ESMAP
Energy Sector Management Assistance Program

THE WORLD BANK
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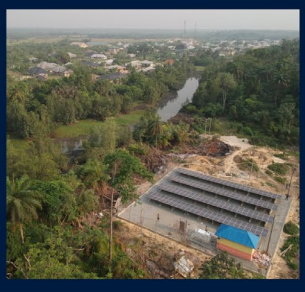
REPUBLIC OF KENYA
MINISTRY OF ENERGY & PETROLEUM

AMDA

Nairobi | February 27-March 3, 2023

Expanding Mini Grids for Economic Growth

7th Mini Grids Action Learning Event



MINI GRIDS: THE GLOBAL CONTEXT

According to the latest Tracking SDG7: The Energy Progress Report, the world is still not on track to meet SDG7 goals of access to affordable, reliable, sustainable, and modern energy by 2030. As of 2020, the global electrification rate reached 91 percent, with the number of people without access dropping to 733 million—compared with around 1 billion people in 2016 and 1.2 billion in 2010. Between 2010 and 2018, an average of 130 million people gained access to electricity annually. From 2018 to 2020, this number shrank to 109 million per year. While the slowdown is attributed in part to the difficulties in reaching the remotest and most vulnerable populations, it was compounded by the devastating effects of the COVID-19 pandemic. The pace is expected to further slow in the wake of the energy crisis provoked by the Russian invasion of Ukraine. Under current policies, an estimated 670 million people will remain without electricity in 2030 – 10 million more than projected last year. In Africa, 8 out of 10 remain without electricity.

Reaching the remaining unserved people, including those connected to frail and overburdened urban grids, as well as displaced people and in hard-to-reach locations, will require strong policies, increased private financing, and comprehensive electrification planning. Countries with a comprehensive approach to planning—which consists of main grid extensions, mini grids, and solar home systems—have achieved the fastest results in electricity access, including Bangladesh, Cambodia, India, Kenya, Myanmar, Nepal, Rwanda, and Tanzania.

In Sub-Saharan Africa, nearly 291,000 population clusters have profiles favoring the deployment of solar mini grids. That is, they are located more than 1km from the existing grid network and have a population density (>1,000 people/km^2) that favors decentralized system deployment. ESMAP has developed a database of more than 21,000 installed mini grids, connecting 48 million people at an investment cost of $29 billion. Furthermore, 29,400 planned mini grid projects, 95 percent of them in Africa and South, will connect more than 35 million people at an investment cost of $9 billion. These planned systems reveal a massive shift from diesel to solar hybrid systems; 99 percent will be powered by solar.

Over the past decade, mini grid costs have been declining and are expected to continue a downward trend through 2030. A detailed ESMAP survey of mini grids in Africa and Asia has shown that capital costs have fallen from more than $8,000 per kilowatt of firm power output (kW_{firm}) in 2010 to $3,660/$kW_{firm}$ today, with a corresponding levelized cost of energy (LCOE) of about $0.38/kWh. ESMAP analysis further indicates that with further component costs decline and income-generating uses of electricity increase, the upfront investment cost of solar and solar-hybrid mini grids should drop below $2,500/$kW_{firm}$ by 2030, with LCOE falling to $0.20/kWh.

Leading developers are leveraging transformative technologies and economic trends to build third-generation mini grids with the potential to provide high-quality, affordable electricity at unprecedented scale. A typical third generation mini grid consists of a solar hybrid generation system,

smart meters, and remote monitoring systems. They have also integrated partnership programs throughout the lifecycle of the mini grid that stimulate the local economic development of their clients, and do this in collaboration with suppliers of energy-efficient appliances as well as microfinance providers. Research shows that the uptimes of third-generation mini grids often exceed 99 percent—equivalent to less than 4 days of scheduled maintenance per year. This performance is significantly better than previous generations of mini grids and most utilities across Sub-Saharan Africa, and in a completely different league than typical utilities with 40 to 50 percent uptime.

The combination of falling costs, new technologies, and favorable enabling environments has made third generation mini grids an option to connect 490 million people by 2030. Connecting 490 million people to mini grids by 2030 will require 217,000 mini grids and $127 billion in investment from development partners, governments, and the private sector. Year-on-year gains needed to achieve universal access will require scaling up private-sector-led mini grid deployments from tens to hundreds to thousands of mini grids per country per year in each of the top 20 countries with the highest electricity access deficit rates today.

