# POLICY BRIEF

## Community-Driven Mini-grids:

## A Promising Approach to Electrifying Nigeria's Rural Population

November 2024


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# Executive Summary

## Background and Context

Nigeria faces a significant electricity access deficit, with approximately 86 million people lacking electricity, making it the country with the largest such deficit globally. Urban areas have access rates of around 82%, while rural regions lag behind at only 31%. Business owners report that challenges related to electrification significantly hinder operations, with an average monthly power outage of 239 hours. Despite the availability of decentralized renewable energy as a long-known solution, Nigeria's off-grid renewable energy sector currently contributes only 0.1% to the power supply, while Nigerians spend about $14 billion annually on alternative power sources like diesel generators.

Current Initiatives and Challenges Government initiatives, including the Nigeria Electrification Project (NEP), have helped grow the mini-grid sector from 11 mini-grids in 2015 to over 100 by 2023. However, the prevalent corporate focus on developer-owned mini-grids and Build, Own, and Operate (BOO) models has often resulted in project failures due to inadequate community engagement.

## A Bottom-Up Approach to Rural Electrification

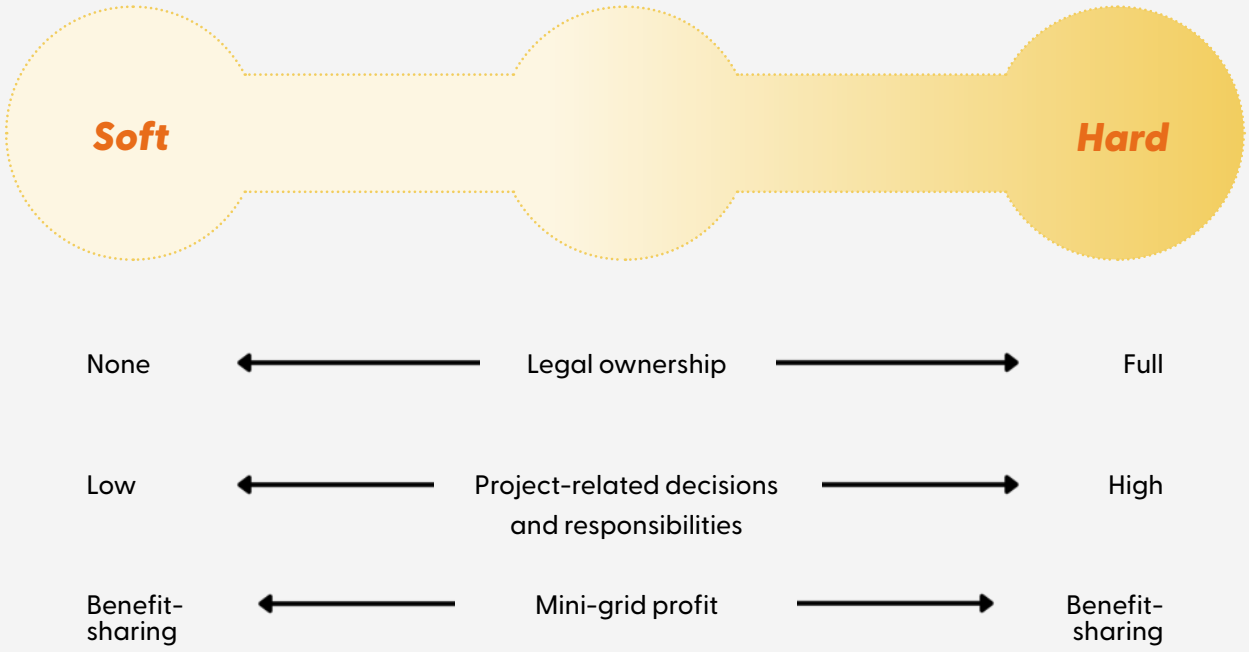
This policy brief advocates for a shift towards community-driven mini-grids (CDMGs), which emphasize community involvement and ownership, thereby ensuring more sustainable and successful electrification outcomes. Although CDMGs are scarce in Nigeria, they are gaining traction, demonstrating significant socio-economic benefits and enhancing community awareness and participation. The brief outlines the structure and potential of CDMGs, emphasizing the importance of legal and functional ownership structures, often facilitated through energy cooperatives.

## Definitions and Frameworks

While the literature on CDMGs is growing, a common definition is absent. In this regard, „hard“ and „soft“ definitions of community ownership can be distinguished, as the following table displays:

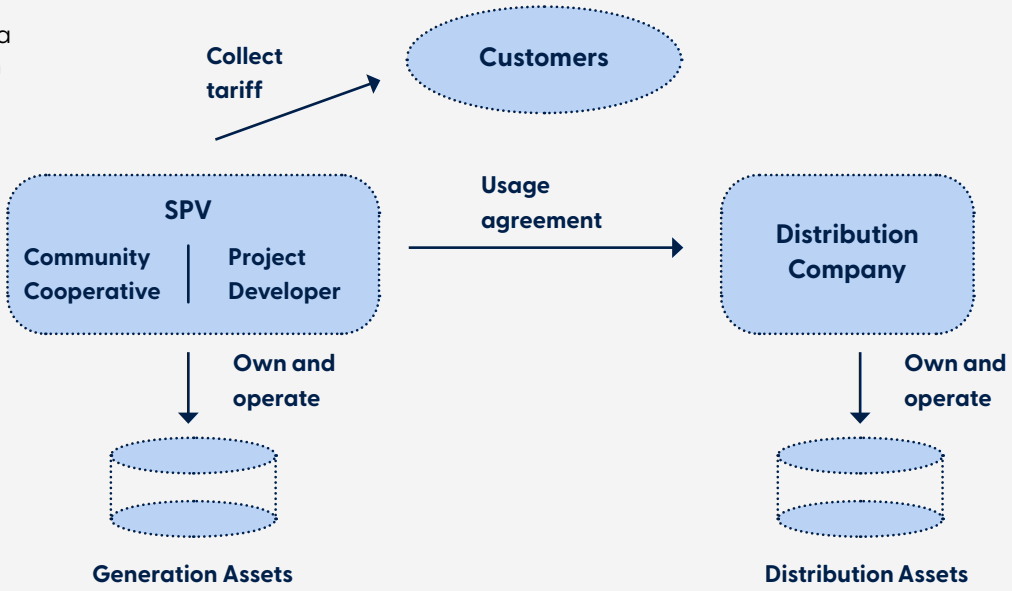
*See next page.*

| ***Hard* ownership** | ***Soft* ownership** |
| --- | --- |
| Communities hold full or partial legal ownership of energy assets. This typically requires a functioning energy cooperative or similar structure. These cooperatives, together with the project developer, agree on roles and responsibilities regardinggeneration, transmission, and distribution of energy, and the community members have significant control and decision-making power. | Involves community-based organizations with significant control and decision-making power, even if they do not own the assets outright. These organizations play a crucial role in initiating, planning and partly managing the operations of the mini-grid system, ensuring that the community members adequately benefit of the system's business model. |




