experts, and the private sector to address energy poverty in Africa. Realizing that previous efforts at addressing energy poverty had focused on expanding grid access to rural communities but had had poor outcomes, the initiative invested significantly in off-grid solutions. It helped several solar companies to gain momentum in East African markets, but Zambia was not yet part of the market.

The climate crisis has led to prolonged and more frequent droughts in Zambia, which have made hydropower an unreliable source of energy. The energy deficits caused by droughts in 2015 (and again in 2019) increased demand for off-grid energy solutions, as even customers already connected to the grid experience frequent power cuts and unreliable access. This has expanded the consumer base for solar products and allowed companies to scale up. The energy gap also, however, further reduced food security and the incomes of rural families who depend on agriculture, and they have been unable to afford the solar home systems. This has widened the affordability gap.

Encouraged by the early success of pioneering solar companies, the Zambian government recognized the role that they can play in the electrification of rural regions and has begun working to create an enabling environment for off-grid companies.

Advances in technology, particularly in battery storage capacity, continue to bring down the costs of solar technology, making it more economically viable in Zambia. The development of PayGo and mobile money systems has also made such systems more accessible to lower-income segments of the population than ever before.

Constraints

Still, significant constraints remain, namely affordability for low-income households, reliance on international funding and an energy market that is still distorted by fossil fuel subsidies.

Zambia is landlocked and its population highly dispersed, making the delivery of solar products expensive. The country's financial sector is not yet well enough developed to finance the significant upfront costs of PayGo solar systems. Thus, ongoing international funding is still necessary to de-risk investment and incentivize companies to serve low-income customer segments.

Zambia's energy sector is still highly distorted by government subsidies, mainly to support the mining industry, which requires significant amounts of electricity. Subsidized energy makes it hard for solar companies to compete on price.

TIMELINE

Scaling took place rapidly, with the programme exceeding its targets, although affordability for lowest-income households remains an issue:

- **2016:** Programme launched.
- **July 2017:** BGFZ signed the first contracts with the four energy service providers. All four were able to leverage additional funding almost immediately and achieved significant success within the first two years.
- **August 2017:** Africa's largest telecoms company, MTN, partnered with Fenix International to launch mobile payments for off-grid products.
- **October 2017:** Multinational electricity utility company ENGIE purchased Fenix International, which gave the company access to extensive and cheap funding to scale up.
- **April 2018:** The Off-Grid Energy Task Force was launched, which has since met five times to draft regulation and aggregate input from stakeholders about next steps.
- **Early 2019:** Zambia began experiencing a severe drought, which made many households financially- and food-insecure and caused the take-up of Energy Service Subscriptions to slow down compared with the rapid 'take-off' period.
- **April 2019:** BGFZ connected 100,000 Zambian households.
- **October 2019:** In the year prior to contracting with BGFZ, the four companies had sold just over 4,000 solar home systems in Zambia. After 18 months of working with the Fund, they had sold an additional 85,964, bringing modern, clean and affordable off-grid energy access to over 447,000 people. This was 99% above the target for this point as per the contracts (BGFZ, 2019a).
- **February 2019:** Sweden announced expansion of the programme to Burkina Faso, Liberia and Mozambique, as well as an additional round of funding for new companies in Zambia, through the new Beyond the Grid Fund for Africa (BGFA) facility.
- The details of the programme design will be made public at the launch of the next procurement cycle (Q3 2020).
- **Q3 2020** (approximately): Next procurement

FURTHER DETAILS

Justification and evidence base for scaling

Off-grid solutions offer a way of providing energy access to rural populations. Even for those currently connected to the grid, there is a strong case for diversification of the energy supply. Large and mini hydro stations account for 85–95% of installed electricity capacity in Zambia, but in recent years droughts have led to major energy shortages, as high as 50% of peak demand in 2015 (Hill, 2015). To deal with energy shortages, the government has expanded fossil fuel-based generation, such as coal power (almost 11% of the total in 2016). However, expansion into fossil fuels only exacerbates climate change, further endangering the country's hydropower-reliant energy supply and the livelihoods of the 75% of Zambians who are engaged in subsistence, rain-fed agriculture.

There was a strong case to be made for expanding energy access to rural communities on the basis of alleviating energy poverty and diversifying with renewable energy for continued economic growth and mitigation of climate change. Luckily, Zambia enjoys an average of 2,000–3,000 hours of sunshine each year, making it an ideal candidate for the development of solar power generation. In 2018, at the request of the Zambian government and with funding from USAID, the Southern African Energy Program (SAEP) conducted a geospatial mapping of population densities to identify the least-cost options for electrifying the country. The results established that off-grid solutions were the most promising route to electrification. In the short term, grid connections would account for only 25% of newly electrified households (primarily driven by the growth of urbanization in existing locations rather than by expanding the grid), while home solar systems would account for the remaining 75%. In the medium term, by 2030, solar mini-grids would also become commercially viable due to the declining costs of solar technology (USAID Southern Africa Energy Program, 2018).