While the mini grid industry represents a significant business opportunity for mini grid developers and suppliers, experience shows that reaching universal access requires public funding—even in private-sector–led programs— to overcome the gap between the cost of reaching the remote areas and the affordability level of these clients. Governments and development partners recognize this and are developing comprehensive support packages that include subsidies to attract private investment. The World Bank has committed more than $1.4 billion to mini grids over the next five to seven years, through 50 projects in 42 countries. This investment is expected to crowd in close to $1 billion in cofinancing from the private sector, governments, and development partners.

To advance this portfolio and further mainstream mini grid programs into World Bank operations and national electrification programs, as well as to support the development and dissemination of knowledge and learning on mini grids, ESMAP established a Global Facility on Mini Grids (GFMG), with core support from the government of the United Kingdom. In addition, the Climate Investment Fund ‘s (CIF) Clean Technology Fund (CTF) and the Scaling-Up Renewable Energy Program in Low-Income Countries (SREP) are supporting the scaled-up demonstration and deployment of renewable energy in middle- and low-income countries.

The World Bank’s experience over the past decade working with mini grid developers, government officials, investors, experts, and donor partners has helped identify 10 building blocks that need to be in place to support five key market drivers that can help countries dramatically scale up mini grid deployment. These 10 building blocks are: (1) reducing costs and optimizing design & innovation for solar mini grids; (2) planning national strategies and developer portfolios with geospatial analysis and digital platforms; (3) transforming productive livelihoods and improving business viability; (4) engaging communities as valued customers; (5) delivering services through local and international companies and utilities; (6) financing solar mini grid portfolios and end user appliances; (7) attracting exceptional talent and scaling skills development; (8) supporting institutions, delivery models, and champions that create opportunities; (9) enacting regulations and policies that empower mini grid companies and customers; and (10) cutting red tape for a dynamic business environment.

In consultation with the mini grid industry, development partners and other stakeholders, progress indicators have been defined for five market drivers by 2030:

Market Driver	2030 Target
1. Reduce the cost of electricity from solar hybrid mini grids.	$0.20/kilowatt-hour (kWh).
2. Increase the pace of deployment through a portfolio approach to mini grid development.	Building around 2,000 projects per key access-deficit country per year by 2030.
3. Provide superior-quality service.	Achieving industrywide average uptime of more than 97 percent (already achieved 2021) and industrywide average load factor of 45 percent.
4. Leverage development partner funding and government investment to "crowd in" private-sector finance.	Attracting approximately $127 billion of investment from development partners, governments, and the private sector, of which $105 billion for energy access mini grids.
5. Establish enabling mini grid business environments in key access-deficit countries.	Raising the average Regulatory Indicators for Sustainable Energy (RISE) score in the top 20 electricity-access-deficit countries to 80 out of 100.

PUBLICATIONS

- ESMAP. 2022. *Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers*. Washington, DC: World Bank. https://www.esmap.org/Mini_Grids_for_Half_a_Billion_People_The_Report.

- World Bank 2022. *Tracking SDG 7 – The Energy Progress Report 2022.* https://www.worldbank.org/en/topic/energy/publication/tracking-sdg-7-the-energy-progress-report-2022

UNIVERSAL ACCESS TO ELECTRICITY & MINI GRIDS: KENYA

Access to electricity is an essential input to the social, economic, and political transformation of a country. The Sustainable Development Goal (SDG) 7 provides for access to affordable, reliable, sustainable and modern energy for all by 2030. Kenya is one of the leading Sub-Sahara Africa countries in electricity access. According to the 2019 census report more than 70 percent of the population has access to electricity (about 51 percent from grid and the rest through off-grid), up from just 25 percent in 2010.

Strides in electrification have been achieved through interventions by both the Government of Kenya (GOK) in collaboration with development partners and the private sector. These interventions include, Last Mile Connectivity Programme, electrification of all public primary schools, Global Partnership of Output Based Aid (GPOBA) and the Rural Electrification Programme, among others. The programmes are spearhead by the Ministry of Energy and Petroleum (MOEP) and implemented by Kenya Power (KPLC) and Rural Electrification and Renewable Energy Corporation (REREC). KPLC is the main electricity distributor in the country and REREC the rural electrification agency.