A "hard" definition entails that communities hold full or partial legal ownership of assets for generation, transmission, and distribution. In the case of a **partial ownership approach**, legal ownership is executed through a ***Special Purpose Vehicle*** (SPV), which is owned by a project developer and the community energy cooperative (or equivalent organisation) at certain shares and terms and conditions. Figure 1 shows a simplified illustration of a shared ownership approach.

The following figure illustrates a shared ownership approach in the case of an interconnected mini-grid.




*Source: own compilation*

## Empirical Evidence and Best Practices

Community-driven approaches not only improve project success rates but also contribute to energy democracy, enabling community members to take active roles in energy management and decision-making.

CDMGs offer several advantages over traditional electrification models:

1. Greater community engagement: CDMGs involve the community not only in using electricity but also in maintaining and operating the mini-grid, leading to a sense of ownership and responsibility. This minimizes theft, enhances system maintenance, ensures appropriate usage and prevents conflicts.

2. Improved economic outcomes: By creating local jobs and providing affordable energy, CDMGs contribute to economic development. Additionally, community energy cooperatives can reinvest profits into local infrastructure.

3. Increased reliability and sustainability: Projects are more likely to succeed in the long term when the community is actively involved. This approach reduces the risk of failure due to neglect, insufficient maintenance, or poor engagement, common issues in developer-led projects.

4. Environmental benefits: Off-grid renewable energy systems reduce reliance on diesel generators and lower carbon emissions. In Nigeria, the use of solar mini-grids in 660 off-grid communities could reduce annual emissions by up to 188,000 tons of CO2.

Examples from countries like Tanzania and Côte d'Ivoire highlight successful community-owned mini-grid projects that provide valuable lessons for Nigeria. These initiatives have demonstrated economic viability and community engagement, ultimately resulting in sustainable energy solutions.

## Potential for CDMGs in Nigeria

Nigeria has enormous potential for CDMGs, with an estimated 660 communities identified as ideal candidates for off-grid electrification. These communities are located at least 20 km away from the national grid, making mini-grids the most cost-effective solution. Simulations suggest that a typical community of 300 buildings would need a PV system of approximately 160 kWp, with an annualized cost of around USD 65,000 and a total upfront investment of about USD 350 million. Off-grid electrification of the identified rural communities offer substantial economic and ecological benefits, including reduced carbon emissions of 188,000 $tCO_2e$.

## Key Constraints and Proposed Reforms for CDMG implementation in Nigeria

Despite the clear advantages, several barriers hinder the widespread adoption of CDMGs in Nigeria. To promote the development of CDMGs in Nigeria, a list of actions is recommended:

### Constraints & proposed actions

Barrier 1: **Lack of awareness** among communities and government agencies on the benefits of CDMGs

- Movement-building for CDMGs by social, economic, and political players, including the support for the development of energy cooperatives
- Establishment of dedicated entities that function as one-stop shops for rural electrification.

Barrier 2: Communities lack a broad **technical understanding** of PV systems and their mini-grid project scope as well as project planning skills.

- Establish capacity-building opportunities for energy cooperatives
- Regional knowledge exchange for cooperatives
- Support volunteer networks that reach the local level and disseminate basic information to community leaders
- Disbursement of mini-grid planning tools

Barrier 3: The **commercial banking sector** in Nigeria is not equipped to serve the needs of rural electrification programmes.

- Establishment of targeted financing mechanisms for CDMGs
- Governments and DFIs offer risk-mitigation instruments aimed at mobilising private investments
- Revolving fund dedicated to the financing of community energy projects

Barrier 4: The **REA performance-based grant** funding is currently not conducive to CDMG projects

- Explicitly support CDMGs within the REA performance-based grant financing
- REA should support projects in attracting loans with reasonable interest rates.

Barrier 5: Feeding **excess electricity into the grid** currently faces legal and technical constraints

- Create a regulatory framework for feed-in-tariffs
- Establish the legal option for virtual/community net metering scheme

Barrier 6: Nigeria's **political and legal environment** does not adequately support CDMGs

- The REA (2021) Framework for Electricity Users' Cooperative Society should be revised to define modalities for [legally] community-owned renewable energy systems.
- Renewable energy targets and local ownership quotas should be established and implemented

## Conclusion

Community-Driven Mini-Grids offer a transformative opportunity for Nigeria to address its electricity access challenges, especially in underserved rural areas. By fostering community ownership and engagement, these models can ensure long-term sustainability, lower energy costs, and support local economic development. With the right legal, financial, and technical support, CDMGs could play a crucial role in advancing Nigeria's electrification goals and contributing to a cleaner, more inclusive energy future. The NEP initiative provides an unprecedented opportunity to shape Nigeria's energy infrastructure of tomorrow. In this context, community-driven mini-grids and renewable energy cooperatives must play a crucial role.

# 1. Introduction: Nigeria's Electrification Challenge

In Nigeria, around 86 million people lack access to electricity, making Nigeria the country with the largest electricity access deficit in the world in absolute terms (World Bank, 2024). While Nigerian urban areas achieve access rates of about 89%, rural areas significantly lag behind with electricity access rates of only 27% (IEA et al. ,2023). Over 80% of Nigerian business owners state that electrification challenges are among the most significant obstacles to doing business, as they experience an average monthly power outage of 239 hours (RMI 2018).

The solution is long known: decentralised renewable energy. The country has the largest untapped off-grid electrification market potential in Africa. While the off-grid renewable energy sector supplies a mere 0.1% of the power supply (USAID, 2022), Nigerians spend an equivalent of $14 billion annually on the generation of power using small petrol and diesel generators (RMI, 2018).