Who was involved

- **Swedish International Development Cooperation Agency (Sida):** Programme funder. Sida has been a long-time donor to efforts to electrify rural Zambia. It was one of the founders and has been a primary funder of the Rural Electrification Authority (REA) since its inception in 2004. REA strategy focused on grid extension, which provides high quality connection but has demonstrated slow progress on increasing energy access. Sida saw opportunities emerging elsewhere and channelled resources towards supporting off-grid electrification. The REA is engaged with the project as a member of the Off-Grid Energy Task Force, along with other Zambian government actors.

- **Renewable Energy and Energy Efficiency Partnership (REEEP):**
An international non-government organization dedicated to developing innovative financing mechanisms to advance markets for clean energy services in low- and middle-income countries. REEEP's mission is to make clean energy technology accessible to all through targeted financing of small and medium-sized enterprises (SMEs), facilitating market- and community-led energy transitions.
- **Off-Grid Energy Task Force:** Embedded in and led by Zambia's Ministry of Energy, the Task Force brings together representatives from the Zambian government, the private sector and development partners to create regulatory frameworks, coordinate market development efforts and improve market conditions for off-grid energy services. Since its launch in April 2018, the Task Force has met five times and has already facilitated a VAT exemption for LED lights, the drafting of a new national mini-grid policy and the initiation of discussions to improve the affordability of off-grid energy solutions. The Task Force consists (BGFZ, 2019a) of:
 - **Government of Zambia:** Ministry of Energy (MoE), Department of Energy (DoE), Energy Regulation Board (ERB), Rural Electrification Authority (REA), Ministry of Finance (MoF), Ministry of National Development Planning (MNDP), Office of the Vice President (OVP).
 - **Partners:** African Development Bank (AfDB), Department for International Development (DFID – UK), European Union, International Finance Corporation (IFC), Swedish International Development Cooperation Agency (Sida), World Bank, United States Agency for International Development (USAID).
 - **Private sector:** Zambia Renewable Energy Association (ZARENA), Solar Industry Association of Zambia (SIAZ) and specially nominated representatives from private sector companies in the mini-grid and bioenergy off-grid sectors.

The four companies selected in the first round of BGFZ funding:

- **Emerging Cooking Solutions** is a Zambian company established in 2012 that makes high-efficiency stoves under the SupaMoto ('Strong Fire') brand, which are powered by pellets made from sustainable biomass. The stoves reduce cooking time by 75% and cost less than burning charcoal or wood, in addition to reducing air pollution and deforestation. Currently, most low-income families in peri-urban areas spend about \$200 per year on cooking fuel, but SupaMoto pellets are 30–40% cheaper than charcoal. The company has greatly benefited from the public subsidies because while the pellets are cheaper than charcoal, the stoves are not: the initial cost ranges between \$40 and \$100 (Emerging Cooking Solutions, n.d.). The high-end stoves have a built-in battery to power a fan for cleaner combustion and use solar power to charge the battery (without the fan, the combustion is not clean enough to cook indoors). Using BGFZ incentives, in 2016 Emerging Cooking Solutions introduced a comprehensive home energy package – a stove powered by a home solar system using PayGo technology. The company's new business model is to extend its payment terms for this comprehensive home energy system to 6–

18 months, much longer than the 3–4 months it typically offers for the stoves alone. As a result of this longer payment period, the company has more than doubled its average revenue per customer, increased its margins and reached both peri-urban and rural areas.

- **Fenix International**, a company offering home solar systems on a PayGo basis. Its ReadyPay systems allow customers to choose a pricing plan based on what they can afford, from running phones and two lights (Tier 1 connection) to this plus radio (Tier 2) and TVs and more (Tiers 3–5). Customers set up the solar kits themselves, and can upgrade by adding extra panels, lights and accessories. A Home Starter kit requires a deposit of \$10 and has a total price of \$160, which can be repaid over two years in daily, weekly or monthly instalments using mobile money transfers (Fenix International, 2019). Fenix has been successful partly because its home solar systems are the cheapest option, but also because it has prior experience of working in Uganda, and is therefore building on past knowledge and well-established management. The company also has an exclusive partnership with MTN Zambia, which is part of Africa's largest telecoms company, allowing customers to use MTN Mobile Money transfers to pay for their systems. MTN's established brand and large distribution network have helped Fenix to scale up quickly. In addition, Fenix International is now owned by multinational utility company ENGIE, so it has access to cheap finance. Besides electrification, Fenix's lease-to-own mechanism allows clients without previous access to credit to slowly build a repayment record, or credit history, which could allow them to access formal financing from banks in the future. With each payment, the customer receives a secure code via SMS to unlock their kit until the next payment is due.
- **VITALITE** allows low-income customers to access home solar systems for the first time. It has distributed over 20,000 home solar systems in the past two years. The systems include a 6W solar panel, two high-tech solar lamps, a battery pack, a solar-charged radio with USB and memory card inputs, a phone charging set with four different outlets to accommodate any phone and an infrared remote control (VITALITE, 2018). The cash price is \$92, though the company offers payment plans for up to 18 months (the majority of customers use payment plans of 12 to 18 months). Looking beyond the BGFZ funding, VITALITE also offers a solar-powered water pump, which is useful for the largely agricultural population in rural Zambia.
- **Standard Microgrid**: Microgrids are more finance-intensive than home solar systems and are limited in terms of the area they can cover. In order to be financially viable, grids must be installed in areas with higher population densities than is the case for individual home solar systems. However, they offer significant benefits in that they last for 20 years (as opposed to five years, which is the lifetime of a home solar system) and can provide higher levels of energy (up to Tier 5), which is what would be required to power larger institutions, such as schools and health clinics. Each 10kW grid can service up to 150 customers (including households, small businesses and clinics). Individual customers connect to the grid using 'smart' metering technology that is very similar to the home PayGo systems, allowing