Electricity supplied by the main grid is derived from a well-diversified mix of renewable energy. As at June 2022, the country's installed capacity was 3,074.34 MW with 837.58 MW being hydro; 949.13 MW, geothermal; 435.5 MW, wind, 170 MW, solar and 646. 32 MW supplied by thermal power plants. The actual generation is mainly derived from the renewable energy sources at 88% in 2022. The country therefore has a unique opportunity to meet its electricity needs almost entirely from green energy sources and achieve its commitment made in the COP26 World Leaders' Summit in Glasgow in November 2021 to achieve 100 percent renewable energy supply by 2030.

The country has the potential to attain universal access to electricity much ahead of 2030 as is targeted under the UN Sustainable Development Goal (SDG7). Achieving these will require adequate, reliable, and affordable electricity supply, expansion of electricity access to households and businesses through grid and off-grid systems particularly including mini grids, and efficient and financially sustainable sector.

The role of minigrids in Kenya's national electrification and renewable energy agenda cannot be overstated. The Kenya National Electrification Strategy (KNES) of 2018, supported by the World Bank (WB), established that the least-cost pathway for achieving universal access by 2022 would involve 70 percent grid access and 30 percent from off-grid grid (through mini-grids and stand-alone solar systems). At least 34,700 unserved households are to be electrified through mini grids under the KNES, and the MOEP. The 2018 KNES is currently under review for the extended timeframe of 2030.

Kenya continues to ensure mini grids significantly contribute to the achievement of universal access and green energy targets. The GoK has largely implemented a public sector-led business model for mini-grids, with the public sector responsible for the investment and the ownership of the assets and management, operation, and maintenance, and the private sector playing an important role in engineering, procurement, and construction (EPC). However, the Kenya Off-grid Solar Access Project (KOSAP)- being implemented by GoK with financing from WB- is using a Public Private Partnership. The project targets 14 underserved counties with solar mini grids. The project has identified 137 mini grid sites. This is in addition to solar water pumping and clean cooking solutions.

Complementing the public sector-led business model, private sector business models have also been implemented. Investments by private sector have seen a vibrant off-grid sector: - solar home systems and renewable energy based mini-grids. Currently, more than 50 private mini-grids are in operation with 150 under development in the country. The mini-grid sector is guided by mini-grid guidelines issued by sector regulator in 2017, Energy and Petroleum Regulatory Authority (EPRA). Further, the Energy (Mini-grid) Regulations, 2022, due for gazettement by the Cabinet Secretary, have been developed. The regulatory tools provide a simplified and transparent regulatory framework for mini-grids tariff approval, licensing, technical guidelines, and mini-grid performance and reporting.

In the developed regulations, a participatory approach is adopted in the development and operation of the mini-grids by the local community, county governments and national government agencies. The mini-grid tariffs are determined based on prudent development and, operation and maintenance costs where engagements are held with the local community before approval.

Looking into the future, more than 400 mini-grids are to be developed in the short to medium term as part of the efforts towards universal access. Innovative business models around the mini-grid sector are required for prompt roll out of mini-grids at an affordable cost.

AGENDA AT A GLANCE

DAY 1 - MONDAY | FEBRUARY 27, 2023

- **Welcome and Introductory Remarks** – Location: Jambo Conference Center (9:00 to 9:50)
- **Introduction to Mini Grid Action Learning Event and WBG DARES Initiative** – Location: Jambo Conference Center (9:50 to 10:15)
- **Panel Discussion: Reaching 100% Electricity Access with 100% Renewable Energy in Kenya** – Location: Jambo Conference Center (10:45 to 12:15)
- **Evolution, Challenges and opportunities for Mini Grids in Reaching Universal Energy Access** – Location: Jambo Conference Center (13:30 to 15:00)
- **Kenya Off-Grid Solar Access Project (KOSAP): Overview, Status, Lessons and Next Steps** – Location: Jambo Conference Center (15:30 to 17:00)
- **Closing Remarks** – Location: Jambo Conference Center (17:00 to 17:20)

DAY 2 - TUESDAY | FEBRUARY 28, 2023

Parallel Sessions Round 1 (9:00 to 10:30)
- Nigeria – **Location:** Tsavo
- Madagascar - **Location:** Amboseli
- Financial Innovation that will Scale the Mini Grid Space - **Location:** Samburu

Parallel Sessions Round 2 (11:00 to 12:30)
- Sierra Leone – **Location:** Tsavo
- Ethiopia - **Location:** Amboseli
- Interconnected Mini Grids - **Location:** Samburu