With several power sector reforms[1] and initiatives, such as the Nigeria Electrification Project (NEP), the Nigerian government has been able to grow the country's mini-grid sector from just 11 mini-grids in 2015 (Alliance for Rural Electrification, 2024) to over 100 (Izuaka, 2023). Nigeria's mini-grid market has a predominant corporate focus and pushes for the deployment of developer-owned mini-grids and Build, Own and Operate (BOO) models. Under this approach, however, projects often fail due to inadequate community engagement.

Against this trend, this policy brief proposes a different approach, namely community-driven mini-grids (CDMGs). Currently, CDMGs are few in Nigeria as well as in the African region, but this approach is on the rise. Community-driven approaches, in particular community-ownership models[2], place community involvement at the centre and are regarded as the most sustainable model in the long term, while also creating significant socio-economic benefits (Étienne, 2024; AMDA, 2022). The community-driven approach significantly raises the awareness of community leaders as well as community members and the perception of their value increases, which prevents conflicts and theft, increases maintenance efforts and ensures appropriate usage. Community-driven project structures are often accompanied by technical capacity building, which additionally strengthens the maintenance of the PV system and creates local job opportunities.

The policy brief draws on secondary literature — academic papers, policy briefs, industry reports, websites and research blog posts, field reports from primary data collection, and content analysis of relevant policy documents — and is structured as follows: section 2 presents the CDMG approach in more detail, including empirical examples as well as an extrapolation of Nigeria's potential for community-driven mini-grids. Section 3 outlines key constraints that impede the proliferation of CDMGs as well as proposes reforms that could create the necessary support for community-driven approaches. Section 4 concludes on the key arguments of this policy brief.

[1] Central reforms include the Electric Power Sector Reforms Act, the Power Sector Recovery Program and the Rural Electrification Strategy and Implementation Plan.

[2] A community-driven approach is defined in this context as an approach where a community takes (at least) key roles in the initiation and planning stage of a mini-grid project. A community-ownership model is a sub-term of a community-driven approach, which involves full or partial ownership of mini-grid assets.

# 2. A Bottom-up Approach to Rural Electrification

## 2.1 The concept of community ownership

Due to their innovative approach and great success around the world, the literature around CDMGs is growing. Nevertheless, diverse interpretations of community-driven decentralised renewable energy systems exist, while a common definition of CDMGs is absent in the literature. It can be observed that a discussion of community-driven systems typically contains elements such as legal ownership, control, voting rights, and the nature of community-based organisations. This Policy Brief distinguishes two different types of CDMGs along the lines of "hard" and "soft" definitions of community ownership.

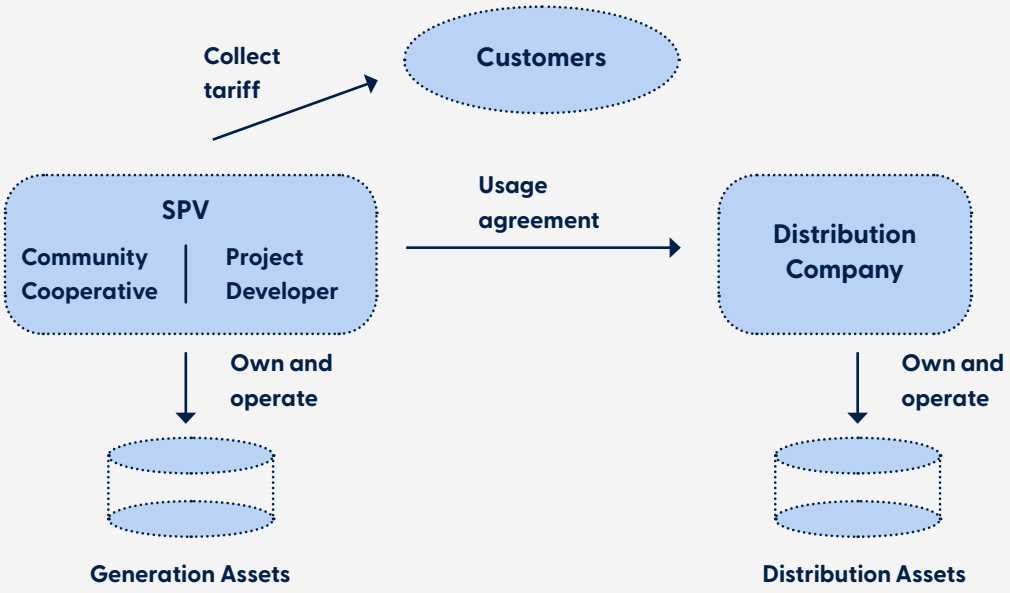
A "hard" definition entails that communities hold full or partial legal ownership of assets for generation, transmission, and distribution. While this definition is not explicitly outlined in the literature, many models are consistent with this concept, in which beneficiaries themselves fully or partly own the mini-grid infrastructure (Ahlborg & Sjöstedt, 2015; Bertheau et al., 2020; Bhandari et al., 2020; Dall-Orsoletta et al., 2022; Duran & Sahinyazan, 2021; Holstenkamp, 2019; Poudel et al., 2021; Yadoo & Cruickshank, 2010). Generally, a vital prerequisite for legal community ownership is a functioning energy cooperative structure in the community. However, in certain cases, informal or community-based organisations governed by constitutions or by-laws can also meet the requirements for pursuing an approach involving legal asset ownership by the community.

The classical energy cooperative model, particularly in a legal context, refers to a structured framework that allows individuals or entities to come together to collectively manage and distribute energy resources. This model is often established through specific legal statutes that define the rights, responsibilities, and governance of the cooperative. In essence, an energy cooperative is typically formed as a legal entity, often taking the shape of a non-profit organization or a cooperative society. The legal structure is designed to facilitate collaboration among members who share common energy goals, such as increasing energy efficiency or utilizing renewable energy sources. Members of the cooperative usually invest in the organization, contributing capital that is used for projects like renewable energy installations or energy-saving initiatives. In return, they benefit from reduced energy costs and potential dividends based on the cooperative's performance. Governance is a key aspect of this model. Members typically have a say in decision-making processes, with voting rights that ensure a democratic approach to management. This structure fosters transparency and accountability, as members can directly influence the cooperative's direction. Furthermore, legal frameworks often provide protections and incentives for cooperatives, such as tax benefits or grants for renewable energy projects. These frameworks help to encourage community engagement and investment in sustainable practices.

