5th Mini Grids Action Learning Event

Reaching Universal Energy Access in Ghana

WORLD BANK GROUP

ESMAP
Energy Sector Management Assistance Program

MINISTRY OF ENERGY
REPUBLIC OF GHANA

CIF
CLIMATE INVESTMENT FUNDS

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MINI GRIDS: THE GLOBAL CONTEXT

According to the latest *Tracking SDG7: The Energy Progress Report*, progress toward achieving universal access to electricity has been promising. In 2017, the global electrification rate reached 89 percent, with the number of people without access dropping to around 840 million—compared with around 1 billion people in 2016 and 1.2 billion in 2010. Despite this progress, under current policies, an estimated 650 million people—or 8 percent of the global population—will still lack access to electricity in 2030; 9 out of 10 of them will be in Sub-Saharan Africa.

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.

Compared with the main grid and solar home systems, mini grids are a more viable solution for off-grid areas with high population density and demand. They are not a new phenomenon and have been widely deployed. ESMAP has developed a database of more than 26,000 installed and planned mini grid projects in 138 countries and territories around the world, representing around $40 billion of investment and over 70 million people. At least 19,000 mini grids are already installed, mostly in Asia, with another 7,500+ mini grids planned in the next few years, mostly in Africa. These planned systems show a significant shift from diesel to solar hybrid systems using the latest technologies.

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 $3,900/$kW_{firm}$ in 2018, with a corresponding levelized cost of energy (LCOE) of about $0.55/kWh in 2018. ESMAP analysis further indicates that if component costs continue to decline and income-generating uses of electricity increase, the upfront investment cost of solar and solar-hybrid mini grids could drop below $3,000/$kW_{firm}$ by 2030, with LCOE declining 60–70 percent to around $0.20/kWh.

Leading developers are now 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 97 percent—less than 2 weeks of scheduled maintenance per year. This performance is significantly better than previous generations of mini grids and most utilities across Sub-Saharan Africa.

The combination of falling costs, new technologies, and favorable enabling environments has made third-generation mini grids an option to connect 490 million people, complementing grid extension and solar home systems to provide a total of 1.2 billion people with electricity in order to reach universal electrification by 2030. Connecting 490 million people to mini grids by 2030 will require more than 210,000 mini grids and almost $220 billion in investment. This represents a two-order-of-magnitude increase in the number of mini grids deployed in each of the top-20 electricity access-deficit countries, on a per-country, per-year basis: from 10–50 deployed annually today, to more than 1,500 deployed in each of the highest energy access deficit countries annually by 2030.

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. Development partners, including the World Bank, have committed more than $1 billion to mini grids over the next several years, not including funding for technical assistance and research. The World Bank's investment commitment in mini grids spans 37 projects in 33

countries, with a total commitment of more than $660 million. This investment is expected to leverage an additional $1.1 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. For more information, see Annex A. 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. A series of projects supporting clean energy mini grids—based on renewable energy technologies, including storage in systems with variable renewables or renewable energy-diesel hybrid systems—have been approved and are in startup phases, while others are in the pipeline.

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: (i) solar hybrid technology and costing, (ii) geospatial portfolio planning, (iii) income-generating uses of electricity, (iv) community engagement, (v) local and international industry, (vi) access to finance, (vii) training and skills building, (viii) institutional framework, (ix) workable regulations, and (x) enabling business environments. The five key market drivers are: (i) increasing the pace of deployment through a portfolio approach to mini grid development; (ii) providing superior-quality service; (iii) leveraging development partner and government funds to crowd in private-sector finance; (iv) establishing enabling business environments in key access-deficit countries; and (v) reducing the cost of solar hybrid mini grids.

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

1. Pace: develop 1,500 projects per key access-deficit country per year by 2030 through a portfolio approach, and reduce the time it takes to build a mini grid to five weeks in 2030
2. Service: achieve 97 percent uptime by 2020, and increase the industrywide average load factor of 3rd-generation mini grids to 45 percent
3. Enabling Environment: Raise the average RISE (Regulatory Indicators for Sustainable Energy) score in the top-20 electricity access-deficit countries to 80 out of 100
4. Finance: attract almost $220 billion of investment from donors, governments, and the private sector between 2019 and 2030
5. Cost: reduce the cost of solar hybrid mini grids (which the other four market drivers will also support) to $0.20/kWh by 2030

The objective of this event is to bring stakeholders together to discuss these building blocks and market drivers, in an effort to identify concrete solutions/action plans that will put the objectives above within reach. It is envisioned that the overall lessons generated through the event will inform future efforts in the global mini grid sector on how to effectively scale up. A facilitator ensures that a process of action learning is established and continued, following up on earlier similar events in Kenya, Myanmar and Nigeria.

UNIVERSAL ENERGY ACCESS & MINI GRIDS: GHANA

The energy sector in Ghana has been undergoing a transition for several years, as the electricity market has been restructured to unbundle generation, transmission and distribution assets and increase private sector participation to allow greater competition to drive down service costs.

Ghana has one of Africa's highest rates of electricity access, with a national electrification rate of 84.3%[1] and a rural electrification rate of 71%. The National Energy Policy is targeting universal access for the country by 2020. While the Government of Ghana (GoG) is going to make use of all technical solutions to achieve the target, 92% of the population served by electricity services will be connected to the grid.[2]

The country has the target to establish 55 solar mini-grids, with an average capacity of 100 kW, by 2023.[3] These will be installed in islands and lakeside communities and smaller communities elsewhere, targeting communities with less than 500 inhabitants and no road access.

The GoG has opted primarily for a public sector-led business model for mini-grids, where the public sector is responsible for the investment and the ownership of the assets. The management, operation and maintenance of mini-grid installations are the responsibility of the utilities. Private sector participation is foreseen in engineering, procurement and construction (EPC), and operation and management concessions. The existing Uniform Tariff Policy (UTP) applies to mini-grids so that customers enjoy the same pricing policy as those on the main electricity grid and public funds are used to cover the gap between revenues and operating costs. Under this model, the Ministry of Energy, with the financing support of the World Bank, successfully implemented five pilot mini-grids in the framework of the Ghana Energy and Development Access Program (GEDAP).

To complement the public sector-led business model, fifteen pilot projects were implemented under a different and specific arrangement between the Energy Commission and the private company Black Star Energy Ltd. (BSE), which received a pilot license under the Solar Installation and Maintenance licensing framework to commercially develop and operate mini-grids. Their business model relies on a direct contract made between the company and the concerned communities, which defines the price at which the electricity will be sold to the end users. The replicability of this arrangement is in question since it does not conform to the UTP and there is no arrangement to provide a reliable cross-subsidy to the service provider.

While GoG has made significant progress in adoption of mini-grids, several challenges remain, including: i) Inadequate local technical expertise in the target communities; ii) Higher LCOE than the Uniform Tariff; iii) Renewable energy resources availability limitations in some locations; iv) Difficulties accessing communities using existing modes of transport, especially to deliver equipment; v. Pronounced operational risks, due to the need for a reliable on-going subsidy, heavy prevalence of lifeline consumers in the customer base, and limited availability of efficient payment options in remote areas; and vi. Need for stronger drivers for efficiency due in business, financial, and procurement models.

The achievement of universal access requires an acceleration in new connections by making use of all economically viable technical solutions, including clean-energy mini-grids. In order to be able to do so, GoG will need to address some key issues, including: i) complete the update of the existing GIS-based database to provide better information for planning what areas grid extension will cover and where off grid is needed; ii), update the mini-grids targets if required, based on the outcomes of the GIS-planning; iii) finalize, adopt and enforce the mini-grid regulations, the key missing piece in the policy and regulatory framework of the sub-sector; iv) complete the process that PURC has initiated concerning the tariff approach to address the gap between revenues and running costs for mini-grids as a public sector-led business; v) mobilize funds for investment in the last mile electrification (grid extension and off-grid including mini-grid development), including consideration of incentive structures that can mobilize private investment that is aligned with Ghana's public equity objectives.

[1] Ministry of Energy, 2018

[2] Ghana National Renewable Energy Action Plan

[3] SREP Investment Plan, 2015

Additionally, if private sector investment and ownership is pursued to complement the public sector model, some key challenges should be addressed, including: i) the need for a clear licensing and permitting process; ii) the need to establish a reliable subsidy regime to complement revenues from customers under the UTP, or a smart incentive scheme to achieve this in a manner that builds in drivers for operational efficiencies; iii) the lack of incentives for investment and for development of local private sector expertise and ownership in this effort; and iv) the difficult access to finance for local private sector via commercial finance institutions.

AGENDA AT A GLANCE

DAY 1 - MONDAY 24 OF JUNE

- **Africa Mini Grids Summit & Country Programs** – Location: Ballroom 1 (8:55 to 16:40)
- **HOMER Training** (For registered invitees only) – Location: Meeting Room 1 (9:00 to 17:30)

DAY 2 - TUESDAY 25 OF JUNE

- **Ghana Universal Energy Access and Mini Grid Roundtable** – Location: Ballroom 1 (8:55 to 17:15)
- **Odyssey Training** (for registered invitees only) – Location: Meeting Room 1 (13:30 to 17:30)
- **Evening Reception** – Location: Pool Area (17:30 to 19:30)

DAY 3 - WEDNESDAY 26 OF JUNE

Plenary Session – Location: Ballroom 1&2 (8:30 to 10:15)

Clinic Sessions – Round 1 (11:00 to 12:45)

- Access to Finance - Location: Meeting Room 6
- Closing the Gap between Women and Men in the Off-Grid Sector – Location: Meeting Room 1
- Demand Creation and Productive Uses – Location: Ballroom 2
- Workable Regulations & Enabling Business – Location: Ballroom 1

Clinic Sessions – Round 2 (13:45 to 15:30)

- Community Engagement - Location: Meeting Room 6
- Business Models & Enabling Business Environment - Location: Ballroom 1
- Geospatial Portfolio Planning - Location: Meeting Room 1
- Technology and Costs – Location: Ballroom 2

Clinic Sessions – Round 3 (16:00 to 17:45)

- Capacity Building/Training - Location: Ballroom 1
- Role of the Private Sector – Location: Meeting Room 6
- Taking Mini Grids to Scale Sustainably/ Institutional Framework - Location: Ballroom 2
- Transforming Regional Energy Markets through Policy Harmonization - Location: Meeting Room

Closing Session – Location: Plenary Ballroom 1 (18:00 to 18:15)

DAY 4 - THURSDAY 27 OF JUNE

Global Technical Conference on Mini Grids – Location: Ballroom 1 (9:00 to 10:15)

Parallel Sessions Round 1 (10:45 to 12:45)

- Geospatial Planning – Location: Ballroom 1

- Technical Solutions - Location: Ballroom 2

Parallel Sessions Round 2 (13:45 to 14:45)

- Cost, Financing, and the Role of Development Partners in Reaching Universal Access – Location: Ballroom 1
- Institutional Arrangements for Achieving Universal Access – Location: Ballroom 2

Parallel Session Round 3 (15:00 to 17:00)

- Cost, Financing, and the Role of Development Partners - Location: Ballroom 1
- Institutional Arrangements – Location: Ballroom 2

Side Meetings:

- **Green Mini Grids Africa** (for invited participants only) – Location: Meeting Room 3 (8:30 to 12:45)
- **Clean Cooking Forum** (space limited) – Location: Meeting Room 4 (9:00 to 16:30)
- **Development Partners Forum** (for invited participants only) – Location: Meeting Room 1 (14:00 to 17:30)

DAY 5 - FRIDAY 28 OF JUNE

Field Trip to Pediatorkope Island (Lobby @8:25, for first 100 pre-registered participants only)

ESMAP Mission

The Energy Sector Management Assistance Program (ESMAP) is a global knowledge and technical assistance program administered by the World Bank. It provides analytical and advisory services to low- and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is funded by Australia, Austria, Canada, ClimateWorks, Denmark, the European Commission, Finland, France, Germany, Iceland, Italy, Japan, Lithuania, Luxemburg, the Netherlands, Norway, The Rockefeller Foundation, Sweden, Switzerland, and the United Kingdom, as well as the World Bank.

Ghana Ministry of Energy Mission

MoEn develops and ensures a reliable high quality energy service at the minimum cost to all sectors of the economy through the formulation, implementation, monitoring and evaluation of energy sector policies.

Within the context of energy sector vision, the goal of the energy sector is to make energy services universally accessible and readily available in an environmentally sustainable manner.

ANNEX A | PROGRAM DESCRIPTIONS

Clean Technology Fund & Scaling Up Renewable Energy Program, CIF

Both of the major energy sector Climate Investment Funds (CIFs)—the Clean Technology Fund and the Scaling-Up Renewable Energy in Low Income Countries (SREP) Program—are supporting the scaled-up demonstration and deployment of renewable energy in middle- and low-income countries. Clean energy mini grids (CEMGs)—based on renewable energy technologies (including storage in systems with variable renewables) or renewable energy diesel hybrid systems—are one potentially promising option for delivering reliable energy in a sustainable manner.

While some initiatives are also ongoing within Clean Technology Fund, mini grids are of particular interest to SREP countries. The SREP has allocated more than $140 million to mini grid projects identified through country investment plans in 13 countries (out of 27 SREP countries), representing a relevant and strategic part of the SREP portfolio, with strong ownership from countries. An additional $55 million has been allocated to mini grid projects through the Clean Technology Fund Dedicated Private Sector Program on Renewable Energy Mini Grids and Distributed Power Generation.

Global Facility on Mini Grids, ESMAP/World Bank

ESMAP at the World Bank—with core funding from DFID and committed funds from Danida—initiated a Global Facility for Mini Grids to accelerate the pace of electrification to large groups of people by mainstreaming least cost mini grids into World Bank Group operations as well as develop the global and local knowledge associated to achieve this. While mini grids have a long history and are widely used around the world, they are now emerging as a viable option for meeting the energy demand in Sub-Saharan Africa, South and East Asia, and Small Island Developing States. Mini grids are the expected least-cost option for more than 120,000 villages and towns in these regions.

The Global Facility for Mini Grids is part of the joint effort of ESMAP and the SE4All High Impact Opportunity on Mini Grids. The Global Facility for Mini Grids, focusing on:

- Pillar 1: Accelerating the pace of electrification for large groups of people by working together with operational task teams and clients to mainstream least cost mini grids into World Bank Group operations and national electrification programs. Where possible, these mini grids will be powered by renewable energy.
- Pillar 2: Developing the required knowledge to assist in achieving the first objective and contribute to the frontiers of global knowledge development and learning. This development will look at the experience of mini grid projects worldwide.