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# Mini-Grids on the Trajectory of Rural Electrification in Africa

An AMDA Position Paper

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A decade ago, the emergence of mobile phones and mobile data services made the introduction of traditional cable-bound phone and data networks in Africa obsolete. The rapid evolution in distributed energy technologies and services is showing us that, Smart Grids will similarly soon overtake outdated electrification approaches based solely on hub-and-spoke main-grid extension. In this evolution, mini-grids are already playing an important role as nuclei and test centers for Smart Grid development.

## Executive Summary:

Decentralized renewable power generation and distribution systems such as mini-grids, are important tools for providing power to the roughly 600 million Africans currently living without access to modern energy services. For African Governments to meet the Sustainable Energy for All Goal of Universal Access to Energy By 2030, it is estimated that 40 percent of new power connections will need to be provided by mini-grids.[1]

Several changes to mini-grid deployment strategies, policy infrastructure, and financing facilities, will be needed to meet this goal. This paper presents the Africa Mini-grid Developers Association's (AMDA's) perspective on barriers to the utilization of Smart Mini-Grids and proposes changes that would help to eliminate these barriers. It further describes what it will take to make these changes a reality.

1 International Energy Agency's World Energy Outlook (2011) report

## Key messages from AMDA contained in this paper:

- **Decentralized approaches to rural electrification have been central to the development of power infrastructure everywhere - including across Europe and the United States**. While the technology has radically improved with the advent of renewable solutions and smart grids, the proven efficacy of a decentralized approach should not be abandoned. Technological innovation has improved the reliability and cost of smart mini-grids, making them an ideal technology to address rural electrification.

- **Concessional funds have been - and remain - key to rural electrification efforts worldwide.** Ensuring that concessional funds are used to promote the least cost option is essential to rural electrification

- **Integrated national energy planning is necessary to achieve universal electrification**. Mini-grids won't replace national grid infrastructure. Instead, they will provide energy solutions that improve access with the goal of creating a bi-directional energy network.

- **Mini-grid developers provide more than power access, they are instrumental in building rural jobs and economies,** driving efficiency improvements in both service delivery and costs. Demand stimulation in conjunction with cost efficiency is essential to realizing universal access to energy. The private sector is the best placed to deliver on both fronts.

- **The mini-grid sector, and African rural electrification efforts in general need modern regulatory frameworks built for integrated energy systems.** It is important to provide the mini-grids sector with security and certainty on important questions around quality standards, tariff regulation, access to finance, and procedures for grid interconnection. Templates for these already exist and can be quickly tailored to the needs of countries looking to update their regulations. Standardizing regulatory frameworks across multiple governments is needed to enable scale.

- **A sector-wide mini-grid Results Based Financing (RBF) facility is needed to ensure public funds are spent in a way that rapidly scales energy access across the continent**. To date, public support for mini-grids has focused on individual firms and projects, and therefore has seldom led to scale. Now that pilots have been proven and the sector is beginning to mature, new support mechanisms are needed. AMDA believes a mini-grid RBF facility is the best way to accomplish this. AMDA also believes that such a facility would help drive down costs per connection (AMDA member connection costs are already competitive or cheaper than grid connections in most contexts).

## AMDA - Who We Are:

AMDA is the first Trade Association for mini-grid developers in Africa. We represent private utilities developing small, renewable, localized power grids. AMDA's members operate AC mini-grids that ensure power reliability of at least 20 hours per day. Though nascent, the association already has 11 developers across Kenya and Tanzania and is setting up a chapter in Nigeria that will represent 7 developers with growth plans that would encompass all private sector mini-grid developers.

In Africa AMDA members already serve over 11,000 connections with at least 20 hours of reliable power every day. Members have built over 430 kilometers of transmission lines, and renewable generation to serve households, schools, health clinics, micro-enterprises and agricultural production.

With USD 75M of additional funding, AMDA members in East Africa will be able to connect 140,000 more people to reliable power at an average cost per connection of under USD 800. The expansion to other regions of the continent will deliver even more connections at a much lower cost per connection compared to an electrification strategy focused exclusively on main grid expansion.

The importance of an integrated approach that includes mini-grids as a major component is highlighted by the fact that projections show that maintaining the current pace will leave 600M Africans without access to power in 2030 as population growth keeps up with electrification efforts. AMDA aims to see 100% of Africa electrified by 2030 by leveraging the private sectors ability to innovate, driving down connection costs while improving quality of service.

# The Energy Challenge in Africa: Connecting 500m People to Power while Building the Energy System of the Future

**Research opportunities:**

- The state of grid connectivity in Africa
  - Assess the of level of access (Industry vs households)
  - Evaluate grid extension plans vs. execution over the past 5-10 years

After almost a century of stagnation, the global electricity sector is undergoing one of the most profound shifts in the modern era. Thanks to a slew of new technologies such as efficient smart inverters, advanced control systems, Internet of Things (IoT) enabled devices and intelligent energy storage systems, we are fast approaching a tipping point at which distributed power generation will be the least costly way to provide electricity to households around the world.

Though such a change would mark a major shift in the way energy generation and distribution is currently organized, it also marks a reversion to how power systems first emerged in the early days of the development of the electric grid. In the late 1800s, centrally operated power grids, then known as 'central stations' were vastly outnumbered by 'private plants', the smaller power systems that performed a variety of tasks ranging from lighting the homes of the wealthy to running the streetcars of New York City.

Over the course of the 20th century, these private plants gradually gave way to centralized generation. This shift was driven by a variety of regulatory, economic and technological bottlenecks. These made sharing generation capacity across a large base of clients through a monopoly grid operator the most cost effective and convenient way to provide cities with reliable electricity.

Until recently this centralized grid paradigm appeared to be unassailable as a model for providing power at scale. However, as first the technological then the economic and finally the regulatory barriers to decentralized generation fall away, attention has once again turned to the possibilities presented by a decentralized grid. These include lessening the need for the construction of costly high voltage transmission lines and in- creasing the resilience of grids to both natural disasters and cyber-attacks. The exploration of these options is happening on a global scale, from the efforts to rebuild Puerto Rico's electric grid, to private companies across Africa working to connect rural villages to power for the first time.

This push to decentralize the grid does not mean that the grid is destined to become obsolete, rather, it means that the grid is bound to undergo a radical transformation from a large unidirectional network that was built for a power generator supplying a large number of customers, to a, 'Network of Networks'. This Network of Networks will be characterized by multiple interconnected points of power generation, storage and consumption that will allow smaller grids to be largely self-sufficient while retaining the ability to tap into a broader network to draw additional power or sell excess power.

This vision of the future, though compelling, is not where the mini-grid sector in Africa currently stands. The industry is still in its early stages, with a few developers working independently across the continent. The African Mini-grid Developers Association (AMDA) has been formed to pull together the efforts of these developers, rallying them towards a unified goal.

There are three major components that will underpin the evolution to this new decentralized grid. The first is bidirectional storage which will improve grid reliability by reducing the overall grids reliance on the fragile distribution system. This will be accomplished by bringing more sources of power closer to the consumer. The second is a modular grid architecture that will enable easy integration of new and varied sources of generation and energy storage thus enabling all the nodes on the grid to become both producers and consumers of energy services. The third is smart metering throughout the grid which will enable enhanced and cost-effective monitoring and management of all the assets on a grid thus improving resource efficiency.

## Why grids will still be important

**Research opportunities:**

- The importance and impact of productive loads on communities
  - Assess improvements in productivity, income, entrepreneurial activity, access to key services such as medical care, education and information
- Tariff Pricing - impact on consumption
  - Look at how tariff price affects consumption patterns of consumers and allows them to 'climb the economic ladder'

There are three reasons why this 'Network of Networks' vision is the most likely point at which the global 'grid of the future' will converge:

1. Autonomous solar systems suffer from a 'double scaling problem'; autonomous solar PV is too expensive to scale up for productive loads, and storage is too expensive to scale down for productive loads: Demand for power in emerging markets will grow dramatically over the coming decades despite efforts to increase energy efficiency. As populations grow and standards of living rise, power consumption will grow for households as well as small businesses. While Solar Home Systems offer a powerful entry point for bringing electricity to those without access, they limit the ways in which that electricity can be used by requiring specialized appliances that run on DC power and consume significantly less power than commercially available alternatives. Access to grid style AC power will be crucial to ensuring that these newly electrified users of power do not get locked into using a power system that is incompatible with the power systems of the rest of the world. Providing power that meets the global standard using the off-grid model is prohibitively expensive with estimates for the capital costs of energy storage alone ranging from USD 3,000 per average Indian household (2.5 kWh/day) to USD 40,000 per average US household (30 kWh/day). Even with the projected reductions in costs over coming decades, it is most likely that a form of grid electrification will remain the most cost effective and efficient way to provide productive power across the developing world.

2. Grids are networks, and well-managed networks drive resource utilization efficiency, reducing cost without compromising quality: Having access to a grid in a world of decentralized power generation, storage and consumption is analogous to having access to a cloud computing service. Cloud computing creates massive efficiencies of scale for both computing power and data storage by leveraging the internet without eliminating the need for personal computers. Similarly, access to a well-managed energy network would greatly enhance the capabilities of mini-grids by eliminating the need for complete self-sufficiency while enabling the sale of excess capacity at times of low demand, ensuring optimal resource utilization

3. The transition to a world primarily run on intermittent renewables will require very large amounts of storage, and the grid is one of the largest batteries we have: The need for a robust energy storage infrastructure has become increasingly apparent as the world moves to tackle climate change by deploying increasing amounts of renewable energy from sources like solar and wind. Though several technologies such as utility scale lithium ion batteries have emerged to fill this gap, they are unlikely to scale up to meet the needs of the global electricity market in addition to satisfying demand from new sources such as electrified transportation. Building a robust inter-network transmission grid is a powerful way to ensure that excess power produced on a network reaches a suitable consumer or storage point for use at times of peak load.

## Why Private grids are an important complement to Public grids

**Research opportunities:**

- The potential benefits of private grids to the African grid ecosystem
  - Compare grid reliability and customer satisfaction between public and private grids
  - Compare capital costs between public and private grids
  - Study approaches to reducing capital costs for mini-grid deployment and operation
  - Evaluate the impact of demand stimulation programs on the 'idle grid' problem

Connecting households to electricity for productive use is a capital-intensive exercise, regardless of where it is done. This is made doubly so when the customers being connected are rural, due to the high cost of logistics to get to these rural areas as well as the high cost of building transmission lines to bring power to rural locations.

Juxtaposing these costs against the low incomes of the typical rural energy consumer makes two things clear:

1. A focus on efficiency is essential to achieving the goal of universal and equitable access to energy
2. Reducing the net cost of rural electrification will require utilities to stimulate demand for electricity services

Private sector operators have shown themselves to be best placed to deliver on both these needs. In East Africa, the average unsubsidised cost per connection for private sector mini-grids is less than half of the cost per connection to the main grid. This is driven by an aggressive focus on reducing the cost of capital of

mini-grid deployments by sourcing low cost raw materials and streamlining and standardization grid development processes. The O&M costs of private operators are also significantly lower than those of the typical public grid, driven by the use of advanced technologies to remotely monitor, diagnose and operate grid components such as meters, inverters and generators. These costs continue to drop year on year as private developers continue to innovate.

These reductions in cost through better processes and technology have been achieved while maintaining levels of reliability and customer satisfaction that are on par with or better than those enjoyed by public grid operators as shown in upcoming analysis to be published by AMDA and its research partners. Private operators continue to lead the way in investing in tools to improve customer engagement and monitor satisfaction such as SMS based surveys and alerts. These channels of communication combined with the ability to monitor customer energy consumption ensure that operators are aware of customer challenges and can proactively respond to potential issues as they occur. The investment in this consumer centric approach to electricity provision makes private grids an ideal test case for how the grid of the future will operate and a conduit for integrating advanced technologies into the main grid through grid interconnection.

Private sector operators across Africa are also implementing demand stimulation programs that help customers to transition from a pre-electrified lifestyle to one that makes the most use of access to electricity. These include appliance financing programs for both productive loads such as motors for saw mills and household appliances such as TVs. Operators also provide services such as business training and support to encourage local SMEs to scale up and thus find more uses for electrical power. These and other innovations which were first pioneered by actors in the Solar Home System (SHS) space have redefined the relationship between providers of electricity and their customers and can be adopted to the needs of customers on the main grid as well.

Getting to 100% electrification by 2030 through an integrated approach will require the participation of main grid operators, private mini-grid developers and SHS operators. Just as significant demographics in Africa will be best served by mini-grids, there will remain segments of the population for whom mini-grids will not be an ideal solution, specifically locations with very low population densities spread over large distances. Sector enablers should therefore avoid a zero-sum approach to supporting actors across these three areas but rather seek to identify which populations are best served by each group of actors.

Countries across Africa have diverse regulatory environments governing mini-grids making it difficult for developers to scale beyond a single country and limiting private sector participation in electrification. Greater convergence around a core set of pro-mini-grid regulation would help private sector developers grow by providing certainty around important questions such as quality standards, tariff regulation, access to finance and procedures for grid interconnection. The diversity of regulatory environments in Africa is illustrated by the difference in regulation across three mini-grid markets: Nigeria, Kenya and Tanzania.

## Nigeria

Nigeria's total power generating capabilities are estimated at around 13 GW. However, only half of the installed capacity is actually available due to outdated technology and poor maintenance of the grid. The government wants to improve the country's generating capacity in order to meet their new energy target, which is set to have a generating capacity of 30 GW of power by 2030 with 30% (10 GW) of this coming from renewable sources. Of this 10 GW, 5.3 is intended to come from mini-grids creating a strong mandate for the sector. To support this agenda the World Bank is currently contributing USD 350M to energy projects in Nigeria with USD 150M earmarked for mini-grids.

In 2017, the Nigerian Electricity Regulatory Commission (NERC) issued one of the most private sector friendly regulations for mini-grids worldwide. It comprises of:

1. A standardized tariff calculation methodology and tool based on the cost -plus method combined with a process for tariff adjustments over time,
2. A clear compensation mechanism for assets and business value of a mini-grid company in case of a Distribution Company (DISCO) connecting to a mini-grid,
3. A reference to technical and safety standards,
4. Regulations for so-called Interconnected Mini-Grids (mini-grids that can work in a stand-alone mode but can also buy electricity from and sell electricity to the DISCO connected to the mini-grid under a tripartite agreement between the mini-grid operator, the DISCO and the connected community).

This is supposed to foster Smart Grid approaches starting from a mini-grid nucleus on the one hand, while reactivating existing but poorly operated distribution networks of DISCOs on the other hand.

## Tanzania

Tanzania currently has about 109 mini-grids, serving over 180,000 people. Tanzania mini-grids account for

157.7 MW of installed capacity spread across a variety of energy sources including hydro, biomass, hybrid, fossil fuel and solar. Tanzania estimates that about half the rural population may be more cost-effectively served by decentralized options than by centralized grid expansion.

In 2008, Tanzania adopted a new regulatory framework to encourage low-cost investment in mini-grids, called the small power producers (SPP) framework, which caused the number of mini-grids to double. The financial mechanism created – a feed-in tariff – was technology neutral, which favored biomass and hydro development with low generation cost. However, a 2015 revision to the policy encouraged solar and wind development. In 2017 Tanzania's Energy and Water Utilities Regulatory Authority (EWURA), the national regulator, approved a third generation mini-grid framework.

The third-generation rules provide several important improvements to create an enabling regulatory environment. The rules cover the following aspects: allowing mini-grids at multiple locations to acquire a single license (above 1 MW) or registration for mini-grids using the same technology (below 1 MW); exemption from tariff regulation for mini-grids below 100 kW; defining eligible customers that need not have their tariffs reviewed by EWURA; allowing grid-connected mini-grids to operate in islanded mode when power supply

is not available from the main grid; and, providing some clarity and credibility on the calculation of the limited compensation for distribution assets when the main grid connects to a previously isolated mini-grid. Although these improvements are steps in the right direction, there are limitations on the grid integration framework creating significant ambiguity in implementation. Additionally, the lack of clarity on grid expansion planning increases the risk to developers and their investors. There is not sufficient security within the existing mini-grid framework for investors and financiers.

## Kenya

Kenya's current installed capacity sits at about 2400 MW with the bulk of this power coming from geothermal and large hydro sources. The country has robust private sector participation in power generation but lacks clear frameworks to encourage such participation in Transmission and distribution. The national utility, Kenya Power, along with the Rural Electrification Agency (REA) have been working together since 2006 to increase rural electrification through the Last Mile Connectivity Program (LMCP), funded by the World Bank. The program provides a connection subsidy to Kenya Power for each household connected to the national grid.

Kenya Power and REAs objectives for Kenya's distribution system include building a stronger and more flexible grid by building in redundancies, reducing losses, and adding in smart technologies. They also aim to In-crease renewable off-grid access by hybridizing 19 off-grid diesel-powered stations and adding 43 greenfield solar mini-grids.

The regulatory environment governing mini-grids has been hampered by the stalling of the 2015 National Energy Policy and Bill which is meant to bring clarity on key issues such as the procedure for mini-grid - main grid interconnection. Current regulation provides guidance on licensing requirements for mini-grids based on size of generation. Installations smaller than 3MW are required to apply for a permit while larger installations require a full license. The lack of a full mini-grid policy has slowed growth in the Kenya mini-grid sector with many developers holding off on development as they await regulatory clarity. The new bill is expected to re-duce the regulatory burden for the mini-grid developers in part by providing guidelines for the use of national funds for mini-grid development and clarifying the national electrification strategy.

This wide variance in regulatory environments is one of the key issues that AMDA will be looking to address by building consensus among developers on what policies are best suited to supporting the growth of the sector and communicating this to policy makers and sector enablers. The association also aims to ensure that mini-grid developers adhere to high quality standards when building grids in order to ensure that the sector lives up to the service expectations of both governments and funders.

## How grids are financed: the historical precedent of subsidies in rural energy access

**Research opportunities:**

- Historical precedents in rural energy access
  - Updated review of rural electrification programs in Cambodia and the US with a focus on the role of subsidies
  - Evaluation of the relationship between expansion of public grid infrastructure (generation and distribution) and access to power for households vs. industry (e.g., in India)

Whether one looks at the United States in the 1930s, China in more recent decades, or any other country that has electrified its rural population over the past century, one finds a key commonality: all have used public sector funds to subsidize energy access for their rural populations.

No country in the world has achieved rural electrification without substantial concessional money. Utilizing wealth surpluses from urban areas to enable equality of energy access for less affluent rural areas is a well recognized, progressive approach to expanding access. Advocating for an approach in Africa which ultimately puts the full burden of cost on the poorest, most vulnerable rural people would therefore be both regressive and historically unique.

While some point to the reducing cost of solar and batteries and improving appliance efficiency as evidence of a changing paradigm, analysis of current and future power needs in the developing world does not support such claims. “Subsistence energy” may be possible through autonomous, households-scale small systems (at a very high price per kilowatt-hour), but in order to power productive loads and grow rural economics we will still need substantial investment in rural energy systems and grids. Autonomous solar home systems are excellent at solving lighting and low-level energy needs, but they will not provide the power needed for rural communities to develop, nor enable long-term energy equality between rural Africans and other global consumers.

There is little doubt that we still live in a world where concessional money is critical to enabling growth in the renewable energy and energy access sectors. The United States solar industry depends on the Investment Tax Credit, while many European countries also support the propagation of solar through subsidized feed-in tariffs. Despite the acceptance of the need for public sector support for renewables in developed countries however, many investors come to Africa demanding “commercial projects” in energy access, forgetting that the projects that they fund in the US and Europe are enabled by a system of non-commercial support from the public sector, and an electricity distribution system which has had a century to depreciate. For energy access and renewables to succeed in Africa, we must be wary of this double standard.

The increasing availability of subsidized funding for public sector grid extension in several countries across Africa indicates a positive trend towards recognizing the importance of this type of funding for rural

electrification. Unfortunately, current funding mechanisms are contributing to a highly uneven playing field between the private and public-sector actors. This have resulted in a mismatch between funding availability and the most effective approaches to improving access to power.

There are essentially two categories of subsidy for energy access in Africa:

1. **For the private sector:** donor grant programs for private projects. These grants are typically small (typically significantly less than USD 50M for a full country), and very onerous for companies and projects to actually utilize (require extensive due diligence before approval participation, are prohibitively expensive to comply with and take unreasonably long to disburse funding even after approval).

2. **For the public sector:** extremely low interest loans to governments from donor-lenders, which are passed to public utilities as pure grant or extremely low-cost debt. These concessional loans are typically large (> USD 500M) and low-friction for the public utility to draw down on.

The concessional funding available to the private sector is useful for piloting, but not suitable for scale. The public sector has access to orders of magnitude more funding through structures which are much better suited for scale. If we hope to have a vibrant private sector in energy access in Africa, this asymmetry must be addressed.

## How financing should be configured to enable Private Utilities

**Research opportunities:**

- Effective financing for private sector participation in national renewable energy and energy access programs
  - Meta study of successful renewable energy and energy access financing programs (e.g., World Bank Mali Rural Electrification Program, US solar Investment Tax Credit and European feed-in-tariffs)

There are several things that donor grant programs aiming to catalyze the private sector can do to make their funding more usable.

These changes are essential to the success of the sector as it is becoming increasingly clear that significant portions of allocated funding is not currently reaching projects on the ground. For example, in Tanzania and Kenya, tens of millions of dollars have been available on paper for the past 3 years to support private companies developing micro-utilities, but only a tiny fraction of that amount has actually been disbursed to projects.

AMDA Developers developing Solar PV Grids, have received $1,438,967 in grant funding since 2011.

## S.M.A.R.T Results Based financing

The first step in addressing this funding bottleneck should be to learn from the successful subsidy programs used for solar in the United States and Europe. Simple results-based financing (RBF) was key to the success of these programs and thus should form a core part of any approach to providing subsidies for private utilities in Africa. Put simply, if a company develops a project that connects customers to power, funders should provide a fixed rebate per connection installed to relieve the capital cost burden of the project, so it can attract commercial capital.

Though there are several RBF programs currently running which target the mini-grid sector, most are hampered by excessively complex evaluation and approval processes. This has resulted in a large discrepancy be- tween the amount of RBF funding pledged to the sector and the amount that has actually been deployed. To achieve their full potential, current and future RBF should strive to conform to the criteria for 'SMART RBFs' outlined by AMDA. These criteria seek to promote RBF programs that are **S**imple, **M**easurable, **A**frica-wide, **R**epeatable, and **T**imely. The criteria are discussed further in the AMDA white paper on SMART RBFs.

Once funders structure their programs to enable the private sector to make full use of them, then the private sector will start to gain enough scale to catalyze the second change which is necessary for the private sector to have a place in energy access in Africa: private-public subsidy parity institutionalized at the country government level.

Through demonstrating capital efficiency, innovation, scale, and customer service, the private sector must show large scale donor-lenders and the local governments they serve that subsidy parity between the public and private sector is wise policy. Configuring Country level financing from donor/lenders to support not just the national utility, but a diverse landscape of private developers and operators as well, will increase the potency of such funding. This will address the objectives of reaching universal energy access by ensuring public-private partnerships that institutionalize a long term private sector role in the energy access story in Africa.

## Concessional project debt

The second major component of an effective funding structure for mini-grid developers is project level debt. This debt needs to either be offered on concessional terms or blended with other grant and concessional funding in order to be a viable option.

A major bottleneck to the availability of such funding appears to be the low number of deployed asset currently in the market with many funders requiring an installed asset based of USD 10M or more to consider a developer for investment. This creates a chicken-and-egg situation for a growing sector characterised by several small players looking to scale. In order to address this challenge, sector enablers should work toward more effective aggregation mechanisms for existing developers. Such aggregation could include new approaches to channeling lending at the sector level such as portfolio aggregation.

## What various players can do to enable this future

Achieving this vision of an electrified African continent that models what the grid of the future should look like will require concerted effort from, and coordination between, key players in the electrification sector including governments, donors and mini-grid developers. Though progress has been made by each of these stakeholders over the past few years, more will be needed over coming decades to ensure that the private mini-grid sector achieves its potential as a key tool for meeting the continents universal electrification targets.

Each of these stakeholders has an important role to play in making this potential future a reality. In order to achieve the Sustainable Development Goals, Governments will need to continue to include mini-grids in their national planning. As Governments provide clarity on key issues such as national electrification strategies, grid interconnection standards, and the allocation of national electrification funds to mini-grids, they will increase access to energy for their constituents. AMDA looks forward to working with Governments to develop and implement national electrification strategies that partner with the private sector to expedite energy access. Regulators across the continent should also strive to align national policies based on emerging best practices to lower barriers to entry for mini-grid developers seeking to operate across the continent.

As Donors work to support the realization of Universal Energy Access by 2030, new mechanisms for allocating funding are necessary in order for Renewable & Smart-grid technologies to drive efficiency in connection rates. By increasing the proportion of funds earmarked for mini-grid development and ensuring that committed funds actually get to developers, more systems will be built at rates that supersede current electrification rates. AMDA looks forward to working with Funders to create clear standards for effective financing programs such as SMART RBFs and increasing the levels of coordination between providers of grant, debt and equity funding to the sector. Additionally, supporting subsidy parity between public and private utilities will take advantage of the private sectors lower customer connection cost and encourage the development of smarter grid infrastructure. Donors will also be instrumental in supporting innovation in the mini-grid sector by providing funding for experimentation with new business models and technologies.

Finally, developers should seek to bring clarity to the mini-grid sector with regards to minimum quality standards, funding needs, project pipelines, connection rates, grid economics and customer satisfaction. This will require robust organizational structures such as AMDA which is acting as a conduit for both policy advocacy and information sharing. Developers should seek to build cross-national partnerships to accelerate learning in the sector and attract scaling capital. Additionally, the private sector must show large scale donor-lenders that subsidy parity between the public and private sector is wise policy. This can be accomplished by demonstrating capital efficiency, innovation, scale, and excellent customer service.