In the case of a partial ownership approach, legal ownership is executed through a Special Purpose Vehicle (SPV), which is owned by a project developer and the community energy cooperative (or equivalent organisation) at certain shares and terms and conditions. Figure 1 shows a simplified illustration of a shared ownership approach.

Figure 1: Illustration of shared ownership approach (interconnected mini-grid)

*Source: own compilation*




On the other end of the spectrum, under a "soft" definition of community ownership, the actual legal asset ownership remains with another party, such as a private developer (Katre et al., 2019; Katre & Tozzi, 2019). Soft ownership refers to the (co-) 'ownership' of a mini-grid project as a whole, ensuring that communities participate in shaping and managing the mini-grid project in various forms. These could include the following:

- Taking care of groundwork and initiation of a mini-grid project, including feasibility assessments - e.g. with the help of programmes and tools such as the **CP-Nigeria Tool**[3].
- Active involvement in wide consultations and negotiations, including the donation of land by the community and tariff setting.
- Hiring community members on clearing construction sites, fetching water for construction of the powerhouse, security of the installation; and training community-based technicians for minor repairs and maintenance. Developers may strengthen their internal community engagement capacities and even employ full-time community engagement officers or departments.

[3] Available online: https://community-minigrid.ng/en/.

- Setting up community energy committees which act as intermediaries between communities and developers, although they have no legal ownership claims on the mini-grid system.

- Benefit-sharing models, where a certain percentage of the profits are invested into community projects (without actual asset holding by the community).

For the following sections, this policy brief explicitly refers to legal ownership ("hard" ownership, as described above) when mentioning community-ownership. Community-driven models can refer to both "soft" and "hard" approaches.

## 2.2 The case for community-driven approaches

Despite their major benefits, community-driven approaches have yet to receive adequate attention in Nigeria. The following outlines why CDMGs and in particular, community (co-)ownership models should play a more prominent role in the development and implementation of mini-grid projects.

In Nigeria and the wider region, traditional ownership models, which focused on utility or project developer ownership structures, have often failed to ensure the long-term success of mini-grid projects in rural communities (Ugwu et al., 2022). Frequently, state-driven efforts to electrify unelectrified and underserved populations prioritize the installation of mini-grid systems over their long-term reliability (Étienne, 2024). The reasons for the failure of traditional models are diverse, but clearly include a lack of awareness and understanding among community members, inadequate maintenance, shortages of human resources to operate the systems, and theft (Étienne, 2024; Nyarko et al., 2023). Some projects have also reported issues with unaffordable tariffs for community members (Étienne, 2022). Ultimately, most of these challenges stem from insufficient community inclusion and participation in project development and execution (Nyarko et al., 2023).

In contrast, the CDMG approach places community involvement at the center of the electrification efforts and promises to deliver better outcomes concerning the challenges faced by traditional approaches. Indeed, several scholars emphasize that community engagement in system design, operations, maintenance, and repair is a crucial factor for the long-term sustainability of these systems (IRENA and SELCO Foundation, 2022; Nyarko et al., 2023). By involving citizens not only as consumers of electricity but also as producers, the community ownership model significantly enhances the awareness and engagement of both community leaders and members. Since the mini-grid assets belong to the community, their perceived value increases, which helps to prevent conflicts and theft, enhances maintenance efforts, and ensures appropriate usage and demand.

Additionally, the establishment of energy cooperatives, a prerequisite for successful community-ownership structures, introduces energy democracy and 'energy citizenship' to the country's rural communities. In other words, energy cooperatives significantly strengthen joint decision-making concerning energy and climate challenges and trigger a wider consciousness among citizens and communities of energy issues (Gancheva et al. 2018). This means that they will gradually start participating in the operation of distribution grids, energy supply and energy services.

Energy cooperatives are not only characterised by a participatory process to achieving electricity access but also ensure wider acceptance and uptake of renewable energy projects (Gancheva et al. 2018).

Successful community energy projects often invest in capacity building and skill development to enable local populations to maintain and operate installations. This approach adds local socio-economic value through investments, job creation along the entire renewable energy value chain, and improved welfare (Callaghan and Williams, 2014; IRENA Coalition for Action, 2020; USAID, 2020a). CDMG projects are likely to employ local contractors and reinvest in local enterprises, services, and goods, thereby supporting local resilience (Gancheva et al., 2018). Furthermore, community ownership leads to lower energy prices, especially for energy-poor consumers, while profits can be reinvested into community infrastructure (Gancheva et al., 2018).

Additionally, for project developers, who prioritize system performance and revenues more than state agencies, the lower profitability of mini-grids in lower-income communities renders these areas less attractive for project development. Empowering more communities to engage actively in the mini-grid sector could enhance the rate of community-initiated mini-grid projects in regions that may not have initially attracted developer interest (USAID, 2020b)[4].

**Box 1**

### Community Initiation by the Communities of Practice Nigeria Project

A consortium of organisations, comprising the Reiner Lemoine Institut (RLI), Clean Technology Hub (CTH) and the greenwerk. (TGW), has been building an online tool that Nigeria's local communities will be able to use to initiate their own solar mini-grid projects. Rather than wait for their community to be selected as a mini-grid site by the project developers or the Rural Electrification Agency (REA), the community members input the features of their communities and receive an implementation plan (pre-feasibility study) with which they are equipped to approach potential project developers, donors, state agencies and investors to fund and execute the project. The goal is to increase community participation and involvement from the first step of mini-grid project development, and potentially to incentivize the adoption of community-owned systems. The project is being piloted in five communities across Nigeria (Ezere in Enugu State, Ebute Ipare in Ondo State, Ungwar Kure in Kano State, Usungwe in Kogi State and Egbuniwe in Delta State).

The CP-Nigeria Tool is free of charge and accessible online under: www.community-minigrid.ng.

[4] Annex III provides an overview of actors that will be relevant for the promotion of community-owned mini-grids in Nigeria.

## 2.3 The status quo in Africa and Nigeria

Despite being recognized as a significant opportunity for many unserved and underserved rural communities to achieve clean, reliable, and affordable electricity access, it is evident that Nigeria and the wider region lack energy cooperative federations or movements at both sub-regional and continental levels, which are essential for the sustainable deployment of the Community-Driven Mini-Grid (CDMG) approach. In contrast, such federations exist in Europe, North America, and Latin America[5].