customers to choose different payment plans for energy access. As of February 2020, Standard Microgrid had 10 operational grids, with plans to complete 88 by the end of the project (Standard Microgrid, 2020). The company initially ran into challenges due to the lack of regulation for microgrids, but it has benefited immensely from the work of the Off-Grid Energy Task Force, which has helped to create the necessary regulation regarding local land use for the installation of the 20-foot long panels.

ANNEX: CASE STUDY AT A GLANCE

<i>Case study name</i>	Reducing Energy Poverty: Beyond the Grid Fund for Zambia
<i>Location</i>	Zambia (country-wide). Project is currently being extended to Burkina Faso, Liberia and Mozambique, plus an additional round of funding for Zambia.
<i>Country indicators</i>	<p>Zambia:</p> <p>Income: lower-middle-income economy with 54% living below the national poverty line in 2015 (World Bank, 2019; World Bank, 2020).</p> <p>Inequality: high levels of inequality, Palma ratio of 5.0 in 2015 (UNU-WIDER, 2019).</p> <p>Human Development Index: ranked 143rd of 189 countries (UNDP, 2019).</p> <p>Gender gap: ranked 45th out of 153 countries (WEF, 2020).</p> <p>Civic space: rated as 'Obstructed' (Civicus, 2020.)</p> <p>Fragility index: 'High Warning'. (Fund for Peace, 2019).</p> <p>Climate Risk index: ranked 137th out of 181 countries for 1998–2018, (Eckstein et al., 2020).</p> <p>Ecological threat – Medium exposure, ETR count: 3 (Ecological Threat Register, 2020).</p>
<i>Time period</i>	Project span: 2016–22 (next cycle of funding to Zambia and the other countries will be for 2021–25).
<i>Systemic challenge(s)</i>	<p>Climate crisis</p> <p>Economic inequality.</p>
<i>Type(s) and scale of poverty reduction</i>	<ul style="list-style-type: none"> • Reduced carbon emissions, by 2,603 tonnes of CO₂e annually. • Strengthened energy security. • Improved access to energy: 160,726 households or 835,775 people connected – of which the majority live in rural or semi-rural areas and a quarter are female-headed households. The project is on track to connect 1.6 million people by the end of the programme in 2021. • Co-benefits: cleaner indoor air (85% of surveyed households); more and better education; savings on fuel bills (87% of surveyed households); increased incomes (255 households undertaking new income-generating activities and 1,300 jobs created); improved communications.
<i>Structural changes</i>	<p>Market transformation policies including:</p> <ul style="list-style-type: none"> • Public subsidies in the form of growth finance for renewable energy companies (helping rebalance market distortions and unequal playing field created by fossil fuel subsidies) • Clarification of regulation for solar mini grids

	<p>enabling future scaling.</p> <ul style="list-style-type: none"> • New energy infrastructure and services which enables wider access
<i>Dynamics of and pathways to scale</i>	Intentional change using (a) vertical pathways – market transformation policies to incentivize and reduce barriers to clean and affordable energy provision; (b) horizontal pathways – such as new types of energy service and female sales agents; and (c) target-setting and monitoring to enable functional scaling.
<i>Types and quality of evidence</i>	This project has high-quality metrics for the numbers of households and businesses that now have access to electricity and household surveys to establish co-benefits of electrification, as well as estimates of how much CO ₂ has been mitigated (updated in real time at: https://edison.bgfz.org).

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NOTES

- 1 Financial transactions that are conducted using a **mobile** phone, where value is stored virtually (**e-money**) in an account associated with a SIM card. Such transactions are compatible with basic phones and do not require internet access.
- 2 The Proxy Means Test (PMT) uses demographic information (i.e. age of household members and size of household); human capacity (i.e. education of household); physical housing characteristics (i.e. type of roof, walls and floors); durables (e.g. refrigerator, televisions or cars) and productive assets (i.e. land or animals) to determine whether a household is poor. If, for example, a household's head had a diploma/degree level education, was employed, owned a brick-walled house with metal roof, durables like television and car, and cattle, then the household was not classified as poor.
- 3 Full list of third-party financiers listed here: <https://edison.bgfz.org/bfgz-impact/financials>.



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