Parallel Sessions Round 3 (14:00 to 15:30)
- Democratic Republic of Congo (DRC) – **Location:** Tsavo
- Somalia - **Location:** Amboseli
- Enabling the Business Environment: A Focus on Pace & Costs - Location: Samburu

Parallel Sessions Round 4 (16:00 to 17:30)
- Niger – **Location:** Tsavo
- Uganda - **Location:** Amboseli
- Investment - **Location:** Samburu

DAY 3 – WEDNESDAY | MARCH 1, 2023

- **Intro Sessions & Opening Remarks for the Global Day**– **Location**: Jambo Conference Center (9:00 to 9:30)
- **Launch of the Mini Grids for Half a Billion People Report – 2022 Edition** – **Location**: Jambo Conference Center (9:30 to 10:30)
- **Overview of Today's Agenda and Clinics on the Ten Frontiers for Mini Grid Market Scale-up** – **Location**: Jambo Conference Center (10:30 to 10:45)

Technical Sessions – Round 1 (11:15 to 12:30)
- Costs: CAPEX, OPEX, LCOE – **Location:** Tsavo
- Public Finance, Performance Grants and Subsidies - **Location:** Amboseli

- Training, skills development and jobs training at scale - **Location**: Samburu

Technical Sessions – Round 2 (14:00 to 15:15)

- Revenue – **Location:** Tsavo
- Regulation: Accelerating the Pace of Processing - **Location:** Amboseli
- Geospatial Analysis and Planning - **Location:** Samburu

Closing Session - Growing Mini Grids by a Magnitude – **Location:** Jambo Conference Center (15:45 to 17:00)

Closing Remarks – **Location:** Jambo Conference Center (17:00 to 17:20)

DAY 4 – THURSDAY | MARCH 2, 2023

Field Trip All day (For registered attendees only)

DAY 5 - FRIDAY | MARCH 3, 2023

Training (For registered attendees only)

BACKGROUND

The Global Facility on Mini Grids (GFMG) was created in 2016 and further endorsed in ESMAP's FY21-24 business plan to increase the deployment of portfolios of mini grids in World Bank operations and client country electrification programs. At that time, only a few countries were including significant numbers of mini grids in their national electrification plans.

Mini grids have risen to prominence over the last few years and are poised to play a significant role in World Bank energy access programs going forward. New technologies—including remote monitoring; smart meters; and robust, inexpensive battery storage—now make it possible for countries and developers to deploy mini grids at unprecedented scale.

The GFMG has helped take mini grids from a niche to a mainstream solution, with an emphasis on robust national and international markets and policies driving the sector's growth at scale to provide large numbers of people with access to high-quality, affordable electricity.

The GFMG is collaborating with the IFC, MIGA, and IDA operations teams to accelerate private sector investment in mini grids over the next five years.

The objective of the site visit is to share knowledge and experience between both mature and emerging markets and to demonstrate real projects and infrastructure and inform how to build up their own mini grid industry. This will be done through an onsite visit to the two sites in the Busia country.

With the ESMAP's Global Facility on Mini Grids further deployment, the program has expanded to cover various countries, and has already started important work developing country roadmaps and providing technical assistance. To follow up and increase the engagement we now want to both invite countries with significant installed mini grids and those with plans to begin engaging with World Bank regional teams to develop their mini grid coverage.

DETAILS OF THE SITE VISIT

BUSIA County is in the western Lake Basin Region of Kenya, along the Kenya – Uganda border. With a population of over 900,000 predominantly represented by the Luhya community. Busia is located 2hrs away from Kisumu County. Kudura Power East Africa Ltd (KPEA) serves an average of 4000 customers in 11 communities across the Busia County. Most of our sites are accessible year-round via earth roads off the Busia Kisumu highway.

Prior to the commissioning of KPEA's first pilot site in Sidonge, almost all KPEA's sites had been without access to electricity relying on kerosene, firewood, and charcoal to meet their energy needs. Alongside the health hazards use of the latter fossil fuels presents, most of these communities did not have access to clean drinking water within their respective communities, with many of them resorting to walking several Kilometers away from their homes to source water from rivers, streams, and wells. As a result, KPEA has been in the process of developing water projects to meet the need for accessible clean drinking water to the communities we serve.

In November 2011 KPEA with support from RVE.Sol, Fortum, Trine, Equatorial Sun Power, EST, and Seccua, KPEA commissioned its maiden 7KWp Smart Metered Low Voltage site in Sidonge (Busia County > Samia > Funyula >Nambuko > Mango Closest town – Funyula).