According to the larger ESMAP (2022, cited in SIGMA Project, 2023) database of mini-grid projects, community-owned mini-grids represent approximately 8% in Kenya, 15% in Tanzania, and 2% in Senegal among the African countries with the largest number of mini-grids. In Uganda, by 2020, about 9 of the 34 (27%) mini-grids were community-owned (SEforAll, 2020)[6]. A tabular overview of mini-grids in African countries by ownership type is provided in Annex I.

In examining Nigeria's mini-grid sector, the Bloomberg NEF Database (2022) identifies only one out of 67 mini-grids in Nigeria as community-owned (SIGMA Project, 2023)[7]. However, it appears that additional mini-grid projects are beginning to consider this innovative approach. For example, a recent program led by the Rocky Mountain Institute (RMI) has introduced a benefit-sharing model in four Nigerian communities (Chikumbo et al., 2024; RMI, 2024).

**Box 2**

### The benefit-sharing approach

The project, 'Sharing the Power', lead by the Rocky Mountain Institute (RMI), which began in 2023, is being piloted in Mbiabet Community in Akwa Ibom State (developed by Prado Power), Mokoloki Community in Ogun State (developed by Nayo Technologies), Chikaji Community in Kaduna State (developed by Konexa), and Alagye Community in Lagos State (developed by Husk Power). Under this community-driven benefit-sharing approach project communities get a specified percentage of mini-grid revenues, which then fund community development projects. Furthermore, communities have the opportunity to own a stake in the solar mini-grid through financial, land, and in-kind contributions (Chikumbo et al, 2024). Also, inclusive governance structures have been implemented under which community representatives are given a voice and voting rights in determining important matters such as tariffs, service levels, and upgrades, which have a direct impact on the community (Chikumbo et al, 2024). The project has highlighted positive impacts on system performance and economic development, including increased electricity demand and new business creation. It also emphasized the importance of community capacity building and training intermediaries.

[5] Senegal is an exception, where the Société de Coopérative d'Energie Citoyenne du Sénégal (Citizen Energy Cooperative Society of Senegal, SCECS) was founded in 2018.

[6] For some mini-grids in the statistic the ownership model is unknown.

[7] The one CDMG probably refers to the Rije Community, located in the outskirts of Abuja. The community installed a 20kWp biogas system in 2016 (Uduka et al., 2024).

## Box 3

The U.S. -based NRECA is promoting the proliferation of Renewable Energy Cooperatives (RECs) in Africa. For example, in 2021, the $5.3 million Zambia Electric Cooperative Development Program was launched in Zambia, funded by USAID and in partnership with the Zambia Rural Electrification Authority (REA). As a result, the first electric cooperative in Zambia was established in 2023 in the community of Ntatumbila (NRECA International, 2023). Additionally, the Clean Energy Cooperatives Program (CECP) was launched in Malawi in 2023, promising to usher in a new era for CDMGs in the country. An overview of selected RECs in Africa is provided in Annex II.

## Box 4

### Best practice example: Tanzania

In the Southern Highlands of Tanzania, known for their temperate climate and favourable conditions for small-scale hydropower, the first hydro-powered mini-grid was established in the Ludewa district in 2009. This 300 kW system was developed by the Italian NGO ACRA-CCS in partnership with a local church, funded by both international and national donors. From the outset, ACRA-CCS intended to transfer the hydropower plant's ownership to local communities (Ahlborg and Sjöstedt, 2015). To achieve this, the community-based utility LUMAMA (named after the initials of the three connected villages) was formed in 2009, with ownership transferred in 2010. This example demonstrates how off-grid systems can achieve economic viability through complete community ownership and management. All customers are members of LUMAMA, fostering effective collaboration, problem-solving, and values such as efficient load management and infrastructure security (Ahlborg and Sjöstedt, 2015). By 2017, the system served over 1,600 customers across 10 villages (Odarno, 2017).

Box 5

### Best practice example: Côte d'Ivoire

Between 2013 and 2016, UNIDO, the Ministry of Finance, the EU, and a local NGO implemented a project in seven remote villages in Côte d'Ivoire's Zanzan region to showcase the potential of solar PV mini-grids for enhancing energy access in rural areas (Draeck and Kottász, 2017; Mohapatra et al., 2022). The systems collectively handle a total load of 17 MWh per month, supporting household needs, productive equipment, and public services. The delivery model integrates private sector expertise, public funding, and community ownership through a mini-grid federation and technicians association. Initial costs were covered by a mix of grants, equity, and in-kind contributions from end-users (IRENA, 2023). Each village has a local user committee of 10 members managing administration, user contracts, and fee collection. Additionally, an overarching local association oversees basic maintenance and economic management for all seven villages. A participatory approach and the training of local stakeholders were key principles of the project (Draeck and Kottász, 2017).

## 2.4 Harnessing Nigeria's off-grid potential

Community-driven mini-grid projects have never been the norm in Nigeria and have received little consideration, largely due to the dominance of developers within national (e.g., the Renewable Energy Association of Nigeria) and continental (e.g., the Alliance for Rural Electrification and the African Minigrid Developers Association) industry associations that lead policy advocacy.

However, Nigeria is considered the second largest potential mini-grid market in sub-Saharan Africa and the largest in West Africa (SEforAll, 2020: 127) and this mismatch risks depriving millions of people of their chance to pursue an electrified future.

With the highest number of unelectrified individuals in the world, it is estimated that mini-grids represent the least-cost electrification method for approximately 27% of population clusters (Husein et al., 2024: 4). According to the Nigeria SE4All off-grid cluster dataset, which includes 4,812 off-grid population clusters, around 660 communities have been identified as suitable for off-grid solutions. These communities are located at least 20 kilometers from the existing grid, rendering grid extension costly and impractical in many instances. Notably, 90% of these communities have fewer than 1,000 buildings, with an average of approximately 300 structures each. This indicates that most communities are small to medium-sized, making them ideal candidates for mini-grid systems. The remaining 10% consist of larger settlements, with building counts ranging from 1,000 to 4,500, which would require more extensive and sustainable energy solutions.

In terms of system size, simulations indicate that a typical community of approximately 300

buildings would require a PV system with a capacity of around 160 kWp to meet its energy demands. The total annualized cost of such a system, including grid infrastructure, is estimated to be about USD 65,000. The upfront investment costs needed to electrify all of these communities are projected to be approximately USD 385 million. These estimates are based on linear trend lines derived from simulations conducted using the Off-Grid Planning Tool[8], which captures detailed energy demand and system sizing data for rural Nigerian communities. The scalability of such systems allows for flexible implementation across various community sizes, ranging from smaller clusters to larger off-grid settlements.

