

OCTOBER 2019

Off-Grid Solar Market Assessment Ghana

Power Africa Off-grid Project

ABOUT POWER AFRICA

The Power Africa Off-grid Project is a four-year program that launched in November 2018 to accelerate off-grid electrification across sub-Saharan Africa. RTI International implements the project in collaboration with Fraym, Norton Rose Fulbright, Practical Action Consulting, and Tetra Tech. Power Africa is comprised of 12 U.S. Government agencies, over 145 private companies, and 18 bilateral and multilateral development partners that work together, supporting sub-Saharan governments to increase the number of people with access to power.

Power Africa aims to achieve 30,000 megawatts of new generated power, create 60 million new connections, and reach 300 million Africans by 2030.

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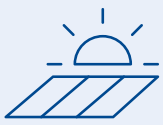
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|--------|--|
| AfDB | African Development Bank |
| AGSI | Association of Ghana Solar Industries |
| DANIDA | Danish International Development Agency |
| DCA | Development Credit Authority |
| EC | Energy Commission |
| ECG | Electric Company of Ghana Ltd. |
| ECOWAS | Economic Community of West African States |
| EPC | Engineering, procurement, and construction |
| EnDev | Energising Development |
| GDP | Gross domestic product |
| GEDAP | Ghana Energy Development and Access Project |
| GHS | Ghanaian Cedi |
| GIPC | Ghana Investment Promotion Council |
| GIZ | German Society for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit) |
| GoG | Government of Ghana |
| GOGLA | Global Off-Grid Lighting Association |
| GRA | Ghana Revenue Authority |
| GRIDCo | Ghana Grid Company Ltd. |
| IPP | Independent power producer |
| KfW | Credit Institute for Reconstruction (Kreditanstalt für Wiederaufbau), also known as the KfW Development Bank |
| LED | Light-emitting diode |
| MFI | Microfinance institution |
| MoE | Ministry of Energy |

| | |
|-------|---------------------------------------|
| MW | Megawatt |
| NEMP | National Electrification Master Plan |
| NES | National Electrification Scheme |
| NGO | Non-governmental organization |
| PAOP | Power Africa Off-grid Project |
| PAYGO | Pay-as-you-go |
| PDS | Power Distribution Service Ghana Ltd. |

| | |
|-------|---|
| PURC | Public Utility and Regulatory Commission |
| REMP | Renewable Energy Master Plan |
| SHEP | Self-Help Electrification Programme |
| SHS | Solar home systems |
| USAID | U.S. Agency for International Development |
| VRA | Volta River Authority |
| VSLA | Village savings and loan association |

INTRODUCTION

This report by Power Africa provides insights into the opportunities and risks associated with Ghana's off-grid solar energy market and gives companies, investors, governments, and other stakeholders a deeper understanding of the market. While other stakeholders (i.e., development partners) have conducted market assessments, Power Africa has identified market information gaps and seeks to bridge those gaps in the following ways:



This report provides a comprehensive and detailed review of solar home systems (SHSs), mini-grids, productive use of energy, and other aspects of the off-grid solar value chain. Additionally, this report includes details on policy and regulatory issues, the structure and historical context of the energy sector, and gender mainstreaming.



This report draws upon the most up-to-date sales and investment data from GOGLA in order to keep pace with the ever-changing dynamics of the off-grid solar sector.



Insights in this report help Power Africa Off-grid Project (PAOP) plan and prioritize activities across work streams of policy and regulations, market intelligence, business performance, access to finance, and cross-sectoral integration throughout sub-Saharan Africa.

The report also serves as a baseline for Power Africa's technical advisors to guide their continuing work and provides a snapshot that can be used to determine growth and changing dynamics of the market over time. Insights provided in this report include characteristics of Ghana's electricity sector, electrification targets, government regulations, donor-funded activities, and details on subsectors of the off-grid solar energy market. Additionally, this report includes expert knowledge from Power Africa lead advisors, information gathered from stakeholder interviews, and data from the Global Off-Grid Lighting Association (GOGLA). For five countries (Cameroon, Côte d'Ivoire, the Democratic Republic of the Congo, Ethiopia, and Niger), a geospatial analysis was performed that leveraged machine learning to identify the potential local markets for off-grid solar energy. The geospatial analysis provides granular details (i.e., latent electricity demand by household income) that will assist companies seeking to expand into new geographic markets.

About Power Africa and the Power Africa Off-grid Project (PAOP)

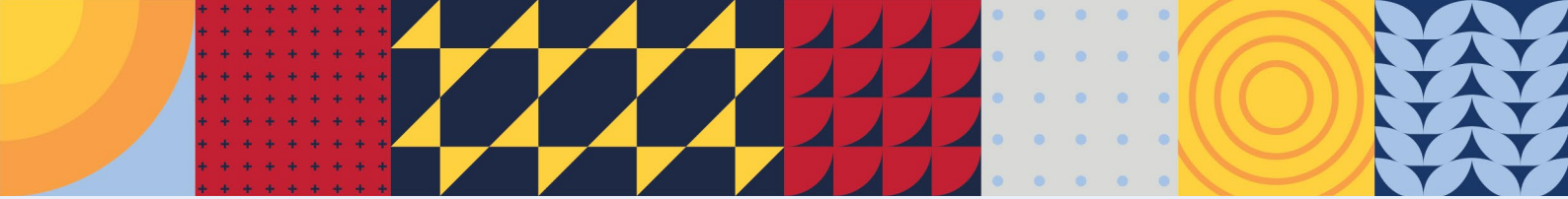
Power Africa aims to accelerate off-grid electrification across sub-Saharan Africa through targeted, context-specific interventions with private-sector companies, governments, investors, and donors. Power Africa's goal is to increase electricity access by adding 30MW of new generation capacity, and 60 million new connections through grid and off-grid solutions by 2030. The goal of the Power Africa Off-grid Project is to provide support to private off-grid companies and make the markets in sub-Saharan Africa more attractive for investment and operations. Power Africa defines "access" as the direct or actual number of new households and businesses connected to electricity via an on- or off-grid solution. The project focuses on accelerating off-grid energy access through household SHSs and mini-grids, with the goal of facilitating

six million new connections by 2022. The project aims to accelerate off-grid electrification across ten focus countries in Africa: Cameroon, the Democratic Republic of the Congo, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Niger, Rwanda, Senegal, and Tanzania. Figure ES-1 identifies the countries in Africa receiving Power Africa support, with the focus countries highlighted. The pins represent the locations of the project's in-country advisors.

FIGURE ES-1. THE PROJECT PROVIDES SUPPORT TO 20 COUNTRIES IN AFRICA



The Power Africa Off-grid Project (PAOP) is a Power Africa project funded by the U.S. Agency for International Development (USAID). Power Africa brings together technical experts with stakeholders from the public and private sectors to increase energy access rates in sub-Saharan Africa. The Power Africa Off-grid Project is implemented by RTI International and headquartered in Pretoria, South Africa.



I EXECUTIVE SUMMARY

Ghana’s off-grid power sector is characterized by government policies and donor-funded projects that stress government ownership of energy assets. It is also shaped by private solar home systems (SHS) companies that directly serve consumers. Both government- and company-led approaches are complicated by Ghana’s high, 84 percent, nation electrification rate,¹ as remaining off-grid communities present challenges regarding the distribution, installation, and/or servicing of systems.

Government electrification efforts are guided by the Rural Electrification Master Plan, which is a high-level planning document that sets deployment targets for stand-alone solar systems, solar lanterns, and mini-grids. The implementation of electrification projects is typically funded by donors, such as the African Development Bank’s (AfDB) Ghana Scaling up Renewable Energy Program.



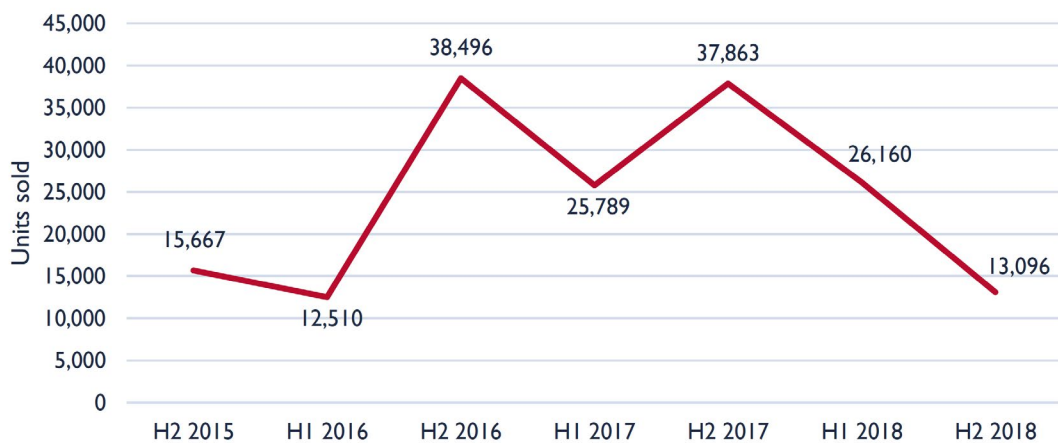
The program’s objectives are to install 55 mini-grids, as well as stand-alone solar systems for 33,000 households, 1,350 schools, 500 health centers, and 400 communities.

These government-driven projects, especially mini-grids, are typically intended to be owned and operated by one of the government-run electricity distribution companies, with private involvement limited to construction.

Pico-solar Sector Overview. For private-sector SHS companies, Ghana is a competitive market. The crowded field of companies includes a few large international players, such as PEG and ZOLA Electric, and several local renewable energy distributors. These companies rely on a variety of sales and distribution models, many of which entail partnerships with commercial and financial organizations, such as agricultural corporations or microfinance institutions, to handle consumer finance. Although important, such opportunities for partnerships are limited in Ghana.

While SHS sales have peaked in recent years, they fell during each half of 2018, according to the Global Off-Grid Lighting Association (GOGLA), as shown in Figure ES-1.

FIGURE ES - 2. GOGLA SALES DATA FROM 2015 THROUGH 2018



¹GhanaWeb, “Universal Electricity Access Target Moved from 2020 to 2025.”

Source: ²

Possible reasons for the decrease in sales are lower awareness and demand for SHS in urban and peri-urban areas because of improved grid reliability and overall saturation of urban and peri-urban markets. Companies may struggle to reach remote off-grid customers because of the difficulties with last mile distribution, including uncertain grid connection status, poor mobile coverage, underdeveloped transportation infrastructure, and sales agent capacity and retention. Furthermore, throughout the 2018 downturn, pay-as-you-go (PAYGO) sales were 50 percent of market share, suggesting that demand has dropped across market segments, regardless of affordability constraints.

Financing is another challenge experienced by Ghana’s SHS companies. The major PAYGO operators, PEG and ZOLA Electric, can raise significant amounts of funding from international investors because of their larger funding needs and larger, bottom-of-the-pyramid customer bases. Smaller, local companies, such as Wilkins Engineering Ltd. or NorthLite Solar Ltd., have been less successful with raising significant funding. These local distributors have smaller operational footprints and typically offer products on a cash-and-carry basis, which does not accommodate very low-income consumers. In addition, although crowdfunding has become an important source of finance for local companies in some markets, Ghanaian companies have yet to experience traction on crowdfunding platforms.

Mini-grid sector overview. Private participation in Ghana’s mini-grid sector is considerably more constrained than its SHS sector. The Government of Ghana views mini-grid development as strictly top-down and government driven. This stance is affected by the lack of a licensing framework for private mini-grids. Thus, nearly all mini-grids built to date, as well as those in the current development pipeline (Table ES-1), are donor-funded and government-owned.

TABLE ES 1. GOVERNMENT MINI GRIDS

| SPONSOR | NUMBER OF SITES | DISTRICTS | YEAR ANNOUNCED | EXPECTED YEAR OF OPERATION | STATUS |
|--|-----------------|--|----------------|----------------------------|----------------------|
| World Bank—Ghana Energy Development and Access Project | 5 | Sene East, Krachi West, Krachi East, and Ada | 2007 | 2015 | Operational |
| Swiss Government | 3 | Alokpem and Azizakpe island communities | 2019 | Not defined | Tender Awarded |
| AfDB—REP | 55 | Ada East | 2015 | Not defined | Feasibility |
| U.S. Trade Development Agency | 50 | Afram Plains South | 2018 | 2020 | Feasibility planning |

Sources: (Centre for Energy, Environment and Sustainable Development 2018; Dassah 2018; Tisheva 2018)

Despite the lack of private licensing, some private-sector development has occurred in Ghana, most notably by Black Star Energy, which operates 17 mini-grids. Black Star Energy has been successful in raising impact equity investments, crowdfunding debt,³ and grants, such as the EDF Pulse Africa award.⁴ Although Black Star Energy has been successful in operating its mini-grids, from an official standpoint, the company is only

² GOGLA, “Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data.”s

³ Poindexter, “Black Star Energy.”

⁴ JoyBusiness, “Black Star Energy Motivated to Produce Cheaper Sustainable Power - CEO.”

an installer, and its retail operations have merely been tolerated by the government. Without a framework for licensing of private sector mini-grid operation, however, Black Star Energy’s situation does not represent a replicable process.

Productive Use Sector Overview. Private companies, government, and donors all play a role in the market for productive-use products. The most notable productive-use applications are found in the agricultural and health sectors. Solar pumping is gaining importance among both off-grid energy companies and traditional agricultural suppliers. Health clinic electrification programs are being implemented by the government, through its Community-Based Health Planning and Services, and by private developers (Table ES-2).

TABLE ES 2. COMPANIES OFFERING PRODUCTIVE USE APPLICATIONS

| COMPANIES | PRODUCTIVE-USE APPLICATIONS |
|---------------------------------------|---|
| PEG | Water pumping for irrigation and SHS for small and medium enterprises |
| Hatoum Trading | Water pumping for irrigation |
| SkyFox Ltd. | Water pumping for irrigation |
| Stella Futura | Health centers |
| Redex International | Vaccine refrigeration and health centers |
| Suka Wind and Solar Energy Ghana Ltd. | Water pumping for irrigation |

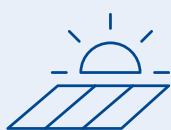
Sources: (Centre for Energy, Environment and Sustainable Development 2018; Dassah 2018; Tisheva 2018)

Similar to the broader off-grid sector, government and donors actively support productive use. In the Renewable Energy Master Plan, the Government of Ghana has set targets to deploy 6,000 solar pumps and 80 solar dryers by 2020. Donors programs, such as Energising Development (EnDev), funded by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), and the Ghana Commercial Agriculture Project, funded by the World Bank and the U.S. Agency for International Development (USAID), support these targets by undertaking both small- and large-scale irrigation schemes.

2 GHANA ENERGY SECTOR OVERVIEW

2.1 COUNTRY INTRODUCTION

According to several metrics, Ghana is a bright spot for economic and social development in Africa. In 2017, Ghana was ranked second on the continent in terms of growth in gross domestic product, and it is consistently among the top three African countries for freedom of speech and freedom of the press.⁵ Expectations for continued performance are high, and in response, the Government of Ghana (GoG) is spearheading major initiatives in manufacturing, agriculture, and education.⁶ Complementing, and in some cases underpinning these initiatives is Ghana's electricity sector.



Ghana boasts the second highest electrification rate of any country in sub-Saharan Africa and ranks sixth in the region on the World Bank Group's Doing Business assessment for getting electricity.⁷

As such, the GoG views the electricity sector as critical to its economic and social objectives and seeks to play a key role in all aspects of sector development.

The GoG plays a commanding role in both on- and off-grid power. Although Ghana's power sector allows for independent power producers (IPPs), transmission, distribution, and the bulk of generation is government-owned. Thirty years of electrification efforts have brought the country to the cusp of achieving its long-term grid access targets. In the off-grid sector, government agencies have taken a lead on deploying both stand-alone power systems and community mini-grids. GoG's vision for off-grid electrification is, therefore, one of public sector-driven development, which has led to a relatively low level of policy support for private-sector electrification.

Despite this environment, many private-sector solar home systems (SHS) distributors, including prominent international players, are active in Ghana. Prime movers of the pay-as-you-go (PAYGO) business model, PEG and ZOLA Electric (formerly Off Grid Electric), have had a presence in the country for several years, and a number of local renewable energy installers now participate in various parts of the SHS value chain.

Although Ghana served as an early target for SHS in West Africa, the outlook for the industry has declined in recent years. During 2015 and 2016, chronic load shedding—colloquially known as dumsor—drove demand for off-grid power in urban and peri-urban markets,⁸ and donor programs, notably the World Bank's Ghana Energy Development and Access Project (GEDAP), raised the profile of off-grid solutions. In recent years, however, improvements to grid reliability have contributed to overall sales leveling off.

⁵ See Annex A for more economic and demographic indicators

⁶ The World Bank, "Ghana Overview."

⁷ The World Bank, "Rankings & Ease of Doing Business Score."

⁸ Clerici, Schwartz Taylor, and Taylor, "Dumsor."

The current state of the SHS sector is marked by its rural client base, which is characterized by challenges common to last-mile distribution. Some of these challenges include high transport and logistics costs, difficulties regarding sales agent effectiveness and retention, low levels of access to mobile networks, and lower purchasing power. To be successful under these constraints, SHS companies require a well-tuned distribution operation, significant and consistent funding, and above all, patience. Results in this regard have been mixed.

More challenging yet is Ghana's private mini-grid sector. High levels of electrification mean that mini-grid sites are relegated to the most remote regions, notably island and lakeside communities on Lake Volta, which have been set aside for off-grid development in government planning. Even there, government-driven models, including several donor-supported initiatives, dominate. Moreover, two policy stances effectively block privately owned and operated mini-grids (i) a lack of a private licensing regime and (ii) a commitment to a harmonized national tariff with no private subsidy forthcoming.

Off-grid opportunities in Ghana are primarily driven by long-term customer value, not market size. PAYGO companies are arguably loan providers first and SHS distributors second. They view their clients as aspiring to larger appliances, financial products, and business assets. In this light, even government-owned mini-grids offer opportunity for financing productive-use equipment. Ghana's relatively strong economic and political situation, not to mention its high level of grid access, requires the off-grid sector to look past the immediate benefit of its products and toward integrating into diverse sectors of a growing economy.

2.2 ELECTRIFICATION

2.2.1 GRID ELECTRIFICATION STATUS

Ghana's current energy access agenda is guided by the National Electrification Scheme (NES). Adopted in 1989, the NES outlines a grid extension policy designed to realize universal access by 2020 (since adjusted to 2025). Rather than a single roadmap, the NES comprises various financing mechanisms, five-year electrification plans, and supplementary programs. The most significant of these components are the National Electrification Levy, which is a fee paid by consumers; the National Electrification Fund; the National Electrification Master Plan, which is reviewed every five years; and the Self-Help Electrification Programme (SHEP), which is a community-driven electrification mechanism.

The NES defines universal access as an access rate of 90 percent. Here, "access" is defined as the ability to connect to the grid and is applied only to those communities that are greater than 500 households in size, are accessible by road, and are situated within 20 kilometers of existing distribution lines. Villages that do not meet these criteria are not considered in the access rate calculations.

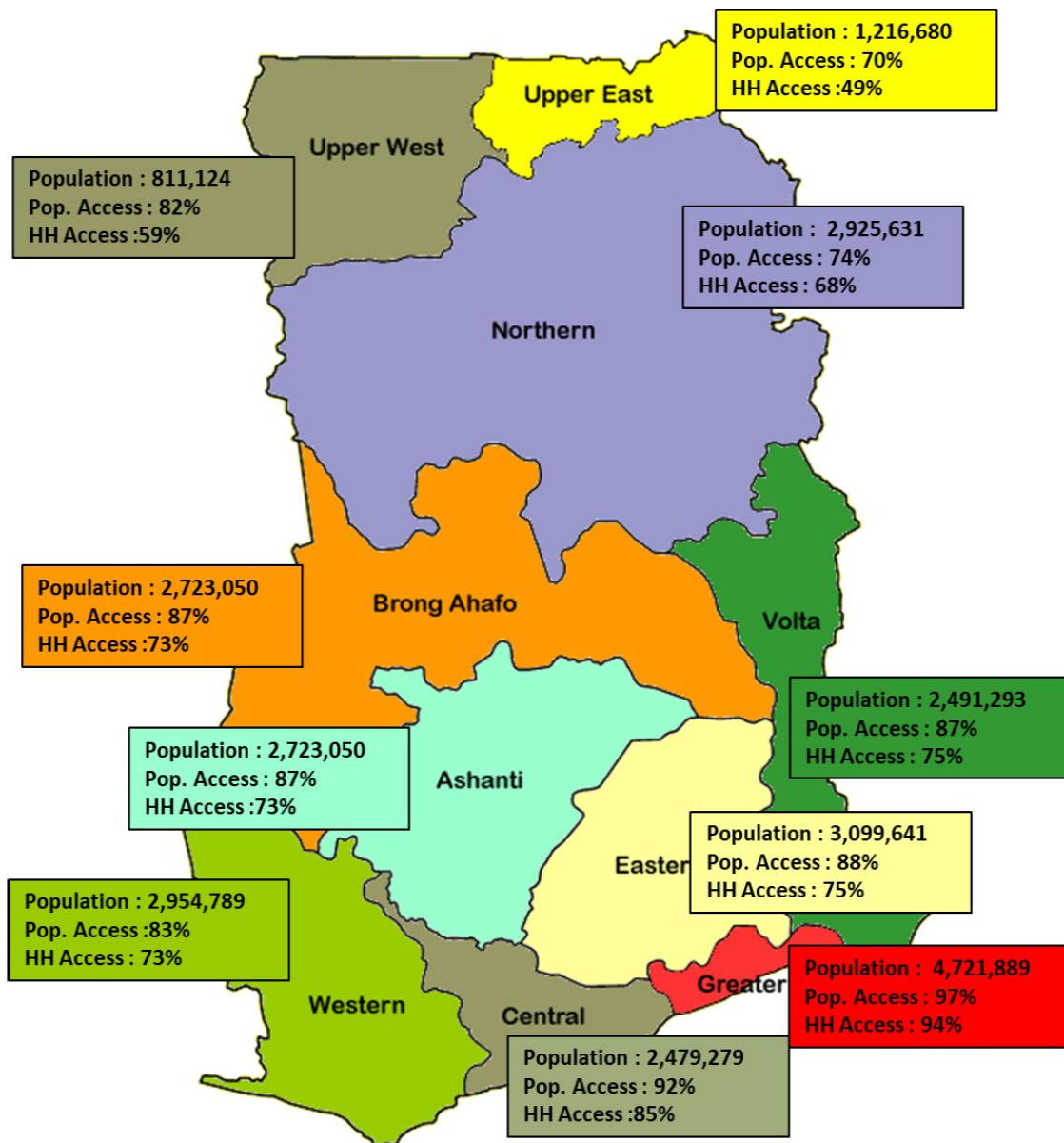
Data regarding the size of Ghana's off-grid population can be difficult to obtain and at times contradictory. Although key institutions such as the Ministry of Energy (MoE), the Power Distribution Services (PDS) Ghana Ltd. (formally the Electricity Company of Ghana⁹), and the Volta River Authority (VRA) are mandated to share information about grid access, they do not often release data. In addition, estimating electrification rates outside of the formal NES universal access definition would result in lower rates than official figures suggest.

Official figures show that progress toward universal access has been substantial but is falling short of the 2020 target. Recognizing this issue, GoG pushed the universal access target to 2025 in June 2019. At the adoption of the NES in 1989, electricity access was approximately 25%. The rate had increased to 66.7% by 2009 and to 84% (91% urban and 71% rural) by 2018.⁹ Estimating electrification rates outside of the formal NES definition to include those households not in communities meeting the minimum criteria would result in lower rates than official figures suggest, however.

electrification rates outside of the formal NES definition to include those households not in communities meeting the minimum criteria would result in lower rates than official figures suggest, however.

The Energy Commission (EC) publishes the most up-to-date map of electricity access in Ghana (Figure I). The map shows access rate by population and household coverage by region,¹⁰ which is Ghana’s main level of subnational administration. Even though the EC uses the map in published material, the map is not available online.

FIGURE I. ENERGY ACCESS MAP OF GHANA



Source: ¹¹

Note: Figure created by Power Africa Technical Advisor

⁹ Millennium Development Authority of Ghana, “Transfer of ECG Assess and Operations to PDS Ghana Ltd.”

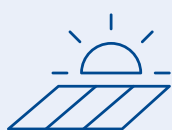
¹⁰ In 2018, six new regions were broken out from existing boundaries (i.e., Oti from Volta; Savannah from North; Western North from West; North East from Upper East; and Ahafo, Bono, and Bono East subdividing Brong Ahafo). Data used in this report refer to the previous administrative boundaries.

¹¹ Energy Commission, “2018 Ghana Energy Statistics Handbook.”

When NES was adopted in 1989, electricity access was approximately 25 percent. That rate increased to 66.7 percent in 2009 and by 2018, it had gone up to 84 percent, including a rate of 91 percent for urban and 71 percent for rural communities.^{12 13} Official figures show that progress toward universal access has been substantial but is falling short of the target. In June 2019, GoG pushed the universal access target back from 2020 to 2025.

2.2.2 RURAL ELECTRIFICATION STRATEGY

Off-grid electrification planning is embedded in the Renewable Energy Master Plan (REMP), which sets deployment targets for stand-alone solar systems, lanterns, and mini-grids. The REMP emphasizes government-driven approaches to reaching last-mile consumers and relies on government entities to deploy, own, and operate systems. The REMP also specifically targets island and lakeside communities around Lake Volta because these areas do not fall under the NES universal access definition and are least likely to be electrified in the near term.



The REMP targets the installation of 1,000 stand-alone solar systems for community institutions and streetlights by 2030.

The REMP also recognizes the importance of solar lanterns in offering basic energy services and suggests instituting incentives and quality assurance programs to encourage local lantern manufacturing. Little else is elaborated, however, with respect to developing these initiatives.

The Mini-Grid Electrification Policy is intended to incorporate mini-grid technology into the NES framework. Under this regime, VRA, PDS, and the Northern Electricity Distribution Company would lead mini-grid implementation and ownership. The REMP elaborates on this policy by setting deployment targets.

Table I provides REMP targets for mini-grid, lantern, distributed, and stand-alone solar deployment.

Table I. REMP Off Grid Solar Targets

| TECHNOLOGY | UNIT | 2015 (REFERENCE YEAR) | 2020 | 2025 | 2030 |
|------------------------------------|---------------|-----------------------|---------|---------|-----------|
| Lanterns | Systems | 72,000 | 200,000 | 500,000 | 1,000,000 |
| Distributed solar | Megawatt (MW) | 2 | 20 | 100 | 200 |
| Stand-alone solar (grid connected) | MW | 2 | 10 | 15 | 20 |
| Mini-grids | Systems | 13 | 86 | 200 | 300 |

Source: Ghana Renewable Energy Master Plan

¹² Kumi, “The Electricity Situation in Ghana: Challenges and Opportunities.”

¹³ GhanaWeb, “Universal Electricity Access Target Moved from 2020 to 2025.”

In addition, the REMP includes estimates of the investment required to meet the 2025 targets. It is important to note that these investment figures correspond to a separate set of deployment targets. Table 2 indicates the investment estimates and alternate deployment targets.

| TABLE 2. REMP INVESTMENT ESTIMATES | | | |
|------------------------------------|---------------|---------|--------------|
| TECHNOLOGY | UNIT | 2020 | INVESTMENT |
| Lanterns | Systems | 128,000 | \$3,480,000 |
| Distributed solar | Megawatt (MW) | 18 | \$50,400,000 |
| Stand-alone solar (grid connected) | MW | 7.5 | \$21,000,000 |
| Mini-grids | Systems | 86 | \$56,940,000 |

Source: ¹⁴

As previously mentioned, government planning has ceded the most remote areas around Lake Volta to off-grid electrification. There are more than 2,000 communities across 23 districts around the lake that are unlikely to be connected to the national grid. The following stand-alone programs or funds are integrated into the REMP framework to accelerate electrification efforts.

SHEP. Although Ghana’s primary off-grid planning relies on top-down, government-driven approaches, SHEP makes room for grassroots, community-driven initiatives. Under SHEP, communities may work through local leadership to receive government support via the district assembly in realizing grid access earlier than scheduled under the National Electrification Master Plan. Communities applying for SHEP must procure and erect all of the required distribution poles themselves and demonstrate that at least one-third of households are wired and prepared to be connected.

The Rural Development Fund: Managed by the Danish International Development Agency (DANIDA), the Rural Development Fund provides \$20 million to small and medium enterprises (SMEs) involved with the following: (i) agriculture and manufacturing, and (ii) energy (including SHS companies) on an 80/20 allocation, respectively. The scheme channels these funds through on-lending agreements with local banks to reduce collateral requirements for small borrowers. Lending rates are indexed to the Ghana Treasury Bill yield, allowing a maximum 10 percent margin.

Renewable Energy Fund: The Renewable Energy Act of 2011 calls for establishing a Renewable Energy Fund to incentivize and promote the development of renewable energy projects.¹⁵ Theoretically, the fund would also extend to off-grid development; however, the fund has not yet been established and is unlikely to be established anytime in the near future.

¹⁴Ahiataku-Togobo et al., “Ghana Renewable Energy Master Plan.”

¹⁵Ahiataku-Togobo et al.

2.3 ENERGY-SECTOR INSTITUTIONS

2.3.1 GOVERNMENT INSTITUTIONS

Ghana’s energy sector is organized around the MoE; several independent regulatory bodies govern activities involving grid operation, sales and installation of energy systems, and importation of energy equipment and products

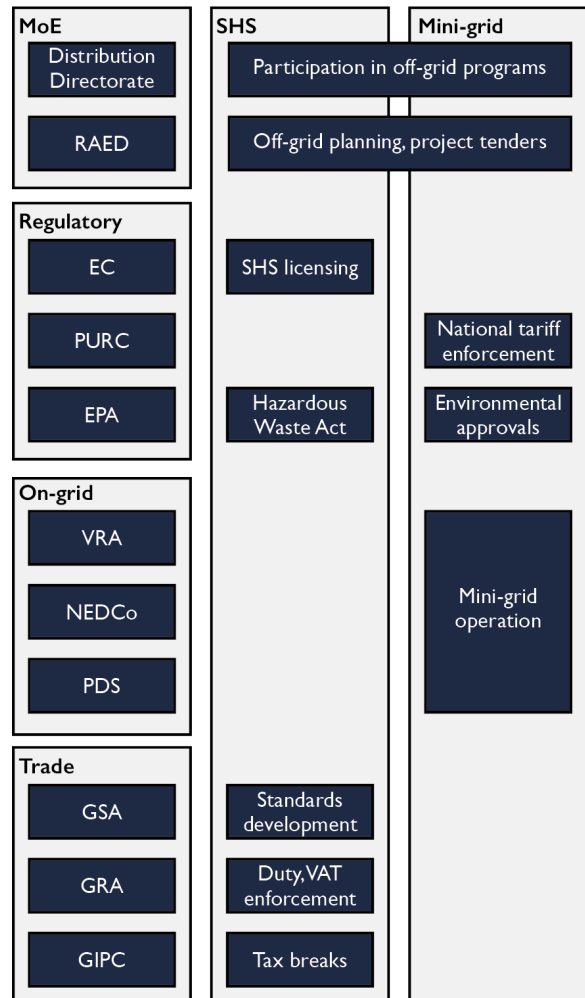
MoE. The MoE oversees all aspects of energy-sector policy. There are two sub-entities that are important to energy access. The first sub-entity is the Renewable Electrification Unit, which sits under the Renewable and Alternative Energy Directorate. The unit is responsible for developing on- and off-grid electrification programs. It tenders for its off-grid projects through an engineering, procurement, and construction (EPC) model, but otherwise private-sector engagement is limited. The second sub-entity is the Distribution Directorate, which focuses on grid extension but has also participated in off-grid electrification programs. While the MoE has a Gender Focal Point, has conducted a gender audit, and has developed a Gender Action Plan, it has been slow to implement the plan.¹⁶

Energy Commission (EC). As Ghana’s technical energy regulatory body, the EC is charged with licensing companies working in the energy sector, including renewable energy supply and installation companies, under which SHS companies are categorized. Licensed energy companies are required to submit reports to the EC with the generation capacity that the companies have installed or the number of stand-alone systems they have sold. The EC also commonly engages with the private sector, such as through an annual renewable energy fair.

Public Utility and Regulatory Commission (PURC). PURC oversees traditional economic regulatory functions for the on-grid sector. Some of the functions include tariff approval, quality of service monitoring, and consumer protection. Tariff regulation for the off-grid sector falls under PURC’s duties, and although no official guidance has been released, private-sector engagement in off-grid mini-grids is, in theory, not precluded.

Environmental Protection Agency. The Environmental Protection Agency sets and enforces environmental regulations. The 2018 Hazardous Waste Act impacts the SHS sector, which requires permits for all companies that import or manufacture electrical or electronic equipment.

FIGURE 2. GHANA’S INSTITUTIONAL FRAMEWORK FOR OFF-GRID



¹⁶Morris et al., “Situation Analysis of Energy and Gender Issues in ECOWAS Member States.”

The Ghana Standards Authority. The Ghana Standards Authority develops standards for energy technologies, including SHS. Standards are designed based, in part, on requirements defined by the EC. Enforcement of standards falls on customs officials.

Ghana Revenue Authority (GRA). The Customs Division, which is housed under the GRA, is responsible for implementing Ghana’s customs taxes, including import and export duties, import value-added tax (VAT), import excise, and other levies.

Ghana Investment Promotion Council (GIPC). The GIPC was established to promote foreign investment in Ghana. The GIPC provides tax incentives to foreign companies investing in local projects and duty exemption for equipment used in those projects, including off-grid renewable energy.

2.3.2 GRID ELECTRICITY COMPANIES

Ghana’s on-grid electricity sector is horizontally integrated; generation, transmission, and distribution are unbundled across several government-owned companies and private IPPs.

Generation is dominated by the state-owned VRA and Bui Power Authority with installed capacity of 2,600 megawatts (MW) and 400 MW, respectively. VRA is primarily based in the Volta Region, operating a number of large hydropower plants on and around Lake Volta, as well as several thermal plants. In contrast, the Bui Power Authority manages one hydropower plant on the Volta River upstream of Lake Volta. IPPs operate an additional 1,700 MW of thermal capacity and 40 MW of solar power. Ghana’s total installed generation capacity is 4,740 MW.

Transmission and distribution responsibilities are split between GRIDCo, the transmission company; PDS, the main distribution company covering six regions—Greater Accra, Eastern, Volta, Central, Western, and Ashanti—and the Northern Electricity Distribution Company, primarily serving Brong-Ahafo, Northern, Upper East, and Upper West Regions.

Power quality and reliability in Ghana have increased in recent years after experiencing intermittent bouts of poor reliability and scheduled load shedding since the 1980s. The most recent period of unreliability occurred in 2015 because of supply shortfalls stemming from inadequate water levels at the country’s hydropower plants and natural gas shortages.¹⁷

2.3.3 INTERNATIONAL DONORS



In Ghana, international donors are very active in the off-grid energy sector and are closely aligned with GoG’s preference for public-sector off-grid projects. Many international donors and groups are supporting projects in Ghana’s energy sector.

Donor Coordination Working Group. Ghana has an active donor coordination working group that includes representation by all of the major donors working in the on- and off-grid energy sector. The working group meets regularly to ensure alignment and to discuss challenges and lessons learned. Working group participants include representatives from the African Development Bank (AfDB), the European Union, the United Nations Development Programme, Agence Française de Développement, and Kreditanstalt für Wiederaufbau (KfW). Working group participants also include representatives from Gesellschaft für Internationale Zusammenarbeit (GIZ), the Millennium Challenge Corporation, the Switzerland State Secretariat for Economic Affairs (SECO), the U.S. Agency for International Development (USAID), and the World Bank.

¹⁷ Climate Investment Funds, The World Bank, and African Development Fund, “Scaling Up Renewable Energy Program in Ghana.”

Programs specific to the off-grid sector, categorized by donor or group, are discussed in the remainder of this subsection.

AfDB. The AfDB is managing a \$1.5 million grant facility on behalf of the Climate Investment Fund to finance technical assistance under the Ghana Scaling up Renewable Energy Program. These grants have been used for project preparation studies, including the following:

- › Environmental and social impact assessments for solar projects with net metering and storage.
- › Socioeconomic, environmental and social impact assessments, and demand studies for mini-grids and stand-alone solar photovoltaic systems in 55 island communities. Preparatory studies are expected to conclude in 2020,¹⁸ and EPC tenders for these grids are currently under development.
- › The Ghana Scaling up Renewable Energy Program’s overall off-grid objectives include public-sector investment in 55 renewable mini-grids and private-sector investment in stand-alone solar systems for 33,000 households, 1,350 schools, 500 health centers, and 400 communities.

GIZ. GIZ is supporting the Energising Development (EnDev) partnership. Financed by Germany, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom, EnDev focuses on energy access and productive use in several sub-Saharan countries. EnDev support consists of a program to integrate SMEs and smallholder farmers into electricity planning processes and to provide market entry support for private distributors of solar pumps.¹⁹ EnDev support will be phasing out in Ghana in mid-2019.

People’s Green Energy, another GIZ program beginning in late 2019, will support decentralized energy for irrigation, productive uses, and social infrastructure in both on- and off-grid communities. The program is working in eight African countries overall, focusing on policy, training, and business productive-use planning for communities and SMEs.²⁰

SECO. SECO is supporting the development of three mini-grids on island communities in Ada East District. The MoE is currently in the process of evaluating EPC bids.

Department for International Development. The Department for International Development’s Africa Clean Energy program is working in a number of African countries to accelerate the off-grid solar sector through market-based approaches. These approaches are to provide environment support to policy makers and regulators; provide grants to off-grid companies through the Africa Enterprise Challenge Fund and establish regional Lighting Global–certified quality assurance laboratories.

The Department for International Development’s Green Mini-Grids Africa program aims to improve policy frameworks and increase investments in the mini-grid sector. Main lines of support are through public- and private-sector technical assistance via AfDB’s Sustainable Energy Fund for Africa and dissemination of best practices through the World Bank’s Energy Sector Management Assistance Program.

U.S. Government Organizations. For USAID’s Power Africa Off-Grid Project, Power Africa is offering technical assistance to SHS and mini-grid companies in Ghana. Technical assistance is provided in the following areas: market intelligence, business performance, access to finance, and gender mainstreaming.

The U.S. Trade Development Agency is financing feasibility studies for more than 50 mini-grids in the Afram Plains South area. The MoE awarded a contract to conduct the studies to Tuatara Group in May 2019.²¹

¹⁸ Markwei and Asuma, “Ghana.”

¹⁹ Energising Development, “Ghana.”

²⁰ Federal Ministry for Economic Cooperation and Development, “Green People’s Energy for Africa.”

²¹ US Trade and Development Agency, “Contract Awards: 2019 | USTDA.Gov.”

During 2015 and 2016, the U.S. African Development Foundation supported Wilkins Engineering Ltd., Atlas Business and Energy Systems Ltd., and the Centre for Energy, Environment and Sustainable Development with grants to install SHS and stand-alone institutional and productive-use systems. The foundation also funded a private mini-grid built by Translight Solar in Upper East Region.²²

In 2016, PEG Ghana received a \$150,000 grant through Scaling Off-Grid Energy and Development Innovation Ventures. The grant supported the development of new payment and customer service processes, designed to help extend PEG Ghana's services to last-mile customers.²³

World Bank. The World Bank's Ghana Commercial Agriculture Project includes a component that focuses on productive uses of electricity in the agricultural sector. Project activities include an analysis of current productive use opportunities, international workshop about mini-grids, the construction of a \$1 million grant-funded facility supporting two mini-grid sites with agricultural anchor loads, and technical assistance for off-grid agricultural productive use.

GEDAP. The World Bank's flagship energy project in Ghana since 2009, GEDAP, will close out in September 2019. Some of GEDAP's off-grid accomplishments include its partnership with Apex Bank and the Association of Ghana Solar Industries to distribute more than 15,000 SHS and the development of five mini-grids, serving 6,000 people around Lake Volta.

2.3.4 SOLAR AND RENEWABLE ENERGY ASSOCIATIONS



In Ghana, two industry associations are relevant to off-grid solar: the Association of Ghana Solar Industries (AGSI), which focuses exclusively on solar, and the Renewable Energy Association of Ghana, which covers a range of renewable technologies. Of the two associations, AGSI is more active.

AGSI supports the industry through government advocacy, technical training, and collaboration with donors. Examples of donor collaboration include participation in the World Bank's GEDAP and a program to train more than 100 technicians in cooperation with GIZ. AGSI's advocacy work is perhaps its most valuable contribution to the industry. AGSI has realized success in shifting kerosene subsidies toward solar lanterns. AGSI's current advocacy priority is to improve the consistent application of customs tariffs and licensing procedures for solar companies.

AGSI has 46 members ranging from solar suppliers and EPCs to small-scale installers and SHS distributors. There are no core staff at AGSI, and leadership is provided by entrepreneurs and consultants working on a volunteer basis. This lack of committed, full-time staff is an obstacle to the effectiveness of AGSI's advocacy efforts. Some members have left because there has been a dearth of progress regarding the customs and licensing issues.

²² Power Africa, "Ghana Off-Grid Energy Grants Portfolio."

²³ SOGE, "After-Action Report: PEG Africa."

However, AGSI has achieved the following notable milestones:

- › A sensitization and advocacy campaign, in conjunction with the Business Sector Advocacy Challenge Fund, led to the removal of import tariffs in 2008.
- › An AGSI technical training program, in conjunction with Deng Training Solar Centre, GIZ, and the MoE, led to the training of more than 100 technicians in 2008–2009.
- › Under GEDAP, AGSI supported market development, standards development, and quality assurance. This effort resulted in the rollout of more than 20,000 SHS.
- › In collaboration with the Business Sector Advocacy Challenge Fund, AGSI engaged with Parliament during the development of the Renewable Energy Act of 2011.

2.3.5 TRAINING INSTITUTIONS, INCUBATORS, AND ACCELERATORS

The main activities involving training institutions, incubators, and accelerators related to the energy sector in Ghana are discussed as follows:

- › In Ghana, several technical institutions provide training to renewable energy companies and installation engineers and offer certifications and degrees. The technical institutions are Deng Solar Training Centre, Kumasi Technical University, and Koforidua Technical University.²⁴
- › The Ghana Climate Innovation Centre offers business incubation services for SMEs working in environmental sustainability. The program is funded by the Governments of Denmark and the Netherlands through the World Bank and offers a mix of support related to private-sector development, climate change, entrepreneurship, education, and training.
- › The Kumasi Institute of Technology, Energy and Environments is a Ghanaian non-governmental organization (NGO) that develops projects in the energy and environmental sector. One such project is to build the capacity of 92 energy professionals under the Clean Development Mechanism.²⁵

Suka Wind and Solar Energy Ghana Ltd. has developed a Women in Renewable Energy Training Program. The company has identified the need to innovate its expansion efforts through more broad-based knowledge transfer, including to women and girls. Program participants complete three- to six-month training courses and become “Power-Sisters” with all-around knowledge about solar power and the business sense behind it.²⁶

²⁴ China-Ghana South-South Cooperation on Renewable Energy Technology Transfer, “Baseline Study of Renewable Energy Technologies in Ghana.”

²⁵ KITE, “KITE - Innovating Clean Energy Solutions.”

²⁶ Suka, “Women in Renewable Energy | Suka Solar Ghana – Efficient Energy System.”

3 PICO-SOLAR SECTOR

3.1 STATE OF PRIVATE COMPANIES

As one of the earliest West African markets for SHS, Ghana is home to both international and local SHS companies spanning the range from established to early stage enterprises. This diversity is characterized not only by origin and years of operation, but also by the complexity of sales and distribution models and the scale of financing raised to date. Despite these differences, all SHS companies operating in Ghana experience a similar set of challenges related to adopting the PAYGO technology, reaching Ghana’s remaining off-grid communities, and advocating for a level playing field for taxation and importation.

3.1.1 COMPANY MATURITY

Table 3 lists the SHS companies active in Ghana and the year when they were established.

| TABLE 3. COMPANY MATURITY | |
|---|------------------|
| COMPANY NAME AND LOGO | YEAR ESTABLISHED |
|  | 2008 |
| GTEC | 2018 |
|  | 2009 |
|  | 2013 |
|  | 2009 |
|  | 2014 |
|  | 2003 |
|  | 2017 |

Another important dynamic with the potential to affect the sector is growing interest from major international players, such as Mobisol, Jabo, Biolite, and EcoZoom, in entering the Ghanaian market via local partnerships. Such developments have the potential to increase competition and the consequent resources allocated toward last-mile communities and the distribution and payment strategies need to reach them.

Distribution and Payment Models. Ghanaian SHS companies use a variety of distribution models to reach both last-mile and urban customers. These distribution models are frequently associated with specific payment models. For example, models that rely on a microfinance institution (MFI) for distribution typically also extend to consumer finance. It is important to note that while distribution models vary considerably, and examples of nearly every combination can be found, they can be generalized into three categories: (i) agent sales, (ii) kiosk and retail outlets, and (iii) partnership sales. All of the following distribution and payment models are interchangeable:

- › **Agent sales:** The SHS company employs its own team of sales agents, who are typically paid on commission. Agents are responsible for sales and customer service functions within their assigned territory. In last-mile contexts, this approach is enhanced by closer sales agent recruitment and support through regional- and district-level management to provide advice and training to agents working in the most difficult markets.
- › **Kiosk and retail outlet sales:** SHS are sold through retail outlets, including village-level kiosks.
- › **Partnership sales:** SHS companies partner with a range of different institutions common in Ghana's off-grid communities. Partner organizations may include MFIs, village savings and loan associations (VSLAs), NGOs, farming and trade associations, and major employers. Such partnerships open new sales channels and typically bring advantages related to consumer finance, either by enhancing credit assessments or shifting consumer financing to the partner entirely.

Payment models are characterized by the level and source of consumer financing, ranging from non-financed cash-and-carry models, to MFI financing models. Payment models are discussed as follows:

- › **Cash and carry (over-the-counter):** This type of model is a simple cash transaction. The customer pays in full upfront; therefore, no financing is required. The SHS company is still responsible for handling any warranty work and for providing after sales service; however, if work is needed after the warranty period ends, then the customer may be charged a fee. Cash and carry is most common through retail and sales agent distribution models.
- › **PAYGO:** PAYGO sales are financed by the SHS company. Customers make an initial deposit on the system and pay the balance over a specified period, often between 12 and 36 months depending on the system price. PAYGO may be implemented through mobile money (for systems enabled with mobile chips or keypads) or cash collections.
- › **Partner sales:** Partner sales refer to distribution partnerships that serve as a sales channel rather than a source of consumer finance. Partners often include VSLAs and farming or trade associations. Although these organizations do not provide consumer finance to their members, their leadership often serves as the group sales agent, generating leads, and collecting payments. Such relationships are beneficial to SHS companies because group leaders are well-placed to assess the creditworthiness of members and to apply their authority to collect payments.
- › **Partner financing:** Partner financing refers to distribution partners that also offer consumer finance. In these partnerships, SHS are purchased upfront by the partner before selling them through a consumer loan to customers. Typical partners in this type of arrangement are organizations with their own means of financing and payment collection, such as MFIs, NGOs, and employers. For example, one approach taken by employers is to deduct payments from monthly paychecks.

Table 4 provides the product types and distribution and sales models of Ghana’s SHS companies.

| TABLE 4. COMPANY MODELS | | | |
|---------------------------------------|---|--|---|
| COMPANY | PRODUCTS | DISTRIBUTION MODELS | PAYMENT MODELS |
| Burro Brands | Solar lanterns and SHS (Greenlight Planet) | Direct sales through agents | Cash and carry, as well as a PAYGO pilot |
| GTEC | Solar lanterns and SHS (Greenlight Planet) | Direct sales through agents and NGOs | Cash and carry |
| NorthLite Solar Ltd. | Solar lanterns and SHS | Distribution through MFIs | Cash and carry, as well as MFIs |
| PEG Ghana | SHS, televisions, (d. light), and solar water pumps | Direct sales through agents, NGOs, and associations | PAYGO, cash and carry (customer or partner), and company payroll deductions |
| Suka Wind and Solar Energy Ghana Ltd. | Solar lanterns and SHS | Retail outlets and agents | Cash and carry |
| Sunhut Enterprise–Villageboom | SHS | Kiosk outlets in off-grid communities, VSLAs, and community leaders as sales agents and payment collectors | Cash and carry, as well as rent to own |
| Wilkins Engineering Ltd. | Solar lanterns and SHS (Greenlight Planet) | Direct sales through agents | Cash and carry, as well as a PAYGO pilot |
| ZOLA Electric | SHS, televisions, and radios | Direct sales through agents | PAYGO and cash and carry |

Source: Power Africa Transaction Advisor

Among distribution models, traditional agent and retail approaches remain the most prominent, although several companies are deepening partnerships with MFIs, NGOs, and associations. Table 5 lists company partners and regions of operation.

| TABLE 5. COMPANY PARTNERSHIPS | | |
|---------------------------------------|--|---|
| COMPANY | DISTRIBUTION AND FINANCING PARTNERS | REGIONS OF OPERATION |
| Burro Brands | None | Eastern and Volta |
| GTEC | None | Ashanti and Northern |
| NorthLite Solar Ltd. | Inutec Solar Center, Juwi, and Novia Energy | Greater Accra, Northern, and Upper East |
| PEG Ghana | VSLAs, Acumen, Hortifresh, Ecobank, MTN, SunFunder, Responsibility, KFW, CDC | All regions |
| Suka Wind and Solar Energy Ghana Ltd. | None | Greater Accra and Northern |

| | | |
|-------------------------------|--|-------------------------------------|
| Sunhut Enterprise–Villageboom | Resilience in the Northern Region of Ghana (RING) VSLAs, Atmosphir | Central, Eastern, and Northern |
| Wilkins Engineering Ltd. | None | Central, Eastern, and Greater Accra |
| ZOLA Electric | EDF, Tesla, Helios, DBL Partners, Vulcan Capital | Ashanti |

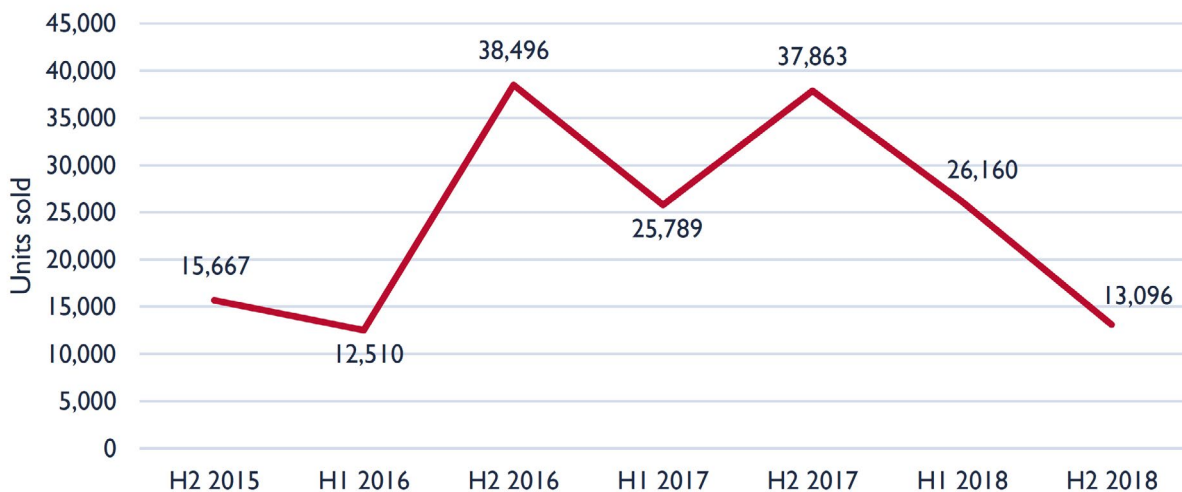
Sources: ²⁷

3.2 MARKET TRENDS AND BARRIERS

3.2.1 GLOBAL OFF-GRID LIGHTING ASSOCIATION (GOGLA) DATA TRENDS

During 2018, there was a downturn in SHS sales in Ghana (Figure 3). Possible reasons for the decrease in sales include lower awareness and demand for SHS in urban and peri-urban areas because of improved grid reliability and overall saturation of urban and peri-urban markets. In rural areas, last-mile distribution challenges discussed in this section of the report have limited the ability of SHS companies to maintain sales levels observed in easier to reach markets.

FIGURE 3. GOGLA SALES DATA FROM 2015 THROUGH 2018



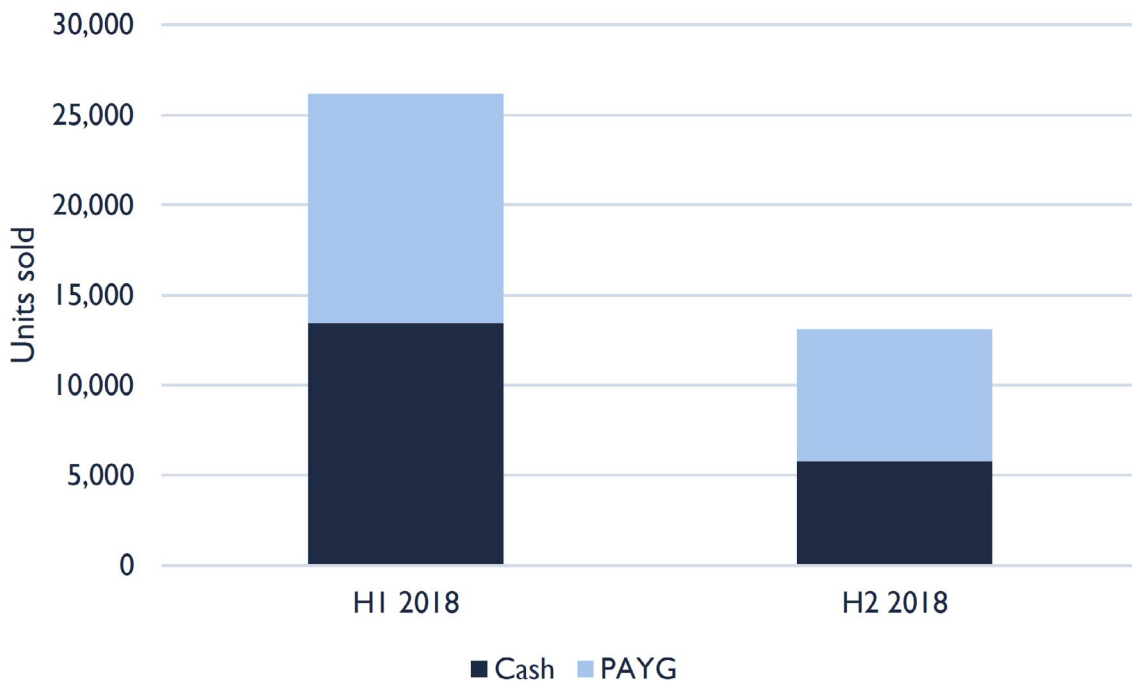
Source: ²⁸

Another notable trend in Ghana’s sales is the steady market share of PAYGO products. Figure 2 shows that PAYGO products contributed to approximately 50 percent of all sales in Ghana during each half of 2018, despite a 50 percent drop in overall sales from the first to the second half of the year. This data suggests that demand has dropped across market segments, regardless of affordability constraints.

²⁷ PEG, “About Us”; atmosfair, “Atmosfair Starts a Solar Kiosk Project in Ghana”; NorthLite Solar, “Partners :: North Lite Solar Limited | Renewable and Sustainable Energy Service Provider”; ZOLA Electric, “ZOLA Electric: About Us.”

²⁸ GOGLA, “Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data.”

FIGURE 4. PROPORTION OF PAYGO SALES IN 2018



Source: ²⁹

3.2.2 LAST-MILE DISTRIBUTION

Given Ghana’s high electrification rate relative to other countries in sub-Saharan Africa, GOGLA estimates that SHS products have penetrated approximately 19 percent of the off-grid market, suggesting that plenty of customers remain to be served.³⁰ Ghana’s remaining off-grid communities, however, are comparatively remote. SHS companies trying to reach these markets experience many challenges, including uncertain grid connection status, poor mobile network coverage, underdeveloped transportation infrastructure, and sales agent capacity and retention. These challenges are further discussed as follows:

- › Uncertain grid connection status. Grid expansion planning is not transparent in Ghana. Companies that want to reach rural markets have limited access to data regarding current and planned grid extension projects, which hinders their ability to select communities for business expansion.
- › Poor mobile network coverage. Low mobile money penetration and poor mobile network coverage in Ghana’s remote areas limit the usefulness of PAYGO systems enabled with Global System for Mobile Communications chips. One approach that is being used to gain traction in these communities has been to directly engage and train mobile money agents. In assessing mobile coverage, the Global System for Mobile Communications Association’s Mobile Coverage Map for Ghana has served as a screening tool for companies to identify those off-grid areas where PAYGO is most feasible.³¹

²⁹ GOGLA.

³⁰ GOGLA.

³¹ GSM Association, “Mobile Coverage Maps.”

- › Underdeveloped transportation infrastructure. Off-grid communities also lack access to other key infrastructure, including quality road networks. Thus, distribution in these areas is time consuming and expensive. This is one challenge where the knowledge brought by local sales agents and partnerships with local MFIs, banks, or associations is especially important.
- › Sales agent capacity and retention. Training and retaining sales agents in remote communities are expensive activities. Education levels and familiarity with digital technology are generally lower in such areas; therefore, agent training must be more intensive and/or frequent. Furthermore, because remote sales agents are working in the most difficult sales territories, they may require more direct, hands-on supervision and encouragement. Companies have addressed this challenge by hiring regional- and district-level sales managers to provide additional support.

3.2.3 INCONSISTENT IMPORT DUTIES

SHS companies operating in Ghana are experiencing a lack of clarity in the application of import tariffs. Two tariff regimes prevail in Ghana: tariffs set by the Economic Community of West African States (ECOWAS) and GRA tariffs. For the most part, the two tariff regimes are aligned: ECOWAS provides the underlying policy, and GRA generates additional tariffs specific to Ghana. However, their policies around product categorization and naming conventions for SHS are not in agreement, and they apply duties, VAT, and other fees inconsistently.

Under ECOWAS, SHS are categorized as “solar generators” and are due special duty and VAT exemptions. Under GRA, however, SHS are treated as a “solar home theatre,” a confusing term, and are subject to normal duty and VAT rates. These conflicting categories are not used consistently, which makes SHS pricing more difficult. Table 6 offers a comparison of ECOWAS and GRA.

TABLE 6. SHS IMPORT RATES UNDER ECOWAS AND GRA

| CATEGORY NAME | ECOWAS | GRA |
|--------------------------------|-------------------------|--------------------|
| | SOLAR-POWERED GENERATOR | SOLAR HOME THEATRE |
| Duty | 5% | 20% |
| VAT | 0% | 15% |
| National Health Insurance Levy | 0% | 2.5% |
| Inspection fee | Not applicable | 1% |
| Import Excise | Not applicable | 0.5% |
| Special Import License | Not applicable | 0.75% |
| Eco-levy | Not applicable | 0% |

Source: GRA/CEPS 2017

Similarly, under the GRA regime, solar lantern rates are based on the ECOWAS category for “light-emitting diode (LED) lamps” rather than “solar generator,” which makes the GRA rates higher than those contemplated under ECOWAS. Companies also report instances where solar lanterns are treated as a run-of-the-mill battery-powered torch, resulting in higher rates.

3.2.4 REGULATIONS

Several GoG regulations that impact the cost of business for SHS companies are discussed as follows:

- › **Local Content and Local Participation Regulation.** As part of its broader push to encourage local manufacturing, the GoG established a Local Content and Local Participation Regulation in 2017. Implemented by the EC, the regulation requires companies operating in Ghana's energy sector to have at least 51 percent local ownership and incorporate at least 60 percent local material or goods into their products by 2025.³² The regulation is intended to promote Ghana as a regional manufacturing hub by building local capital, expertise, and material throughout the energy product supply chain.
- › **Energy company licensing:** All energy companies must be licensed by the EC, and companies may be subject to several different licensing requirements depending on the nature of their business. Although SHS companies do not have a specific licensing category, they do need to be licensed as importers and installers. Both the import license and the installation license cost \$950, plus annual renewal fees. Ghana's licensing regime tends to be more expensive than those in other African countries, such as Kenya, making solar technology in Ghana relatively expensive.
- › **Electronic Waste Control and Management Act:** Ghana recently enacted the Electronic Waste Control and Management Act, which seeks to fund environmental mitigation programs related to electronic waste through an eco-levy. All companies importing electronics, including SHS, must register with the Environmental Protection Agency, receive a permit, and provide advance payment of the eco-levy.

3.2.5 MOBILE MONEY

PAYGO models depend on mobile network connectivity and, frequently, mobile money. Thus, areas that lack access to these services are especially challenging for PAYGO companies. A shortage of mobile network coverage, in turn, generates additional challenges regarding mobile money. Some of these challenges include low awareness and understanding of mobile money among potential customers, low penetration of mobile money agents, and a lack of cash liquidity for those agents who do exist. PAYGO and mobile money, however, are mutually supportive, and mobile money operators are looking at PAYGO as a means of increasing usage rates.



Despite challenges experienced in rural areas, mobile network access is increasing, and Ghana is the fastest growing market for mobile money in Africa.³³ Mobile telephone subscriptions are expected to reach 40 million in Ghana by 2020.³⁴

According to the Bank of Ghana, from 2017 to 2018, active mobile money agents increased 19 percent, from 107,000 to 152,000; active mobile money wallets grew 17 percent to 13 million; transaction volume grew to 1.5 billion, constituting 48 percent growth; and the total value of transactions increased 43 percent, from \$31.2 billion to \$44.4 billion.³⁵

³² Energy Commission, "Local Content and Local Participation."

³³ Ozyurt, "Ghana Is Now the Fastest-Growing Mobile Money Market in Africa."

³⁴ Jumia Ghana, "Annual Mobile Report 2018: Ghana."

³⁵ Bank of Ghana, "Payment System Statistics."

With its market dominance, MTN Ghana is the first choice for PAYGO integration for most SHS companies in Ghana. MTN Ghana charges a 1 percent fee on every merchant transaction. That said, the landscape may become more competitive. At the end of 2018, the GoG, in partnership with major financial institutions and mobile network operators, completed an interoperability initiative to allow the transfer of funds across mobile money platforms and bank accounts.³⁶

3.2.6 PEG'S GENDER LENS INVESTMENT

PEG has taken the lead in the PAYGO industry regarding gender mainstreaming. During a period of growth in 2017, the company implemented a series of policies to encourage the hiring and retention of women. The policies include flexible working hours, family health insurance, paternity leave, and a women's mentorship program.

These programs were successful, resulting in a 22 percentage-point increase of women in leadership roles from 22 percent to 44 percent. Twenty-five percent of the women who were mentored were promoted within six months. These programs also helped to facilitate a 30 percent reduction in employee turnover, with women leaving at a 14 percent lower rate than men.

These policies helped PEG secure \$12.5 million in debt through the 2X Challenge, an initiative of the CDC (the UK development finance institution), the Overseas Private Investment Corporation, and five other development finance institutions, to invest in companies with deliberate gender inclusion policies.³⁷ The 2X funding crowded in a further \$7.5 million in debt and \$5 million in equity.³⁸

3.3 FINANCING

3.3.1 COMPANY FINANCE

Trends in accessing finance for companies in Ghana's SHS sector reflect those seen elsewhere on the continent, such as a lack of local commercial debt, and a divide between local and international companies with regard to investor access.

Commercial Banks

Ghana's commercial banking sector does not actively lend to off-grid energy companies. The banks involved in the country's renewable energy sector generally are Stanbic Bank, Ecobank Ghana, Fidelity Bank, and CalBank. Even in these cases, loans have high interest rates and short tenors.

Several donors have developed local credit facilities that are, in theory, applicable to off-grid energy companies. These facilities include a \$10 million clean energy guarantee facility through the USAID Development Credit Authority (DCA) and Ecobank and the previously mentioned Rural Development Fund. These facilities, however, are not explicitly designed for off-grid energy companies and have not been accessed by the off-grid sector. In fact, a DCA guarantee has never been used for a loan transaction in Ghana's energy sector.³⁹

³⁶ Adepoju, "Ghana Advances on Mobile Money Interoperability."

³⁷ 2x Challenge, "A Holistic Approach to Driving Gender Diversity Helps PEG Qualify as CDC's First 2X Investment."

³⁸ Nsehe, "Solar Company PEG Africa Raises \$25m In Series C Funding."

³⁹ USAID, "Development Credit Authority (DCA) Data Set: Loan Transactions."

Particularly problematic for the off-grid sector are the effects of foreign exchange risk because the debt offered to renewable energy companies is often denominated in U.S. dollars. Several impact investors are looking to possibly partner with local Ghanaian banks as a means to crowd in commercial banks and lend to the off-grid industry in local currency. These conversations are ongoing, and more local commercial bank lending to the off-grid sector through these types of innovative partnerships is expected from late 2019 into 2020.

Investors

Investments in the off-grid sector are from international sources, predominately donor and impact funds. In this atmosphere, PEG and ZOLA Electric, which are the main international SHS companies, have an advantage over their local counterparts. First, as international players, these companies have existing relationships with investors that are active in the space. Second, these companies can raise larger sums of money at one time to cover operational costs and expansion into new countries. Lastly, as leaders in PAYGO, these companies offer a greater opportunity for social impact by targeting bottom-of-the-pyramid consumers compared with cash-and-carry distributors.

By contrast, many local SHS distributors, such as Wilkins Engineering Ltd. or NorthLite Solar Ltd., are traditional suppliers of renewable energy equipment and are not set up to offer consumer credit. Furthermore, many local distribution companies that are considering entering the energy sector often pursue lower risk opportunities such as captive power.

The dynamic produced by this distinction, and a lack of local financing options, have led to the emergence of crowd-funding as an important fundraising source for off-grid companies. Here, however, Ghana lags behind other African markets. An analysis of crowd-funding campaigns in 2016 found only three for companies operating in Ghana, and these were all captive power systems. To put this in perspective, crowd-funding supported more than 2,000 energy projects in Kenya, inclusive of off-grid, over the same period.⁴⁰

In West Africa broadly, 2018 was an exceptionally positive year for fundraising for the off-grid solar sector, with quantum invested continuing to rise precipitously compared with previous years. In 2018, there was a growth primarily in equity, whereas debt transactions lagged behind substantially in comparison.

Another impressive shift was the increase in the number of off-grid transactions, which rose to 24 in 2018 from 4 reported in 2017. As more players in West Africa are able to access finance, the median reported transaction size actually decreased dramatically because new players and smaller companies closed financing transactions.

Geographic market expansion and the addition of new products were the primary uses of funds for West African companies, accounting for 89 percent of funding. A smaller portion of funds (9 percent) was used for bridging working capital needs. For-profit financial institutions dominated the sources of funding with some notable capital coming from crowd-funders and from unknown or unspecified sources.

Despite these positive signs, supply of equity for early stage SHS companies in West Africa has not met founder expectations. International investors have, to date, limited their presence in the region (many are over-exposed in East African markets such as Kenya, Tanzania, and Uganda), leaving most companies to rely on angel investors for seed equity funding.

⁴⁰ Energy 4 Impact, "Crowd Power: Can the Crowd Close the Financing Gap?"

3.3.2 CONSUMER FINANCE

World Bank data indicate that 7.3 million people in Ghana lack formal bank accounts or mobile money wallets.⁴¹ Rural consumers, especially women, are particularly prone to this type of financial exclusion, compounding the challenge experienced by SHS companies to offer financed energy products to off-grid customers.

Credit for such prospective customers is typically offered through MFIs, rural banks, or VLSAs. Ghana has 144 licensed rural banks, several of which offer consumer credit for products but not specifically to off-grid systems.⁴² Meanwhile, MFIs and VSLAs present promising opportunities for sales or financing partnerships for SHS companies. MFIs, such as Opportunity International and Snapi Aba Savings and Loans, are exploring such partnerships but still require greater understanding of and comfort with off-grid business models.

SHS companies have been more successful in forging partnerships with VSLAs. For example, Sunhut Enterprise–Villageboom collaborates with the VSLA Resilience for the Northern Region of Ghana to offer energy products to women’s groups.

⁴¹ The World Bank, “7.3m Ghanaians without Financial Account - World Bank Report.”

⁴² Bank of Ghana, “List of Rural Banks.”

4 MINI-GRID SECTOR

4.1 STATE OF MINI-GRID DEVELOPMENT

The GoG views mini-grid development as top-down and government-driven. According to official policy, mini-grids must be government owned, and private participation is limited to an EPC role. From a national and regional planning standpoint, off-grid energy development is mainly relegated to the island and lakeside villages around Lake Volta.

Despite GoG's top-down approach, a handful of private-sector mini-grid developments have taken place outside of official planning. The EC has also produced a draft regulation for private mini-grid development that would provide a licensing framework for private operators. Given GoG's current stance, however, this regulation is not expected to be adopted, and further tolerance of private development is not likely.

4.1.1 GOVERNMENT-DRIVEN MINI-GRIDS

The REMP sets out the GoG's high-level mini-grid development targets with the goal of commissioning 86 by 2020 and 300 by 2030.⁴³ Realization of this objective will depend upon planning by regional governments through Medium-Term Development Plans. Meanwhile, the operation of government mini-grids is the responsibility of the VRA, PDS, and the Northern Electricity Distribution Company.

Donor support has been critical to this top-down approach, and the bulk of the current mini-grid pipeline is donor funded. Table 7 outlines the existing and planned government and donor mini-grids.

TABLE 7. GOVERNMENT OPERATED MINI GRIDS

| SPONSOR | NUMBER OF SITES | DISTRICTS | YEAR ANNOUNCED | EXPECTED YEAR OF OPERATION | STATUS |
|-------------------------------------|-----------------|--|----------------|----------------------------|----------------------|
| World Bank—GEDAP | 5 | Sene East, Krachi West, Krachi East, and Ada | 2007 | 2015 | Operational |
| Swiss Government | 3 | Alokpem and Azizakpe island communities | 2019 | Not defined | Tender Awarded |
| AfDB—REP | 55 | Ada East | 2015 | Not defined | Feasibility |
| USTDA U.S. Trade Development Agency | 50 | Afram Plains South | 2018 | 2020 | Feasibility planning |

Sources: (Centre for Energy, Environment and Sustainable Development 2018; Dassah 2018; Tisheva 2018)

⁴³ Energy Commission, "Ghana Renewable Energy Masterplan."

4.1.2 PRIVATE-SECTOR MINI-GRIDS

Given Ghana's high electrification rate and national policies that prioritize government-led development, private-sector mini-grid development has been limited. The country's only private operator of multiple mini-grids is Black Star Energy, which operates 17 mini-grids serving approximately 6,000 customers in the Ashanti and Brong-Ahafo Regions.

Black Star Energy's sites are the first to be privately licensed in Ghana, despite the fact that the EC does not have an official licensing framework for private mini-grids. The company was able to obtain a modified installation and maintenance license for an early site after submitting technical designs. Black Star Energy focuses on communities with at least 100 households, and typical system capacity is approximately 8 kW. Tariffs are approximately 1.33 (in Ghanaian cedi (GHS)) per kilowatt hour, and their cost per connection is approximately \$500.

Black Star Energy is funded mainly through impact equity investments, crowdfunding debt, and grants, such as the EDF Pulse Africa award.⁴⁴ As is the case with most mini-grid companies in sub-Saharan Africa, mini-grid companies in Ghana are looking for equity and grants to fund the initial rollout of their sites. There is currently very little lending to mini-grid companies, and there is an overall lack of debt products suitable to their cash flows and business models. When lending does occur, it is on flexible terms with longer tenors and grace periods and tends to be more concessionally structured and priced. Mini-grid developers are eager for this type of capital, but it is currently not forthcoming in Ghana or in the sector.



In 2018, Black Star Energy conducted a study, in collaboration with Power Africa, to assess the impacts that its mini-grids had on female entrepreneurship. They found that of the women entrepreneurs surveyed, 29 percent decided to start their business after being connected by Black Star Energy, and women's income increased by up to 11 times.

4.2 MARKET BARRIERS

4.2.1 TARIFFS

Ghana, through PURC, has adopted a uniform national tariff that applies equally to the national grid and mini-grids. Such policy is problematic for privately funded and operated mini-grids because these operators are not able to cross-subsidize consumer tariffs across a wide customer base as do the national utilities. Although allowing private mini-grids to charge cost-reflective tariffs would be a boon to private mini-grid development in the country, it is unlikely that the government will make such a drastic policy change. There are several reasons for the government's commitment to its current policy. These reasons are listed as follows:

- › Implementation of a national uniform tariff is considered to be a matter of social justice, whereby poor, rural consumers should not pay more than their wealthier urban counterparts.⁴⁵
- › Mini-grid development is considered to be within the government's purview; thus, the interests of private developers are not prioritized.

⁴⁴ Poindexter, "Black Star Energy"; JoyBusiness, "Black Star Energy Motivated to Produce Cheaper Sustainable Power - CEO."

⁴⁵ Energy Sector Management Assistance Program, "Ghana: Mini-Grids for Last-Mile Electrification."

- › Prioritization of job creation and economic development, especially the country’s aspiration to become a regional manufacturing hub, increases pressure to keep electricity tariffs low.

Base tariff rates (GHS per kilowatt hour) for residential and non-residential customers are 0.30 and 0.75, respectively. The lifeline tariff, reserved for low-income users, is a flat rate of GHS2.13 per month.⁴⁶ Black Star Energy has claimed that it would require a \$200 subsidy per user to meet these rates.⁴⁷

4.2.2 LICENSING AND REGULATION

Although Black Star has been successful in operating its mini-grids, from an official standpoint, they only operate as an installer, while their retail operations have merely been tolerated. Their situation does not represent a replicable process. If GoG’s position regarding private mini-grid development should change, a few existing frameworks could be used as a starting point for sector governance. These existing frameworks are described in the following paragraphs.

Distribution company licensing. Even though mini-grids are not mentioned in the official licensing framework for Ghana’s distribution companies, it is thought that these rules would serve as a starting point for any future mini-grid licensing. Under this regime, distribution companies must obtain three separate licenses, one each to generate, distribute, and to sell electricity. The regulation also stipulates the required initial and annual licensing fees. However, many important aspects of private mini-grid regulation, such as procedures for grid integration, are not contemplated, and would require further regulatory guidance.

Draft private mini-grid regulation. In 2017, the EC drafted regulations that would authorize private companies to develop and operate off-grid mini-grids with up to 1 MW in generation capacity. In addition to submitting technical documentation and proof of land rights, applicants would present formal agreements with community members and, for sites slated for grid expansion within two years, approval from the relevant distribution company. Licensees would further agree to adhere to several financial controls, including access to accounts and conformity with PURC tariff rules.

More rigorous technical requirements are defined for systems greater than 100 kW in capacity. Larger mini-grids would be built to grid code, use approved meters, and, importantly, supply 70 percent of annual electricity output from a renewable energy source. The regulation provides minimum safety and quality of service criteria applicable to systems of all sizes.

Finally, the regulation sets forth critical ground rules in the event of interconnection with the national grid. Upon grid arrival, the isolated mini-grid may be integrated as an embedded generation system with the mini-grid operator opting for one of two scenarios. The first scenario is to transfer all assets to the distribution company, compensated based on their depreciated value at the time of transfer. The second scenario is to retain all assets and enter into a retail agreement with the distribution company. Any assets deemed to be at end of life would be disposed of in accordance with all relevant environmental regulations. Although the regulation does not attempt to dictate how assets should be valued or how retail agreements are defined, it does designate PURC as the arbiter of any disputes.

⁴⁶ Public Utilities Regulatory Commission, “Publication of Electricity Tariffs.”

⁴⁷ Addo, “Our Subsidy Is Just 25% of Cost of Rural Electrification Using Grid Extension – Black Star Energy CEO.”

5 AGRICULTURAL AND PRODUCTIVE-USE SOLAR COMPANIES

5.1 PUBLIC AND PRIVATE INITIATIVES



Off-grid energy companies and traditional agricultural suppliers both participate in Ghana's agricultural productive-use sector. Here, solar pumping is the off-grid productive application with the greatest penetration.

More information about some off-grid energy companies and traditional agricultural suppliers is presented as follows:

- › **PEG.** The company is piloting SunCulture micro pumps integrated with a PAYGO system. With robust rural distribution networks, a long track record of success in the PAYGO market, and Ghana's largest base of PAYGO customers, PEG is well placed to expand its existing product line to include productive devices.
- › **Hatoum Trading.** An agricultural supplier, Hatoum Trading has started to pilot PAYGO solar pumps, for which the company has received support from GIZ.
- › **SkyFox Ltd.** SkyFox is currently partnering with the Afram Plains Development Organization to pilot an integrated aquaculture and crop solar irrigation scheme with 1,600 farmers.

Outside of the agricultural sector, stand-alone solar systems for off-grid institutions, such as health clinics, are spearheaded by the government and the private sector. More information about government and private sector efforts involving stand-alone solar systems is presented as follows:

- › **Community-Based Health Planning and Services Initiative.** Under this government initiative, the European Union recently supported an effort to construct several new community health clinics and provided off-grid clinics with stand-alone solar battery systems.
- › **Christian Health Association of Ghana.** Stella Futura, a European renewable energy developer, has partnered with the Christian Health Association of Ghana to supply solar power to off-grid health clinics through power purchase agreements.
- › **Ghana Commercial Agriculture Project.** This project is headed by Ghana's Ministry of Food and Agriculture and with support from the World Bank and USAID to support agricultural development broadly. The project's initiatives include several large-scale irrigation schemes and the promotion of GIPC with commercial agricultural suppliers.⁴⁸

⁴⁸ Ministry of Food and Agriculture, "Ghana Commercial Agriculture Project."

5.2 SECTOR INSTITUTIONS

The main institutions involved in the agricultural sector in Ghana are discussed as follows:

- › **Ministry of Food and Agriculture.** The Ministry leads government policies that involve the agricultural sector, including livestock, fisheries, and all crops other than cocoa, and implements supportive development programs.
- › **Ghana Cocoa Board.** This board is a government entity that oversees Ghana's cocoa, coffee, and shea industries. Similar to the Ministry of Food and Agriculture, the Ghana Cocoa Board is responsible for developing and implementing regulations and for promoting the previously mentioned commodities.
- › **Agricultural Development Bank.** A government bank established specifically to serve agricultural businesses, the Agricultural Development Bank provides credit facilities to support the development and modernization of Ghana's agricultural sector. The bank is responsible for approximately 85 percent of institutional credit to the agricultural sector. Agricultural facilities available through the bank are characterized by the size of the loans and the statuses of the borrowers and other related factors.
- › **National Food Buffer Stock Company.** This government institution supports the farming industry by guaranteeing a minimum price by purchasing excess produce from farmers, thereby reducing post-harvest losses from spoilage.
- › **Ghana Seed Inspection Division.** This government institution is responsible for ensuring the quality of seeds used in Ghana's agricultural sector. The division provides testing, quality control, and certification services, which are designed to determine for moisture content, germination percentage, varietal purity, foreign matter, and weed seed content.
- › **Food and Drugs Authority.** In Ghana, the Food and Drugs Authority regulates the manufacture, distribution, import and export, and advertising of foods, drugs, and a variety of common household consumables.

5.3 RELATION TO ENERGY PLANNING

The REMP considers agricultural productive use through solar irrigation and solar crop dryers. It sets out investment estimates and deployment targets, similar to those defined for other off-grid technologies (see Table 8).

TABLE 8. REMP INVESTMENT ESTIMATES FOR OFF GRID AGRICULTURAL PRODUCTIVE USE

| TECHNOLOGY | UNIT | 2020 TARGET | INVESTMENT |
|-------------------|---------|-------------|--------------|
| Solar irrigation | Systems | 6,000 | \$30,000,000 |
| Solar crop dryers | Systems | 80 | \$160,000 |

Source: Ghana Renewable Energy Master Plan

6 ANNEX A COUNTRY STATISTICS

TABLE A I. DEMOGRAPHIC INDICATORS

| DEMOGRAPHIC INDICATOR | DESCRIPTION |
|--------------------------------------|---|
| Population size | 29.9 million: 49.85% male and 50.15% female |
| Population density | Population density: 126.18 per square kilometer; ranges from as low as 35 people per square kilometer in the Northern Region to as high as 1,205 persons per square kilometer in the Greater Accra Region. |
| Population growth rate | 2.2% |
| Household size | 4.1 people per household |
| Urban and rural populations | 55.3% urban and 44.7% rural |
| Number of female heads of households | 33% in urban and 27% in rural |
| Rate of urbanization | 3.07% |
| Languages spoken | Asante (16%), Ewe (14%), Fante (11.6%), Boron (Brong) (4.9%), Dagomba (4.4%), Dangme (4.2%), Dagarte (Dagaba) (3.9%), Kokomba (3.5%), Akyem (3.2%), Ga (3.1%), and others (31.2%). Note: English language is also an official language in Ghana. |
| Other relevant data | 375,000 registered legal permanent residents, as well as foreign workers and students |

Sources: ⁴⁹

⁴⁹World Population Prospects, “Ghana Population 2019”; FAO Gender, Equity and Rural Employment Division, “Gender Inequalities in Rural Employment in Ghana: An Overview”; CIA World Factbook, “Ghana Demographics Profile 2018.”

TABLE A 2. ECONOMIC INDICATORS

| DEMOGRAPHIC INDICATOR | DESCRIPTION | | | | | | | | | | |
|--|---|------|------|-----------------------------|-----|---------------------------------|-----|------------------|-------|------------------------------------|-------|
| Gross Domestic Product (GDP) | Ghana's economy grew by 6.8% during the first quarter of 2018. | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>GDP</th> <th>Last</th> </tr> </thead> <tbody> <tr> <td>GDP growth rate HI 2019 (%)</td> <td>1.6</td> </tr> <tr> <td>GDP annual growth rate 2018 (%)</td> <td>6.7</td> </tr> <tr> <td>GDP (\$ billion)</td> <td>65.56</td> </tr> <tr> <td>GDP (GHS billion, constant prices)</td> <td>39.27</td> </tr> </tbody> </table> | GDP | Last | GDP growth rate HI 2019 (%) | 1.6 | GDP annual growth rate 2018 (%) | 6.7 | GDP (\$ billion) | 65.56 | GDP (GHS billion, constant prices) | 39.27 |
| | GDP | Last | | | | | | | | | |
| | GDP growth rate HI 2019 (%) | 1.6 | | | | | | | | | |
| | GDP annual growth rate 2018 (%) | 6.7 | | | | | | | | | |
| GDP (\$ billion) | 65.56 | | | | | | | | | | |
| GDP (GHS billion, constant prices) | 39.27 | | | | | | | | | | |
| Inflation | The annual inflation rate in Ghana increased from 9.0% in January 2019 to 9.2% in February 2019. In addition, prices increased faster for food (8.0% in January versus 8.1% in February) and for non-food (9.5% in January vs. 9.7% in February) products. | | | | | | | | | | |
| Exports | <p>Ghana's main exports are cocoa, gold, and timber products. Other exports include tuna, aluminum, manganese ore, diamonds, and horticulture.</p> <p>Ghana's main export partners are Burkina Faso, the Netherlands, South Africa, and the United Kingdom.</p> | | | | | | | | | | |
| Employment | <p>The Ghana Living Standards Survey (September 2008) indicated that household income included income from employment, agricultural and non-farm activities, rent, remittances, and other sources.</p> <p>Agriculture is the main sector of employment for both women and men living in rural areas. Women living in rural areas also have high employment participation in wholesale, retail, marketing, tourism, and manufacturing.</p> | | | | | | | | | | |
| Land use | Agricultural land accounts for 157,000 square kilometers, or 69%, of Ghana's total land area. | | | | | | | | | | |
| Main crops being grown and main livestock in different rural areas | <p>Cotton and tobacco are important cash crops in the north of the country, and important food crops include cowpeas, groundnuts, maize, millet, sorghum, and yams.</p> <p>Rice is important in all parts of the country.</p> <p>Although most rural households keep some sort of livestock, livestock farming is an adjunct to crop farming.</p> | | | | | | | | | | |

Sources: ⁵⁰

⁵⁰ Trading Economics, "Ghana GDP"; Trading Economics, "Ghana Agricultural Land (Percent Of Land Area)"; FAO Gender, Equity and Rural Employment Division, "Gender Inequalities in Rural Employment in Ghana: An Overview."

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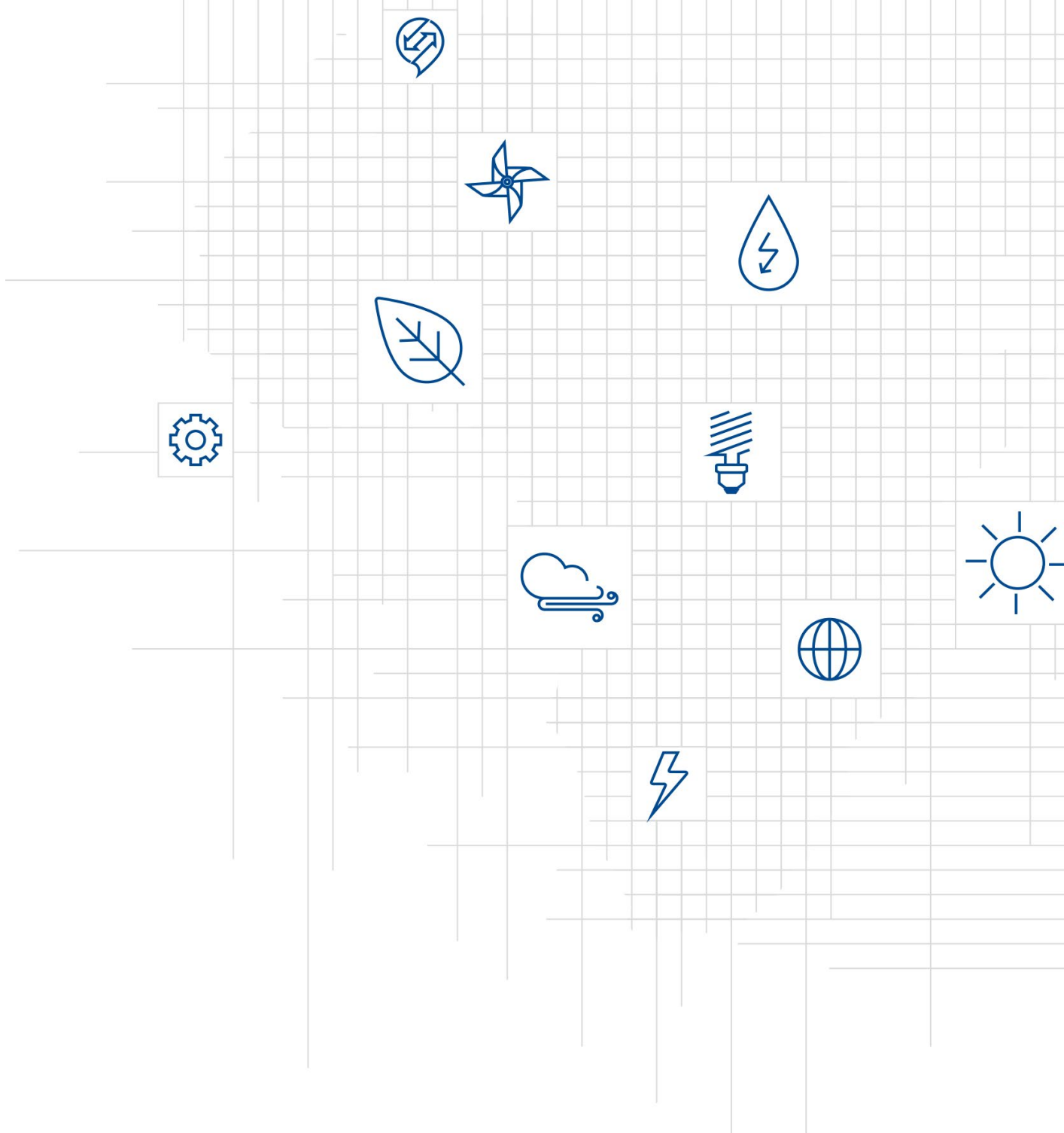
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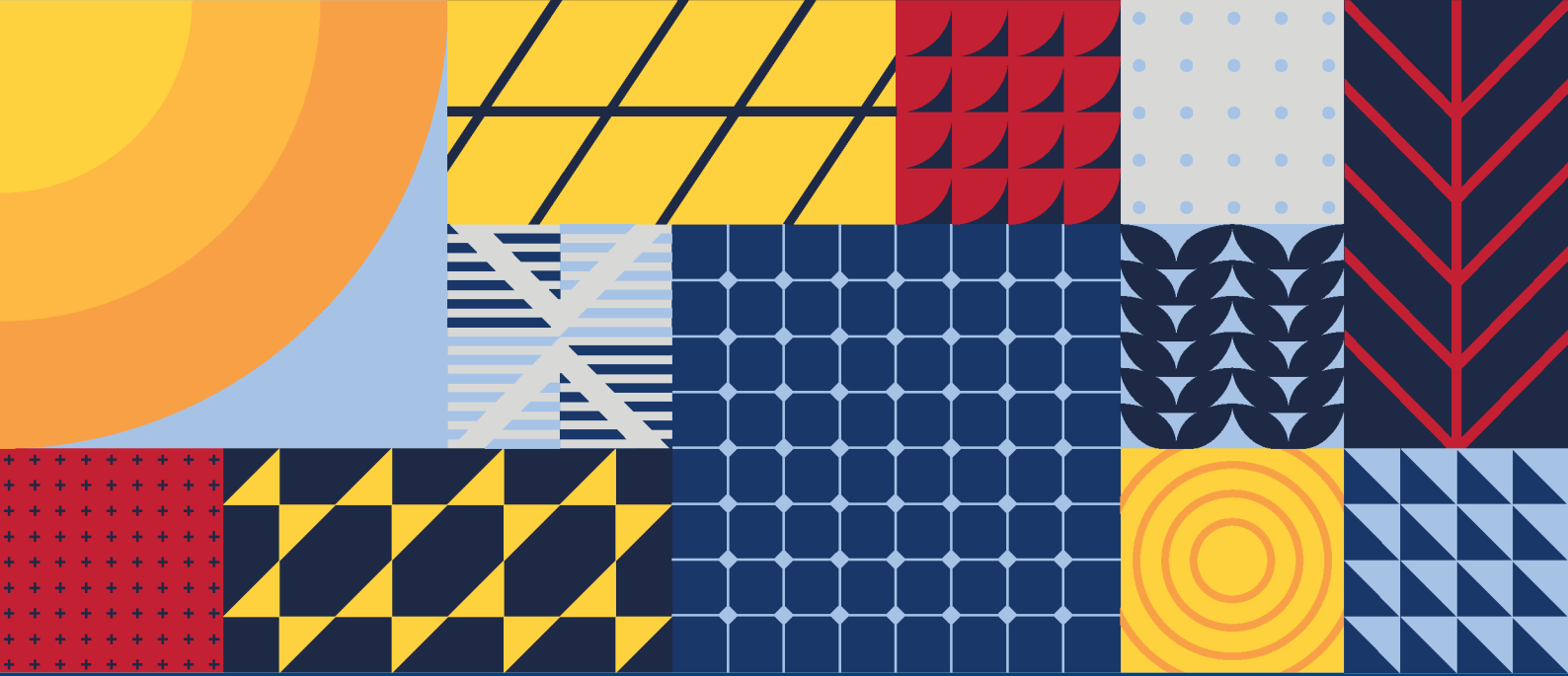
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