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RWANDA

OFF-GRID SOLAR ENERGY MARKET RWANDA

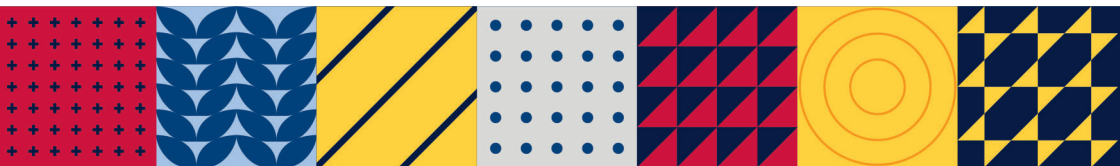
Summary Version of the 2019 Power Africa Off-grid Solar Market Assessment Report

Full report available online at: [usaid.gov/powerafrica/beyondthegrid](https://www.usaid.gov/powerafrica/beyondthegrid)



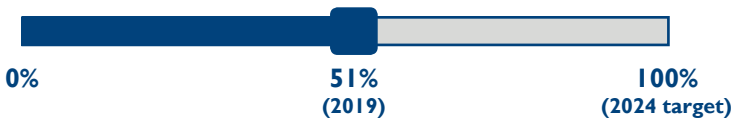
INVESTMENT OPPORTUNITIES

- In 2018, Rwanda's Gross Domestic Product (GDP) was approximately \$9.5 billion, which is anticipated to grow an average of 7.8% per year over the next three years. **Rwanda is unique in that it has the highest population density in Africa and the population is relatively uniformly distributed, which creates an opportunity for electrification through mini-grids.**
- The productive-use sector in Rwanda is in early stages of testing products such as solar egg incubators, off-grid cold storage, and solar irrigation. **Current mini-grids support refrigerators, milling, welding, and tailoring. Mini-grids are a key conduit for improving access in off-grid areas to productive-use equipment that requires more electricity than a solar home system can supply.**
- Agriculture in Rwanda uses 74.5% of land and employs two-thirds of the population, but most are subsistence farmers. **Solar irrigation pumps may help improve land productivity, but access to financing is limited. Innovation in the financing through pay-as-you-go (PAYGO) or other mechanisms may help increase access to these products.**
- Mobile money has shown strong growth in Rwanda over the past several years. However, only 23% of Rwanda's population own a mobile money account. **Expansion of banking via mobile money will facilitate more household participation in the off-grid solar market.**
- In June 2019, the Government of Rwanda (GOR) finalized its National Electrification Plan (NEP). **Because of low demand in rural areas and high upfront costs, an estimated 40 to 70% of capital expenditures must be subsidized for a mini-grid to be economically viable, again creating opportunities for financial institutions.**



ON-GRID AND OFF-GRID ELECTRIFICATION

Actual access rate vs. electrification target



Main provider of electricity. Rwanda Energy Group (REG) is the national electrical utility with two subsidiaries, Energy Utility Corporation Limited (EUCL) and Energy Development Corporation Limited (EDCL). REG handles generation, transmission, and distribution. EUCL conducts operations of government-owned power plants and grids, while EDCL is responsible for planning and development, including off-grid access.



Plan to increase electricity access. The GOR—through the NEP (2019) and in alignment with the Rwanda Electrification Strategy (2016) and Energy Sector Strategic Plan (2018)—has divided Rwanda into on-grid, mini-grid, and solar home system (SHS) areas. Classifying where off-grid companies may participate is the first step, and the second is providing subsidies to make access more affordable.



Constraints to rural electrical grid extension. The constraint prior to the finalization of the NEP grid-mapping in June 2019 was uncertainty regarding what parts of the country would be eligible for mini-grid electrification. Going forward, another constraint is the high cost of connections. Electricity is not easily affordable to rural populations, given their low income.



Policy and regulation. The Ministry of Infrastructure's (MININFRA) Energy Division is responsible for energy activities, including support for on- and off-grid sector development. The Ministry of Finance and Economic Planning controls the government's finances and macroeconomic planning activities. Its main role in the energy sector pertains to government budget allocations and regulations related to tax exemptions.

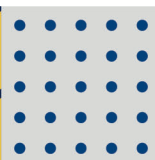
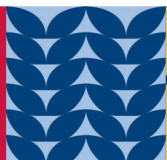
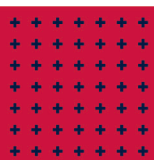


Associations. Energy Private Developers (EPD) is a trade association and advocacy group for energy companies that falls under the Private Sector Federation. It has grown to more than 100 members since its inception in 2014. EPD acts as a bridge between its members, development partners, and GOR to represent the interests of the sector. It functions as a training institution and convenes on- and off-grid private-sector players.

Map of Rwanda, source: freeworldmaps.net



KEY STATISTICS	
GDP	\$9.5 billion
GDP growth potential	7.8% per year over 3 years
Population size	12.2 million
Population density	495 people per km²
Population growth rate	2.3%
Household size	4.3
Rate of urbanization	2.9%
Urban Rural population	Urban: 17.2% Rural: 82.8%
Languages	Kinyarwanda, English, French, Kiswahili



SHS AND PICO-SOLAR

Rwanda is a global leader in electrification relative to its population size. GOR has prioritized the off-grid sector as a means of quickly and cost-effectively increasing access. As of 2017, four companies occupy 80% of the market share. One Acre Fund holds the largest market share for solar lanterns (61%). Opportunities exist for new players; GOR's electrification target means 1.4 million households will need off-grid solutions by 2024.

Consumer Finance. Most loans from microfinance institutions (MFI) are for working capital requirements, investment, and consumer credit. MFIs and savings and credit cooperative organizations (SACCOs) are targets of the World Bank Renewable Energy Fund (\$48 million) to help increase SHS adoption; however, the number of loans so far remains small. SHS companies also offer financing options. Although prices are slightly lower through SACCOs, SHS companies do not require collateral, which is appealing to potential customers.

Commercial Finance. The landscape is dominated by international companies, such as Mobisol, Zola, and Ignite, which have been able to attract significant financing from development finance institutions (DFIs), equity and impact investors, and specialized investment funds. In February 2017, BBOXX and People's Bank of Rwanda (Banque Populaire du Rwanda [BPR]) agreed on a \$2-million debt facility in local currency to grow BBOXX's operations in Rwanda. Then, in October 2017, BBOXX signed a deal with Deutsche Bank and BPR for a \$5-million debt facility.

Productive Use. The productive-use sector is at an early stage in which most companies and projects are in the pilot phase. Several technologies for standalone productive-use products have undergone testing in Rwanda, including solar egg incubation, off-grid cold storage, and irrigation.

Inspira Farms has installed 11 off-grid cold-storage facilities, ten of which support a Ministry of Agriculture program to reduce post-harvest losses by bringing cold storage closer to farmers.

Small-scale irrigation is an area in which solar solutions can have a significant impact. As of 2016, 4,000 hectares (ha) of land were under small-scale irrigation, but the Rwanda Agriculture Board additionally identified a potential 121,000 ha. GOR aims to add 2,000 ha each year and supports this target by offering a 50-percent subsidy on small-scale irrigation technology.

MINI-GRID

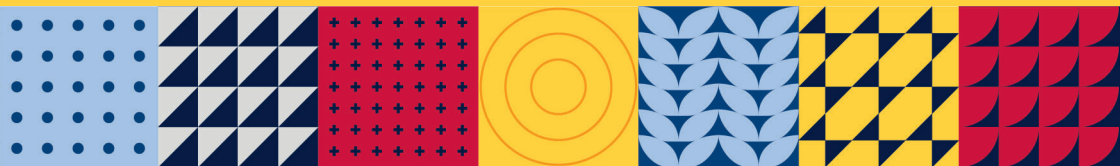
Due to the country's high population density, mini-grids hold significant promise for the Rwandan market. Mini-grids have experienced slow growth in Rwanda during the wait for the NEP mapping, which was finalized in June 2019. As no large-scale deployment has occurred, uncertainty exists about the viability of business models at scale.

Regulation. In 2015, the Rwanda Utilities Regulatory Authority (RURA) adopted regulations that specify licensing requirements, tariff guidelines, and procedures upon grid arrival. RURA is developing the next generation of regulations in consultation with developers and stakeholders. RURA intends to exempt mini-grids below one megawatt from licensing, and this clarification is included in the new version. RURA maintains the authority to review the fairness of tariffs, which is important for some developers to make a return on investment.

Financing. Presently, all financing for mini-grids in Rwanda comes from development partners or DFIs.

Emerging Development (EnDev) provides results-based financing (RBF) grants up to 70% capital expenditures for solar and hydropower mini-grids upon commissioning. Approved projects receive technical assistance, such as business modeling and technical design. EnDev intends to ensure funded mini-grids are viable, long-term businesses.

Energy4Impact (E4I) provides technical assistance and upfront grants. E4I has a pipeline of ten pico-hydro and solar projects. E4I supports local businesses with advisory services and finances productive-use appliances. Its Scaling Up Off-Grid Energy in Rwanda program provides training in business management (including pricing, customer service, and marketing) and gives partial grants for equipment. Examples of businesses the program supports include: tailoring shops, internet kiosks, phone charging shops, a health center, and a refrigeration unit.



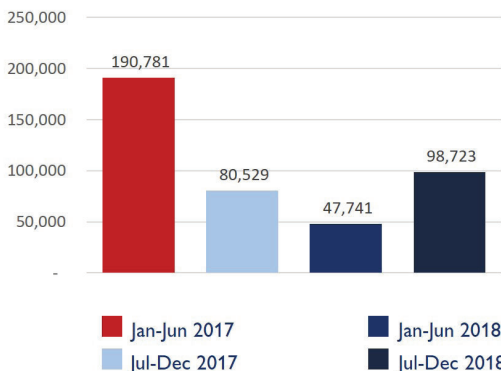
MARKET INTELLIGENCE USING GOGLA DATA

Sales and investment data from the Global Off-Grid Lighting Association (GOGLA) provide details on the off-grid solar sector in Rwanda. More than 800,000 solar products have been sold in Rwanda since 2014. Ninety-seven percent of SHS and solar lanterns sold are ten watt-peak (Wp) or smaller. Sales volumes grew quickly until mid-2017. Some reasons cited for this fluctuation include regulatory uncertainty, free distribution of SHS by GOR, and affordability, as the easiest-to-reach customers are already connected.

Of the units sold in the second half of 2018, 26,751 units (27%) were sold as cash-only transactions, while 71,972 units (73%) were sold via PAYGO. The success of PAYGO in Rwanda highlights the need for consumers to be able to pay down solar assets over time. Additional funding opportunities for solar companies would allow for continued expansion of PAYGO sales, thereby increasing the potential market for off-grid solar.

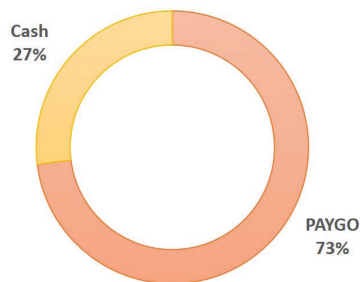
Sales of pico/SHS units

Jan 2017 - Dec 2018



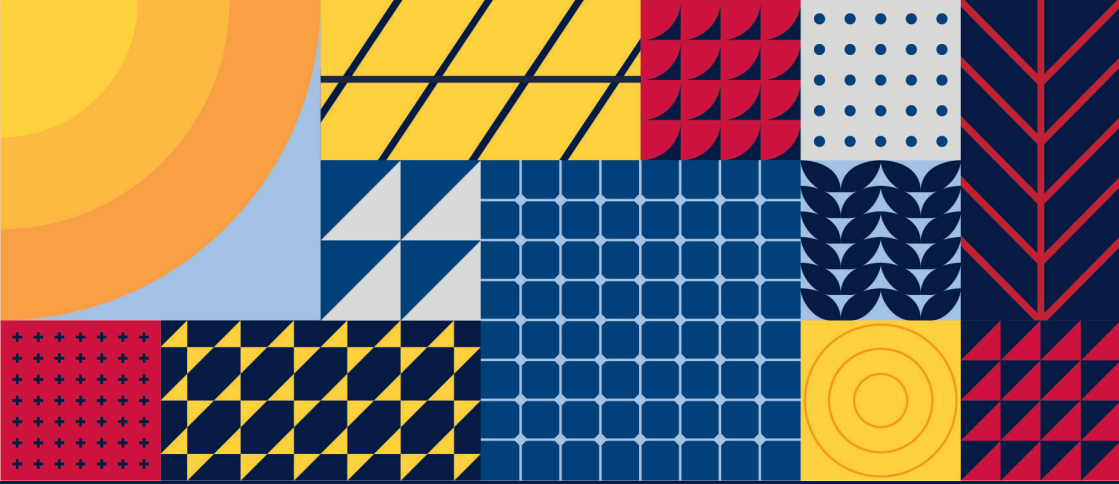
Sales by business model

Jul-Dec 2018



SHS sales declined through the first half of 2018, in part because the consumer segment with the highest ability-to-pay has been saturated. However, the second half of 2018 was marked by a sharp increase from 36 transactions in 2017 to 107 in 2018, demonstrating that the market is adjusting to reach more consumers. Total funding in 2018 was \$153,712,881, a significant portion of which comes from development finance institutions, impact investors, and specialized investment funds. Crowdfunding has increased in importance; in 2018, crowdfunding supplied more than \$19 million in funding to East Africa, up from no funding in 2015. A small amount of 2018 funding was from for-profit investors (\$4.4 million), a decrease of \$30 million from 2017, again reflecting that the easiest-to-reach customers already have service.





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



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