From an economic perspective, off-grid electrification offers significant advantages, particularly in terms of efficiency compared to traditional grid connections and productive uses. The average Levelized Cost of Electricity (LCOE) for these mini-grid systems is estimated at around USD 0.35 per kilowatt-hour. Densely populated areas with a high concentration of productive activities—such as small businesses, shops, and agricultural processing facilities—tend to experience lower LCOE due to reduced grid infrastructure costs and higher energy consumption. In contrast, more dispersed communities with limited economic activity may incur higher costs, making solar home systems a more viable option in those cases.

From an ecological standpoint, off-grid solar solutions play a crucial role in reducing carbon emissions, especially when compared to diesel generators, which are prevalent in many remote areas of Nigeria. By providing cleaner, renewable energy sources, off-grid systems can help mitigate the environmental impacts of traditional energy generation methods and reduce air pollution, while fostering economic growth through increased access to electricity for productive uses. Assuming a renewable energy share of about 96% and an average annual demand of approximately 300 MWh per year for each of the 660 considered communities, this translates into an annual emission reduction potential of up to 188,000 tCO2e[9]. Over the total technical lifetime of 20 years, this potential amounts to an emission reduction of 3,760,000 tCO2e.

These observations underscore Nigeria's vast off-grid electrification potential. . With scalable and cost-effective renewable energy solutions, these systems can meet the energy needs of rural populations, stimulate local economies, and contribute to the country's broader energy and climate objectives.

[8] https://offgridplanner.org/

[9] Assuming that 9% of the generated electricity substitutes Tier 1/Tier 2 applications with an emission factor of 2.72 tCO2/MWh and 91% replace modern diesel gensets with an emission factor of 0.8 tCO2/MWh (in line with CDM Methodology AMS-I.L.).

# 3. Enabling community-driven project structures: Barriers and Recommendations

The following section outlines the key constraints hindering the proliferation of Community-Driven Mini-Grids (CDMGs) in Nigeria and proposes legal, political, and institutional reforms to strengthen their development. These reforms aim to contribute to achieving clean and reliable energy access for rural communities across Nigeria.

## 3.1 Awareness and perception

### Barriers:

Nigeria's overall strategy for mini-grid deployment fails to adequately enhance the awareness and capacities of both undergrid and off-grid communities regarding the benefits of mini-grids, the potential for community ownership, and the practical opportunities for energy cooperatives. Furthermore, the country lacks a robust network of Renewable Energy Cooperatives (RECs) that can effectively support underserved communities in developing and implementing their own mini-grid projects. Also, among developers and government officials, there is a notable lack of awareness and, at times, cynicism regarding the practicality of Community-Driven Mini-Grids (CDMGs) and the ability of rural residents to own and operate sophisticated energy infrastructure (Kelly, 2023). Since CDMG approaches are rare in Nigeria, private project developers often harbor a distorted perception of the risks associated with these models. These perceptual barriers, coupled with insufficient awareness of the viability of CDMGs in other African countries and developing regions, likely contribute to the lack of recognition of RECs and community-driven approaches in key national policies.

### Recommended actions:

- **Movement-building:** Over time, social and economic stakeholders in the African mini-grid sector must establish national and regional movements that promote CDMGs and RECs. This initiative may involve creating regional or continental associations and federations of RECs, as well as organizing peer-learning workshops and knowledge exchange conferences.

- **One-stop shops:** Another solution implemented by several countries, such as the Community and Renewable Energy Scheme (CARES) in Scotland, is the establishment of dedicated entities —whether public agencies or non-governmental organizations— that serve as one-stop shops for rural electrification. These community energy one-stop shops are designed to facilitate community energy projects by streamlining the interface between communities (or individuals) and the government (IRENA Coalition for Action, 2020). While their primary objective is to reduce regulatory and administrative burdens, one-stop shops can also provide valuable information and advice, including capacity building, and can even connect communities with financing options (OECD, 2020).

## 3.2 Technology

### Barriers:

In addition to lacking awareness, communities often lack a comprehensive technical understanding of photovoltaic (PV) systems and the scope of their mini-grid projects. To engage effectively with potential project partners, communities need basic information on key parameters, such as their electricity demand, the overall system scope they envision, their financial capacity, and their technical knowledge regarding various business model options. Currently, Nigeria lacks a supportive network that addresses the technical aspects of mini-grids while also incorporating awareness-raising activities. Moreover, there is a need for structures that effectively build the capacities of Renewable Energy Cooperatives (RECs), similar to the technical assistance initiatives that NRECA International provides for RECs worldwide.

### Recommended actions:

- **Capacity-building:** Relevant institutions in the mini-grid sector should support the development of Renewable Energy Cooperatives (RECs) throughout the country and provide capacity-building in areas such as system maintenance, tariff-setting, financial management for RECs, legal compliance, and the productive use of energy, among others.

- **Regional knowledge exchange for co-ops:** To leverage existing experiences and expertise in the region, it would be advantageous for relevant institutions to actively facilitate knowledge exchange between established energy cooperatives and community committees at the local, national, and regional levels.

- **Volunteer networks:** A network of volunteers or partner organizations that operate at the local level would help disseminate essential information to community leaders and serve as a primary point of contact. For instance, Clean Technology Hub manages a nationwide Volunteer Network through which it trains "Citizen Energy" ambassadors to assist communities in initiating solar electrification plans.

- **Disbursement of mini-grid tools:** Several tools, such as the Community-Minigrid-Toolbox[10], are available to assist communities during the planning phase of a community mini-grid project. Government institutions and NGOs should work to disseminate these tools effectively.

## 3.3 Financing opportunities

### Barriers:

Currently, Community-Driven Mini-Grids (CDMGs) face significant limitations regarding equity and collateral, relying heavily on foreign grants and technical assistance for their implementation (USAID, 2021). In contrast, Renewable Energy Cooperatives (RECs) in Europe and North America are primarily funded by their members. In Germany, cooperative banks, of which there are 1,047, have been crucial financing partners, supporting 75% of energy cooperatives (DGRV, 2019).