To achieve community buy-in and sustainability of the project, a community centric approach was adopted during the project development, construction, and operation, through a well-articulated ESMP, which entails consultation and engagement of the community on key issues. KPEA has always adopted a community first approach when hiring for various site-specific roles which has seen the realization of Customer Experience and Technical O&M Teams predominantly recruited from within each respective community.

All KPEA sites operate under the same Tariff issued and regulated by the Energy and Petroleum Regulatory Authority (EPRA). While this tariff is significantly higher than the National grid tariff, it is reflective of the relative high Capex and Opex costs and the absence of subsidies across the mini-grid sector in Kenya and across the region. Notwithstanding, we remain hopeful that Governments in the region will continue to explore more meaningful partnerships with the Mini-Grid sector in providing last mile access to energy to remote communities.

In addition to the provision of renewable energy to our communities, KPEA has been successful in realizing the following impacts across its community base:

- Avg. 70% decrease in use of Kerosene
- Enhanced security at night
- Extended business and school operating hours
- 180% increase in access to education for Girls
- Avg. 75% savings on energy expenditure
- Avg. 72% reduction in Kerosene use specifically
- Avg. 47% increase in education performance with the extended study hours with access to electricity at night
- Improved access to wealth generating activities resulting in the establishments of several small and micro-businesses, including a clinic and business center at various sites.

SYAMAKHANGA

Site location: 0.351632,34.162225
Site Capacity: 15 KWp
Departure time and place: Delegates shall be collected from Kisumu Airport at approximately 7:50am for onward travel to Busia town

Time travel:
Approx. 2hrs – 2.5Hrs (From Kisumu)
Approx. 30min to 1hr from each of the 1 other Location

The visit will take 1hr approx. and will include a tour of the generation station, visits with various customers and touring of Productive Energy Use activities across the Site.

Arrival time and place: Delegates will arrive in Busia at around 10am and will split into 2 groups who will tour in parallel throughout the day.

DIRAKHO

Site location: 0.313925,34.066539
Site Capacity: 30 KWp
Departure time and place: Delegates shall be collected from Kisumu Airport at approximately 7:50am for onward travel to Busia town

Time travel:
Approx. 2hrs – 2.5Hrs (From Kisumu)
Approx. 30min to 1hr from each of the 3 other Site Locations

The visit will take 1hr approx. and will include a tour of the generation station, visits with various customers and touring of Productive Energy Use activities across the Site**.**

Arrival time and place: Delegates will arrive in Busia at around 10am and will split into 2 groups who will tour the sites in parallel throughout the day.

Should you have any queries, please contact any of us at:
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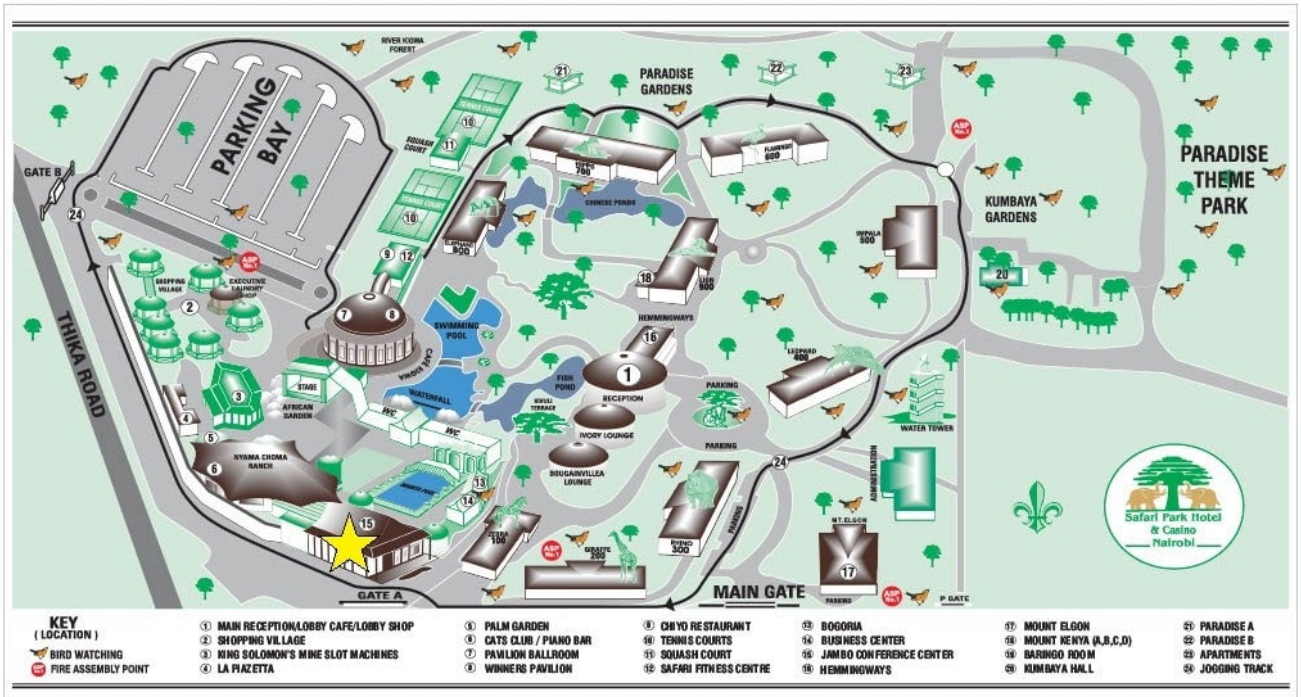
LOGISTICS

- **Localization: Safari Park Hotel & Casino.**
  P.O. Box 45038 – 00100, Nairobi, Kenya



- **Early registration**: Sunday, February 26 from 3pm-6pm in front of Jambo Conference Room.
- **Registration on Day 1**: doors open at 6am and registration closes at 8am SHARP!

Once plenary starts, no one will be allowed inside the ballroom until the coffee break. However, there will be an overflow area with a screen.

- **Getting into the Safari Park Hotel:** With over 800 registered participants, please be mindful of the time it will take to get through the gate -as cars will be checked by security- and completing registration before finally making it to the ballroom.
- **There are 3 Gates:**
    - Parking is through Gate 1
    - Registration is through Gate 2: The main ballroom is here.
    - Main hotel reception is at Gate 3

- **Link to latest agenda:** https://bit.ly/41iyf9l
- Masks are encouraged, but not required.
- Sanitizing gel will be available throughout the venue

STILL NEED A HOTEL ROOM?
We have a negotiated rate with the Safari Park hotel which you can use by following these instructions:

https://book.nightsbridge.com/14655?special=WORLDBANK
Login: Worldbank
Password: Wbank.2023

NEED TO CONTACT THE ORGANIZING TEAM?
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MINI GRIDS FOR HALF A BILLION PEOPLE

I ♥ MINI GRIDS

ESMAP Mission

The Energy Sector Management Assistance Program (ESMAP) is a partnership between the World Bank and 24 partners (https://esmap.org/donors) to help low and middle-income countries reduce poverty and boost growth through sustainable energy solutions. ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector.

Through the World Bank Group, ESMAP works to accelerate the energy transition required to achieve Sustainable Development Goal 7 (SDG 7) (https://sdgs.un.org/goals/goal7) to ensure access to affordable, reliable, sustainable, and modern energy for all. It helps to shape WBG strategies and programs to achieve the World Bank Group's Climate Change Action Plan targets.

Learn more at: https://esmap.org

Africa Minigrid Developers Association (AMDA)

AMDA was founded in 2018 to improve awareness of the capabilities, needs, status and effectiveness of African minigrids and help governments, donors, and investors scale the sector. AMDA represents private sector developers that efficiently deliver high-quality, low-cost electricity at scale. The organization plays a catalytic role in creating enabling policy and safer investment environments for the private minigrid sector and those who fund it. AMDA's position at the nexus of policy and regulation – as well as between concessional and commercial capital investment – supports key players to overcome market barriers, make decisions based on robust data and evidence, and maximize impact of their combined efforts to universalize electrification.

Launched by 11 minigrid developers, AMDA now represents 42 member companies, all private decentralized utilities that develop and operate minigrids across 19 countries in Sub-Saharan Africa. AMDA members comprise approximately 85% of developers who have commissioned at least 1 site on the continent (see the map below) and provide connections to over 78,000 households, commercial, and other public and private institutions. Their 400+ deployed minigrids provide electricity to more than 500,000 rural and peri-urban people in SSA, totaling a capacity of approximately 7,000 kW.
www.africamda.org