The commercial banking sector in Nigeria is ill-equipped to address the needs of rural electrification programs. While developer-driven mini-grid projects contend with extraordinarily high interest rates, community-driven initiatives struggle to access any form of commercial financing. The pervasive misconception of risk among banks hampers the financing of CDMGs. This financial constraint is further exacerbated by the lack of government and donor funding facilities specifically tailored for communities seeking to establish community-owned mini-grids. A notable example is Zambia, where the Zambia Electric Cooperative Development Program, funded in 2021, created a dedicated funding facility for community-driven electrification projects.

### Recommended actions:

- **Funding**: To enhance rural electrification, it is crucial for more agencies, donors, and investors to establish targeted financing mechanisms specifically for CDMGs, particularly those with community ownership structures. This initiative should also encompass technical assistance programs for Renewable Energy Cooperatives that own and/or manage such mini-grids. Additionally, it is essential to involve commercial banks, which currently either do not provide project financing or charge prohibitively high interest rates.

[10] The CP-Nigeria Tool is available online: www.community-minigrid.ng.

- **Financial Risk Mitigation Measures:** Governments and development finance institutions (DFIs) could implement risk mitigation strategies designed to attract additional private investment in small- and medium-scale renewable energy projects, including mini-grids. Effective measures may include first-loss loans and first-loss guarantees to mitigate potential losses for commercial lenders (IRENA, 2016).

- **Revolving Funds:** DFIs could establish a revolving fund dedicated to financing community energy projects (IRENA Coalition for Action, 2020). This revolving fund would serve as a long-term credit source for CDMGs, utilizing loan repayments to sustain and expand the fund's resources for future projects (Burke and Stephens, 2017).project. Government institutions and NGOs should work to disseminate these tools effectively.

## 3.4 REA performance-based grant funding

### Barriers:

In Nigeria, the mandate of its Rural Electrification Agency (REA) and the prevailing public discourse surrounding its activities primarily prioritize the installation of new systems, and neglect assessing their long-term reliability. For instance, REA's impact report (2023: 11) focuses on the number of installations and new connections, while other publications, such as the African Minigrid Developers Association's Benchmarking Minigrids Report 2022, emphasize the performance and reliability of mini-grids (AMDA, 2022: 16-19).

REA's Framework for Electricity Users' Co-operative Society (2021) theoretically promotes user cooperatives for the "ownership, operation, and maintenance" of mini-grids, however, despite these guidelines, no community-owned mini-grids have emerged from the funding facilities provided by the REA and the Rural Electrification Fund (REF).

Although the NEP funding managed by the REA presents significant opportunities for Community-Driven Mini-Grid (CDMG) projects, two critical shortcomings hinder the agency's current processes. First, the requirement that only project developers can apply for REA funding, while the developer selects the community, obstructs the development of CDMGs and often results in unsustainable project arrangements. Second, REA exclusively offers performance-based grants, which inadvertently subsidize the banking sector. With interest rates exceeding 20%, a considerable portion of the grant funds is redirected to banks rather than benefiting the mini-grid projects themselves.

### Recommended actions:

- **REA performance-based grant financing:** The Rural Electrification Agency (REA) needs to explicitly include and support CDMGs within their current performance-based grant facility, as subsidies currently flow only to developer-led mini-grid projects.

An alternative approach would be to adopt the financing windows for electric cooperatives created by USAID in Zambia, which actively provide funding for CDMGs along with technical assistance for the establishment and operation of renewable energy cooperatives that own and manage mini-grids. CDMGs can significantly enhance the sustainability of mini-grid projects while increasing benefits for the communities. Additionally, the REA should assist projects in attracting loans with reasonable interest rates.

## 3.5 Feed-in-tariffs

### Barriers:

For mini-grid systems in undergrid communities, the ability to feed excess electricity into the national grid can provide an additional revenue stream. This option significantly enhances the financial viability of Community-Driven Mini-Grid (CDMG) projects and benefits national utilities, which can purchase electricity at lower rates than their charged tariffs. In Europe, for instance, there is a shift among citizens from being passive consumers to becoming "prosumers" and co-owners of distributed energy systems—individuals who consume, produce, store, and share energy with other users (Chaudhry et al., 2022; Caramizaru & Uihlein, 2020). These renewable energy communities enable both peer-to-peer energy sharing and peer-to-grid sharing. Generally, in countries where community energy has thrived, feed-in tariffs have played a crucial role (Angel, 2016: 13), not only in Europe but also in parts of Latin America (Schneider et al., 2019: 1900).

In Nigeria, while feed-in tariff regulations have been in place since 2015, they have yet to be widely utilized and currently face legal and technical constraints. The Feed-in Tariff Regulation of 2015 applies only to „all qualifying renewable energy sources of electricity with a capacity above 1 MW" (NERC, 2015: 7), which excludes most mini-grids. Furthermore, a significant disincentive exists, as the tariff for feeding power into the national grid is substantially lower than the rates charged to mini-grid customers. This issue is exacerbated by the additional capital expenditure (CAPEX) required to oversize the mini-grid system for grid evacuation of excess power. Additionally, interconnected mini-grids are still uncommon in Nigeria, with only two currently operational: the Mokoloki mini-grid in Ogun State and the Toto mini-grid in Nasarawa State.

### Recommended actions:

- **Feed-in Tariffs (FITs):** As the number of interconnected mini-grids increases, particularly as envisioned under the Distributed Access through Renewable Energy Scale-up project, the Nigerian Electricity Regulatory Commission (NERC) should consider extending the scope of FIT regulations to encompass renewable energy generation below 1 MW, potentially setting a minimum threshold of 500 kW to ensure scalability.

- **Virtual/Community Net Metering Schemes: I**n the long term, Nigeria's regulations should also facilitate the implementation of virtual or community net metering systems managed by distribution companies. Virtual net metering (VNM) is a bill-crediting system designed for community solar projects. It applies the principles of net metering to community initiatives, where members collectively share ownership of the mini-grid system. The excess electricity fed into the grid generates net metering credits, which are distributed among the subscribers or owners based on their respective ownership shares. As a result, community energy shareholders receive credits on their electric bills for the surplus energy produced by their portion of the community solar project (IRENA Coalition for Action, 2020; Money, 2022).

## 3.6 Legal framework

### Barriers:

Nigeria's key policies concerning mini-grids include the 2015 National Renewable Energy and Energy Efficiency Policy (NREEEP) and the 2016 Rural Electrification Strategy and Implementation Plan (RESIP). While the NREEEP lacks specific provisions to promote community-driven mini-grids, the RESIP acknowledges the role of cooperatives, emphasizing the necessity of „ensuring that governmental agencies, cooperatives, and communities, where feasible, have adequate room to participate in enhancing electricity service delivery" (Federal Ministry of Power, Works and Housing, 2016). The RESIP also accommodates various industry and ownership structures, allowing for public, private, and cooperative entities (Federal Ministry of Power, Works and Housing, 2016: 16).

In addition, the initiative of Rural Electricity Users Cooperative Societies (REUCS) exists in Nigeria; however, these cooperatives face challenges due to the lack of legal ownership of the systems. Furthermore, although data on their operations is limited, assessments indicate that community engagement activities diminish after the initial establishment of REUCS, leading to their eventual inactivity (Power Africa, 2021).

Another significant challenge is the reluctance of project developers to embrace shared ownership of mini-grid assets. This aversion stems from the desire for flexibility in decision-making regarding asset management and concerns that community representatives may overstep their boundaries into the technical and financial aspects of mini-grid operations.

### Recommended actions:

- **Policies and Frameworks:** The REA (2021) Framework for Electricity Users' Cooperative Societies should be revised to establish clear modalities for [registered] community-owned renewable energy systems. Additionally, federal and state government policies and initiatives should focus on directing incentives towards community-driven mini-grids (CDMGs).

- **Regulations:** To address developers‘ concerns, the Nigerian Electricity Regulatory Commission (NERC) should amend the 2023 Mini-Grid Regulations to include explicit provisions governing the operations of CDMGs.

- **Targets and Local Ownership Quotas:** A policy environment that supports renewable energy is also advantageous for community energy initiatives. However, more specific targets within Nigeria's policies could further support community projects. In this context, Nigeria could implement sub-targets for community energy and establish local ownership quotas for renewable energy projects (IRENA Coalition for Action, 2020).

# 4. Conclusion

This Policy Brief seeks to enhance awareness of community-driven solutions for rural renewable energy mini-grid projects in Nigeria. Currently, the lack of community participation in many privately-led mini-grids in Nigeria has detrimental effects on the operation of these systems. The brief highlights the diverse benefits of community-driven mini-grids, where communities actively engage in managing energy projects and may hold full or partial legal ownership of generation, transmission, and distribution assets. The reviewed literature and empirical examples demonstrate that community-driven approaches are significantly less likely to fail in the long term and offer numerous socio-economic benefits. Furthermore, this brief advocates for an improved legal, political, and institutional environment that fosters the development of local and regional renewable energy cooperative structures.

The Nigeria Electrification Project (NEP)- and soon, DARES - initiative present a unique opportunity to shape Nigeria's energy infrastructure for the future. In this context, community-driven mini-grids and renewable energy cooperatives must play a pivotal role in advancing access to clean and reliable electricity for the country's rural population.

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# Annex I: Mini-grids in key African countries by ownership type

| Country | Public | Private | Public-Private Partnership | Community | Unknown | Total |
|---|---|---|---|---|---|---|
| **Uganda** | 0 | 23 (67%) | 2 (6%) | 9 (27%) | – | 34 |
| **Tanzania** | 36 (13%) | 112 (40%) | 5 (2%) | 42 (15%) | 83 (30%) | 278 |
| **Kenya** | 70 (34%) | 6 (3%) | 4 (2%) | 17 (8%) | 111 (53%) | 208 |
| **Senegal** | 107 (24.8%) | 1 (0.2%) | 6 (1%) | 7 (2%) | 310 (72%) | 431 |
| **Nigeria** | 1 (2%) | 45 (67%) | 10 (15%) | 1 (1%) | 10 (15%) | 67 |
| **Total** | **214 (21%)** | **187 (18%)** | **27 (3%)** | **6 (7%)** | **514 (51%)** | **1,018** |

*Source: ESMAP, 2022, cited in SIGMA Project, 2023; SEforAll, 2020: 136*

# Annex II: Selected Renewable Energy Cooperatives in Africa

| Electricity Cooperative | Year Installed | Installed By | Funder | Country | No. of Connections |
|---|---|---|---|---|---|
| LUMAMA (300 kW hydro-power mini-grid) | 2009 | ACRA–Coope-razione Rurale in Africa e America Latina (ACRA-CCS) | Scottish Government | Tanzania | 1,200 connections |
| Kyegegwa Rural Electricity Cooperative Society | 2021 | NRECA International | USAID | Uganda | 170 |
| Totota Electric Cooperative | 2018 | – | NRECA International | Liberia | 400 |
| Olele 25 kW solar | 2018 | – | European Union | Malawi | 23 |
| Chipopoma microhydro power plant (45 kW) | 2018 | – | UNDP | Malawi | 124+ |
| Ntatumbila 156-kW solar mini-grid | Ongoing | – | USAID | Zambia | 530 |
| Matembwe Village Company (120 kW Reservoir mini-hydropower) | 1984 (REC formed in 1989) | Italian NGO CEFA | Italian Ministry of Foreign Affairs, Belgian Ministry of Foreign Affairs, European Union | Tanzania | 620 |
| Bomalang'ombe Village Company (250 kW Reservoir mini-hydropower) | 2001 | Italian NGO CEFA | European Union | Tanzania | 328 |
| Kafita Multipur-pose Cooperative Society (60 kW solar mini-grid) | 2013 | – | UNIDO, GEF, Rural Zambia Electrifica-tion Authority | Zambia | 480 |
| Ewangan Shompole Solar Cooperative Ltd (Oloika Commu-nity 13.5 kW solar mini-grid) | 2015 | University of Sou-thampton | – | Kenya | 46 |
| 5 Refugee Camp Energy Coopera-tive in Ballo Addo region (Bokolma-nyo, Melkadida,. Kobe, Hilaweyn, and Buramino) | 2018 | – | Oak Foundation | Ethiopia | NA |

*Source: CEFA, 2015; Refugee Studies Centre, 2020; Vallecha, 2023a; Vallecha, 2023b*

# Annex III: Stakeholder map of actors relevant to community-owned mini-grid promotion in Nigeria


*Source: Own compilation*

*Please note that this list is not exhaustive and additional stakeholders may exist.*

Report written by:




Funded by: