Clean Technology Hub
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The State of Community-Owned Mini-Grids in Africa

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Executive Summary

The World Bank estimates that Africa needs about 160,000 mini-grids as part of its efforts to achieve universal energy access by 2030. About 3,000 of these have already been installed so far. Most of these mini-grids are owned by government actors or private project developers. Comparatively, few are owned by local communities, despite the significant growth in Community-owned mini-grids (COMGs) and renewable energy cooperatives (RECs) seen significantly in many parts of the world, including Europe, North America and South America.

We estimate that only 7% (or 204) of the mini-grids installed on the African continent are community-owned, mostly concentrated in East and Southern Africa (Tanzania, Kenya, Ethiopia, Uganda, and Malawi), with others in Burkina Faso, Senegal, Liberia, Nigeria and, more recently, Zambia (with the first two Zambian electric cooperatives registered in 2023).

The limited reach of the community ownership or cooperative model is due to several key factors, which include:

-  **Corporate Predominance in Mini-Grid Discourse:**

  The transition from a centralized grid electricity sector planning focus to liberalization and decentralization of the power sector emphasized the role of private corporate utility companies. Therefore, much of the funding and research on mini-grids has reinforced this corporate approach.

-  **Absence of Community Energy Movements:**

  Unlike Latin America and Europe where strong transnational community energy movements and associations of RECs exist, there are none in Africa, especially in comparison to the continental mini-grid associations whose membership is dominated by private developers.

-  **Uneven Spread of Mini-Grids across Africa:**

  The spread of renewable energy mini-grids on the continent as a whole has been significantly uneven, which may largely account for the unevenness of COMGs across Africa. Many African countries only recently began installing their first renewable energy mini-grids, and are still in the process of establishing a viable mini-grid sector.

-  **Financial Limitations:**

  Especially in Africa where rural poverty is high, many communities are unable to raise the funds to install a mini-grid. The off-grid nature of many communities for which mini-grids represent the least-cost electrification option implies that a lot of

communities are unable to benefit financially from net metering and feed-in-tariffs. Consequently, most COMGs and their governing RECs require grant funding and financing facilities that provide patient capital.

In light of these challenges, the following recommendations are made:

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Production of Case Studies:

In-depth case studies need to be produced and publicized on COMGs from different countries to highlight their operational and governance dynamics, techno-economic conditions, socio-economic impacts, expansion planning, legal experiences, success factors, risk factors, and other relevant information that could benefit decision-makers in other countries.

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Resources:

In order to aid similar efforts in establishing COMGs, there needs to be a repository of template articles of association for RECs, operation and maintenance service agreements between RECs and mini-grid operators, community solicitation letters for financing, and community project implementation plans for soliciting project partners.

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Regulatory Assessment:

A comparative analysis of the legal and regulatory provisions for COMGs needs to be undertaken for Africa. This would allow stakeholders to better understand how various regulatory provisions affect different aspects of REC operations and COMG survival.

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COMG Alliance Formation:

In addition to the formation of national associations of RECs, a continental alliance for RECs needs to emerge in order to represent the interest of COMGs in Africa.

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Financing Facilities:

Dedicated financing facilities are required to fund feasibility studies on COMGs covering key African countries with high mini-grid potential, to fund the establishment of RECs and installation of COMGs, and to fund the introduction of improved technology and finance key investments by RECs.

1. Introduction

Since the early 2010s, third-generation mini-grid systems, particularly solar and hybrid systems, have increasingly been deployed across African countries (SEforAll, 2020). The World Bank estimates that 160,000 of these renewable energy mini-grids can electrify 380 million of the over 600 million Africans lacking access to electricity (World Bank, 2023). Over 3,000 mini-grids have now been installed on the continent, from about 500 in 2010 (World Bank, 2023). However, at current rates, only 12,000 mini-grids serving 46 million people will be installed by 2030 (World Bank, 2023).

Several financial and regulatory barriers have limited the ability of mini-grid developers to scale. In response to these constraints, donors, financiers and regulatory bodies are at the cusp of expanding their support to the sector by removing some of these bottlenecks and increasing funding. Financing is also being increased by international donors, while more governments have systematised least-cost electrification approaches that see mini-grids as critical for electrifying significant portions of rural and peri-urban areas.

Yet, most of these approaches focus on promoting the deployment of developer-owned mini-grids which often utilise a Build Own and Operate (BOO) model. Scholars and practitioners have indeed questioned the approach taken by many actors in pursuing widespread rural electrification through a regulatory framework that is mainly oriented toward increasing market efficiency (Sesan et al., 2024). They argue that, while the current market-led and developer-led framework has enabled growth in the mini-grid sector, equitable distribution of access to energy for rural populations "dwelling on the fringes of mainstream electricity markets" requires complementary mechanisms to achieve (Sesan et al., 2024).

If communities, which by market standards, are less attractive for corporate mini-grid developers, can drive their own mini-grid plans and system ownership, then they may have a chance of escaping the dual traps of energy poverty and mini-grid market peripherality.

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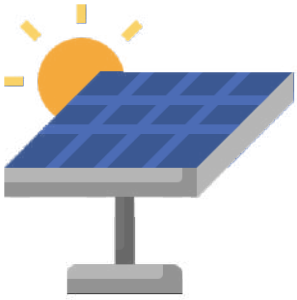

Community-owned mini-grids (COMGs) are few in Africa, both in relation to the total number of mini-grids deployed on the continent and in relation to the number of community-owned mini-grids in other parts of the world. In Europe, REScoop.eu is a European federation of 2,250 citizen energy cooperatives (REScoop.eu, 2025). In the United States, 895 generation, transmission, and distribution energy cooperatives serve 42 million people (NRECA, 2023).

For example, Nigeria is Africa's most populous country and has the largest energy access deficit in the world (at over 90 million people lacking access to electricity). It is estimated that mini-grids are the least-cost electrification method for about 27% of population clusters (Husein et al., 2024: 4). In fact, the country is regarded as the second largest potential mini-grid market in sub-Saharan Africa and the largest in West Africa (SEforAll 2020: 127). Yet, only 1% of mini-grids in the country are estimated to be community-owned (ESMAP, 2022, cited in SIGMA Project, 2023).

This report outlines the state of community-owned mini-grids in Africa and represents the first comparative regional estimation of the number of electricity cooperatives globally. It draws on the extant secondary literature—academic papers, policy briefs, industry reports, websites and research blog posts, field reports, and published datasets. Section 2 provides definitions and estimates of the number of electricity cooperatives in Africa. Section 3 interrogates the historical evolution of COMGs in Africa and the various reasons for their limited presence on the continent. The report concludes with recommendations to energy sector stakeholders to remove bottlenecks to the proliferation of COMGs and RECs in Africa.

2. Electricity Cooperatives in Africa

"Community renewable energy" (CORE), "citizen energy" or "civic energy" refers to decentralised, renewables-based energy system consisting of both municipal generation, distribution and supply models and citizen community energy schemes (McGovern, 2021) or collective energy actions that foster citizens' participation across the energy system (Caramizaru & Uihlein, 2020: 2). In terms of mini-grid technologies, these constitute the "hard" definition of community-driven mini-grids, whereby "communities hold full or partial legal ownership of assets" for generation, transmission and/or distribution (Gaiya et al., 2024, p. 10). There are generally three kinds of actors which have owned mini-grids under the broad umbrella of community-owned mini-grids. These include:

Non-Governmental Organisations (NGOs), Renewable Electricity Cooperatives (RECs), and municipal/local governments.

This report focuses on COMGs owned and managed by community-based electricity cooperatives. These differ from community-based NGOs due to the nature of representation—members of RECs come from the community, and their leadership committee is elected by these members. In addition, an REC is typically set up specifically to own and manage the mini-grid, and therefore the community often has a say in its structure, composition and mandate. NGOs, on the other hand, are generally created by individuals and, although may be led and staffed by community members, usually exist prior to the installation of the renewable energy system.

Estimating the number of COMGs in Africa is difficult since there is no single exhaustive database of the over 3,000 mini-grids (World Bank, 2023) installed in the continent. Not all existing databases record ownership structures and some that do do not record this comprehensively. For example, the CoSMMA database (Berthelemy et al., 2019) records decentralised electrification projects, but does not code their ownership structure. On the other hand, the CLUB-ER (2019) database, which includes 1,888 georeferenced mini-grid projects from 27 sub-Saharan countries, records ownership structure as either "private", "public" or "partnership" (Ayhan et al., 2022: 9). From this database, public and utility ownership is the most common ownership type for SSA mini-grids (53%), followed by public-private partnership (32%) and finally private ownership (14%) (Ayhan et al., 2022: 9).

One dataset of 104 mini-grids contains information on 32 African mini-grids from seven countries, 10 of which are coded as being community-owned (Duran & Sahinyazan, 2020). This would imply that a third of mini-grids in Africa are community-owned, but this is likely an overestimation due to the fact the dataset was not randomly constructed - it was constructed based on publicly available information, and COMGs are likely to disproportionately generate media interest and garner more public attention. Due to this, small sample sizes indeed create an overestimation bias for COMGs. In an in-depth study of 20 mini-grids in Kenya (Onsongo, 2023: 9-10), four (20%) are identified as being community-owned. In a database of 109 renewable energy mini-grids in Tanzania (WRI, 2017), 19 (17%) were coded as being owned by the project community, while 17% of all mini-grids (both renewable energy and fossil fuel mini-grids) were coded as community-owned.

The larger ESMAP (2022, cited in SIGMA Project, 2023) database of mini-grid projects indicates that, among the African countries with the largest number of mini-grids (Senegal, Tanzania, Kenya and Nigeria), community-owned mini-grids may represent 8% (17 out of 208) of mini-grids in Kenya, 15% (42 out of 278) in Tanzania, 2% (7 out of 431) in Senegal and 1% (1 out of 67) in Nigeria (SIGMA Project, 2023). SEforAll (2020: 136) estimates that 9 of the 34 (27%) mini-grids in Uganda by 2020 were community-owned, while Power for All (2018) notes that there are 93 existing mini-grids promoted by local cooperatives in Burkina Faso.

Table 1. Mini-grids in key African countries by ownership type (Source: ESMAP, 2022, cited in SIGMA Project, 2023; SEforAll, 2020: 136)

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%)**	**76 (7%)**	**514 (51%)**	**1,018**

In total, this suggests that only about 7% of mini-grids in Africa are community-owned. However, over half of the reported total of the four countries do not have their ownership models recorded, which poses a challenge to accurate estimation.

Figure 1. African countries with at least one community-owned renewable energy mini-grid (Source: Author's illustration)

If this percentage estimate is applied to the estimated 3,000 mini-grids installed on the continent, it suggests that about 204 COMGs may exist on the continent, most of which are concentrated in East and Southern Africa (Tanzania, Kenya, Ethiopia, Uganda and Malawi), with others in Burkina Faso, Senegal, Liberia, Nigeria and, more recently, Zambia (with the first two Zambian electric cooperatives registered in 2023). This may be contrasted with other regions of the world. The countries with the largest number of electricity cooperatives are the United States in North America (over 900), Germany in

Europe (824), Argentina in Latin America and the Caribbean (600) and the Philippines in Asia (116).

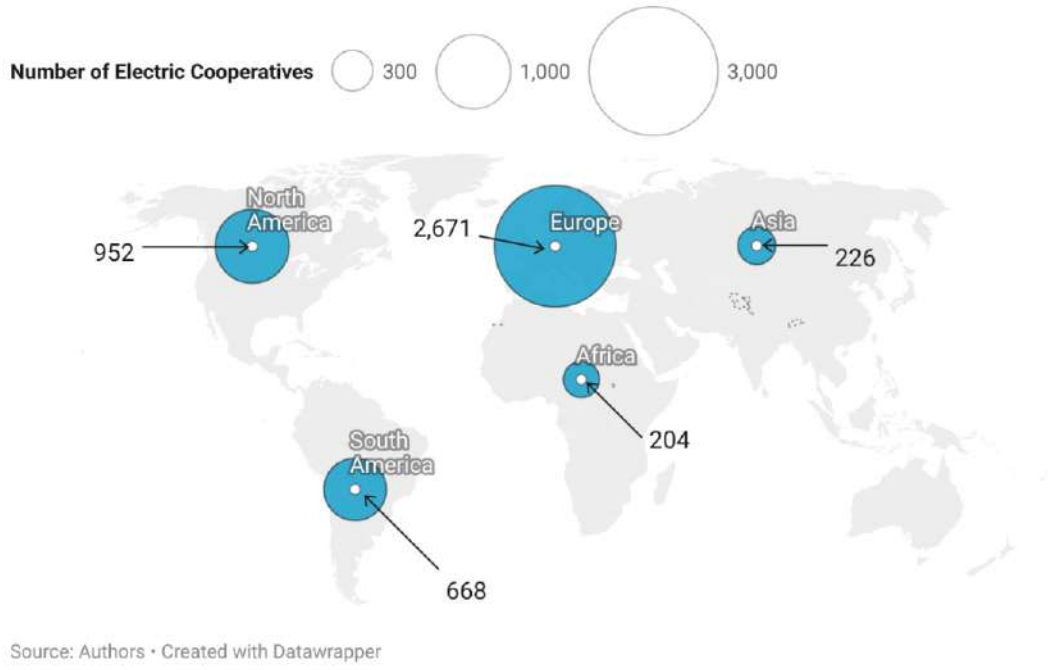

Figure 2. Number of electric cooperatives by region (Source: Author's illustration based on Wierling et al., 2018; NRECA, Leonhardt, 2022; Gutman, 2023; DGRV, n.d.; Schneider & Vidotto, 2022; FENACOPEL, 2025; ILO, 2013; Duran & Sahinyazan, 2020; Shani, 2019)

3. Historical Evolution of COMGs in Africa

The first renewable energy cooperative in Africa may be the Matembwe Village Company in Tanzania, created to own and manage a 120 kW reservoir mini-hydropower plant. This was the first mini-grid realised in Tanzania by the Comitato Europeo per la Formazione e l'Agricoltura Onlus (CEFA), which is an Italian NGO. CEFA commissioned the mini-grid in 1984 (with the REC founded in 1989). It sought to electrify the villages of Matembwe and Image, in the District of Njombe (Njombe Region). It had an explicit productive use purpose, as Poala (2019: 14) recounts:

> "It is necessary to highlight that the project in Matembwe had not started as an energy intervention, but as a livelihoods and food security initiative: together with local stakeholders, CEFA decided to establish a poultry farm and an animal feed production, in synergy with various activities of agricultural training and support. The power plant was intended later, when it was realised that the businesses within the project, especially the incubators for the poultry farm, needed electricity to run. Furthermore, the power produced was initially supplied only to the abovementioned activities. Later on, with the implementation of a proper mini-grid, it has been possible to distribute electricity to other domestic, business and public users, so that, nowadays, with a 19-km network at 10 kV, the mini-grid can count on 620 connections (4 aqueducts included) and an anchor client, TANESCO (the connection to the grid occurred in 2015)."

Subsequent COMGs were installed in Tanzania in 2001, 2004 and 2009 by Italian NGOs (CEFA and ACRA-CCS), funded by European governments and in collaboration with local NGOs. In the late 2000s, there was also an electric cooperative established in the town of Yei in South Sudan, although it managed a diesel-based system (De Koster, 2012), with support from NRECA International and funding from USAID.

These few COMG projects partly reflected the overall small size of the African mini-grid sector, which harboured only 500 mini-grids in 2010 in a small set of countries (World Bank, 2023). It was not until the 2010s that other COMGs began to spring up in other African countries, with a concentration in East and Southern Africa.

Table 2. Some RECs in Africa (Source: CEFA, 2015; Refugee Studies Centre, 2020; Vallecha, 2023a; Vallecha, 2023b)

Electricity Cooperative	Year Installed	Installed By	Funder	Country	No. of Connections
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
LUMAMA (300 kW hydropower mini-grid)	2009	ACRA–Cooperazione Rurale in Africa e America Latina (ACRA-CCS)	Scottish Government	Tanzania	1,200 connections
Bundibugyo Energy Coop. Society (BECS)	2011			Uganda	2,500
Kafita Multipurpose Cooperative Society (60 kW solar mini-grid)	2013		UNIDO, GEF, Rural Zambia Electrification Authority	Zambia	480

Electricity Cooperative	Year Installed	Installed By	Funder	Country	No. of Connections
Ewangan Shompole Solar Cooperative Ltd (Oloika Community 13.5 kW solar mini-grid)	2015	University of Southampton		Kenya	46
5 Refugee Camp Energy Cooperative in Ballo Addo region (Bokolmanyo, Melkadida,. Kobe, Hilaweyn, and Buramino)	2018	-	Oak Foundation	Ethiopia	NA
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+
Kyegegwa Rural Electricity Cooperative Society	2021	NRECA International	USAID	Uganda	170
Ntatumbila Power Electric Cooperative (156-kW solar mini-grid)	2023	NRECA International	USAID	Zambia	530
Petauke Electric Cooperative	2024	NRECA International	USAID	Zambia	NA

Most recently, the U.S-based NRECA International is driving the proliferation of RECs in Africa, especially in Southern Africa (Zambia and Malawi), with funding from USAID. In 2021, the $5.3 million Zambia Electric Cooperative Development Program was launched in Zambia with funding from USAID and in partnership with the Zambia Rural Electrification Authority (REA). As a result, the first electric co-op in Zambia was established in 2023—Ntatumbila Power Electric Cooperative Society, Ltd. (NPECS)—in the community of Ntatumbila in the Nakonde district of northern Zambia (NRECA International, 2023a).

In 2023, the Malawi Clean Energy Cooperatives Program (CECP) was launched as a four-year initiative of NRECA International, with funding support from USAID (under the USAID Cooperative Development Program), to promote the development of five new clean energy cooperative enterprises in rural Malawi (NRECA International, 2023c). NRECA's work in the 2020s, therefore, promises to be a new era for COMGs in Africa.

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Figure 3. Members of Ntatumbila community in Zambia's Nakonde District voting to confirm their interest and give consent to form an electric cooperative (Source: NRECA International, 2023b).

There are a number of reasons for the comparatively low number of COMGs in Africa. Four of the biggest reasons are: the predominance of a corporate focus in the mini-grid discourse; the absence of coalitions for COMGs, the uneven spread of mini-grids in the first place; and financial limitations for communities in advancing COMGs.

4.1. Corporate Predominance in the Mini-Grid Discourse

The early experiments with COMGs in Africa took place at a time when first and second-generation mini-grids (diesel-based or hydropower-based) predominated in the 2000s. When solar, biomass and wind mini-grids began to take off in the early 2010s (SEforAll, 2020), private developers became more prominent, and their growth dwarfed that of RECs. Mini-grid developers have therefore become the focus of donor funding, state funding and private investment in the renewable energy mini-grid sector. The fact that the largest mini-grid sector report, the SEforAll (2020) *State of the Global Mini-grids Market Report 2020*, published at the end of that decade, mentions community-owned mini-grids only a few times, and often in passing for the African case studies, attests to this developer focus.

The only exception to this trend is Burkina Faso, where almost all existing mini-grids are owned and operated by electricity cooperatives (Government of Burkina Faso, 2021) which are generally managed by small volunteers teams executing simple tasks such as administration, invoicing, and bill collection (Integrated Development Authority of the

Liptako-Gourma States, 2020, p. 64). This is because the government in the early 2000s realized that the National Electricity Company, Sonabel, had only extended the national electricity network to only 13% of towns and cities nationwide in 50 years of existence while acknowledging that the government did not have the funds to electrify every town and hamlet with electricity (Dassouri, 2004).

The corporate focus of Africa's mini-grid sector occurred on the back of a wider shift from national electrification based on large vertically-integrated state-owned utility companies to decentralised and privatised national electricity markets and policies. Under both conventions (state-led and private-led electrification), community ownership was never the norm and was therefore given little consideration. With respect to finance, this preeminence of debate between state-utility-led and developer-led electrification is reflected in the massive amounts of capital poured into "insolvent and bankrupt utilities every year (only three Sub-Saharan African utilities are currently solvent), but less than one billion euros of donor funds in total has been disbursed in the off-grid sector to date" (Symington & Leopold, 2018; AMDA, 2022: 4). In many situations:

> "utilities, ministries, MDBs, and indeed – many donor national office staff – do not adequately understand the decentralised energy space and how far it has evolved in recent years. Members of the Alliance for Rural Electrification – despite being told by the global community that they are urgently needed – receive cold receptions by many key players at the national level, hence many policies and regulations (where they exist) are not developed with the true interests of the sector in mind." (Symington & Leopold, 2018).

In other words, the promotion of mini-grid developers over traditional utilities in unelectrified and underserved areas is still ongoing and relatively recent. The continued struggle by mini-grid developers to be seen as equals or, in certain cases, superior to national utilities (AMDA, 2022: 16), overshadows the conversation about promoting a wider presence of community-owned mini-grids. This overshadowing is reinforced by the dominance of developers in national (e.g. in the Renewable Energy Association of Nigeria) and continental (e.g. Alliance for Rural Electrification and African Minigrid Developers Association) industry associations that are at the forefront of policy advocacy. In contrast, with the exception of Senegal—where the Société de Coopérative d'Energie Citoyenne du Sénégal (Citizen Energy Cooperative Society of Senegal, SCECS) was founded in 2018 (and which does not particularly focus on mini-grids)—and the National Union of Electricity Co-operatives in Burkina Faso (UNCOOPEL) in Burkina Faso, no national energy cooperative federation or movement has emerged in any other African country or at sub-regional and continental levels.

4.2. Absence of Community Energy Movements

There is an absence of national and regional/continental movements of RECs similar to the ones found in Europe and North America. In the United States, the National Rural Electric Cooperative Association (NRECA) represents more than 900 consumer-owned, not-for-profit electric cooperatives, public power districts, and public utility districts (NRECA, 2025). In Turkey, the first energy cooperative was formed in 2017 (Troya Energy Cooperative) and subsequently created the Energy Cooperatives Network to bring renewable energy cooperatives from across the country together, which were 46 in number as of 2020 (Özgül et al., 2020). The Network also organises annual energy cooperatives conferences. REScoop.eu is the European federation of energy communities, comprising 2,500 energy communities (REScoop.eu, 2025). The Philippines has 119 electric cooperatives serving more than 56 million people in 36,000 rural villages and rural towns (NRECA International, 2025) and is represented by the Philippine Rural Electric Cooperatives Association (PHILRECA). In Latin America, the Energía Cooperativa advocates for RECs in Brazil, Chile, Colombia and Mexico, and the first Latin American Forum of Energy Cooperatives was recently held in September, 2024 (DGRV, 2024).

In contrast, the off-grid predominance of mini-grids in Africa makes it difficult for national and continental RECs to arise. Even in terms of cooperation among rural localities to create political pressure to address service interruptions on state- or developer-owned mini-grids, "the small size of the villages, their relative geographical isolation, the lack of electricity and lack of access to the media hinder massive protests" (Étienne, 2024). Indeed, the very fact that it is in the "very remote areas where electrification isn't cost-effective for private entrepreneurs or utilities" (USAID, 2020a) that many have argued COMGs are most relevant in Africa, limits their visibility.

To advance this ownership type across Africa, several stakeholders need to be engaged, including government actors, donors, research institutions and NGOs, and cooperatives (Figure 5).

Figure 4. Stakeholder map of some of the actors relevant for community-owned mini-grid promotion in Africa (Source: Gaiya et al., 2024, p. 31).

4.3. Uneven Spread of Mini-Grids Across Africa

The spread of renewable energy mini-grids on the continent as a whole has been significantly uneven, which may largely account for the unevenness of COMGs across Africa. Whereas Senegal began mini-grid projects in the mid-1990s and had 272 mini-grids by 2020 (the highest in Africa) (GET.invest, 2020), Malawi installed its first smart-metered, solar-powered microgrid (University of Strathclyde, 2020) and Côte d'Ivoire launched its first major solar mini-grid project in 2020 (African Energy Chamber, 2020). Zambia began its flagship mini-grid power facility in 2019 (EnviroNews, 2019) and had fewer than 15 operating mini-grids by 2021 (Bumbarger, 2021). The Democratic Republic of Congo installed its first mini-grid in 2017 (Sguazzin, 2023) and Algeria tested its first mini-grid solar power plant in the same year (ClimaSouth, 2017), seven years after Nigeria had installed its first metered solar mini-grid in 2010.

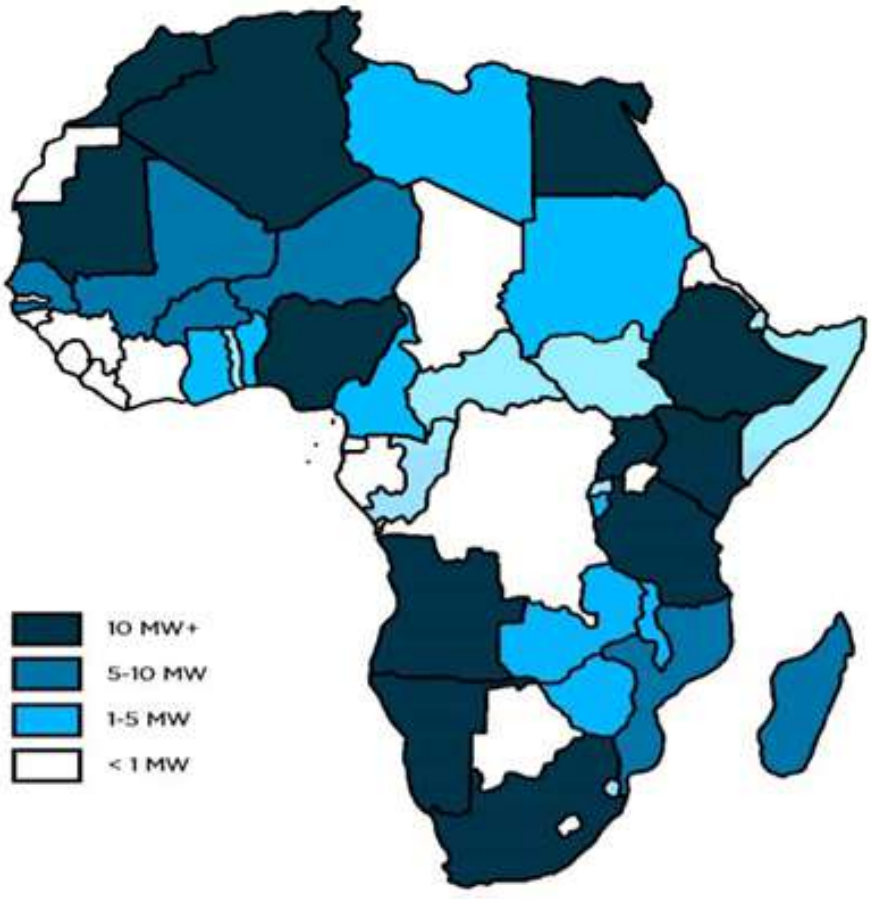

Figure 5. The uneven international distribution of African off-grid solar PV capacity in 2015 (Source: IRENA, 2016)

The fact that Tanzania may have the highest share of COMGs (15%) of total mini-grids installed (SIGMA Project, 2023) suggests strong path dependencies that could arise when initial efforts to establish COMGs are strong and successful. These initial efforts were strong in 2000s Tanzania probably because it was a foreign NGO that led the process and, in the absence of local mini-grid developers to hand over ownership to, local cooperatives had to be created. In West Africa, the only REC—which owns a solar mini-grid—to enjoy relatively wide media coverage is the Totota Electric Cooperative in Liberia, created in 2018 and reported to have achieved self-sufficiency by 2020 (Kelly, 2020).

Figure 6. Members of the Totota Electric Cooperative in Liberia attending the co-op's annual meeting in 2020 (Source: Kelly, 2020).

The absence of more extensive data on COMGs is therefore due to their minority status in the mini-grid sector, the lack of media coverage, inadequate research focus on this ownership type and an overall focus among researchers, the media, donors and investors on developer ownership structures.

4.4. Financial Limitations

The fact that most mini-grids in Africa are deployed in off-grid and non-urbanized areas precludes an important channel that partly accounts for the proliferation of renewable energy cooperatives in North America and Europe—that of benefits from selling power to the grid. Generally, in countries where community energy has flourished, Feed-in-Tariffs (FITs) have played a leading role (Angel, 2016, 13), not only in Europe but also in parts of Latin America (Schneider et al., 2019: 1900). Subsidies offer co-operatives a generous rate for energy sold to the grid.

This is different in Africa, where only relatively few interconnected mini-grids exist, feed-in-tariffs are not common and net-metering is not pervasive. Mini-grid developers and utility companies are more likely to install and own interconnected mini-grids due to the fact that such systems are more likely to be more profitable as they are located in areas with higher incomes and commercial activity than rural and off-grid areas.

As a result, the vast majority of the few COMGs that were established relied substantially on foreign grants and technical assistance for their installation (USAID, 2021: 39-40), in contrast to European and North American RECs which are largely privately funded by their members. In Germany, cooperative banks (1,047 of which exist) have been key financing partners for 75% of energy cooperatives (DGRV, 2019).

Moreover, even among RECs in Africa, there is variation in performance due to the income profile of their customers. Among the five RECs in five refugee camps across the Ballo Addo region of Ethiopia, "Those that have benefitted from installation of the private, commercial mini-grids are the most successful, while the other three cooperatives (in Melkadida, Kobe, and Hilaweyn) have not yet developed reliable income streams" (Refugee Studies Centre, 2020: 6). Zambia's first community-based renewable mini-grid, the Mpanta Solar PV Project, operated by Kapita Cooperative Society (KCS), faces the problem of low and seasonal incomes among fishermen which reduce mini-grid revenues (Mbazima, 2022).

This financial constraint is compounded by the absence of government and donor funding facilities specifically for communities seeking to install community-owned mini-grids. Only in Zambia and Malawi have funding facilities emerged— e.g. the Zambia Electric Cooperative Development Program funded by USAID is a $5.3 million programme. This is little, compared to the hundreds of millions of dollars deployed by donors towards state rural electrification programmes and secured by private mini-grid developers in equity financing.

There is, however, the question of whether, in the low and lower-middle-income countries of Africa where rural areas have high poverty rates, RECs would be able to have a substantial rural development impact. Firstly, there is typically greater pressure for RECs to keep tariffs lower than mini-grids owned by developers driven primarily by profit. RECs would need to make enough revenue to cover administration and staff costs, system operation and maintenance costs, equipment replacement costs (especially batteries, after five to seven years), and, finally, community development investment.

Evidence from Nigeria suggests revenues from average commercial mini-grids of about NGN100,000 ($77) to N150,000 ($115) monthly, which can fall to net revenue of NGN50,000 once management personnel and other maintenance costs are settled (Uduka, 2024: 27, 31). In one case, with monthly revenue of NGN100,000 ($77) projections indicate that with battery replacement costs exceeding NGN14 million ($10,770) when the six-year battery lifespan lapses, gross revenue over the six years would amount to approximately NGN7.2 million ($5,540) (Uduka, 2024: 27, 31; Ugwu et al., 2022).[1] The implication is that the proliferation of RECs, especially in rural areas with inadequate revenue generation, needs to be accompanied by a proliferation of funding facilities that provide grants and concessional loans to subsidise equipment replacement and community development project costs.

4. Conclusion and Recommendations

While a transition to renewable energy has the potential to address Africa's energy deficit while greening energy systems, some have criticized the corporate-led approach that has been taken. The advocacy for community-owned mini-grids comes from two main fronts. On the first front, activists have questioned an energy transition led by corporate megaprojects which do not provide a basis for energy democracy, and express preference for "alternative, decentralized, equitably distributed projects of renewable energy that are owned and operated by communities themselves" (Peoples of the Global South, 2023).

On the second front, actors have argued that corporate mini-grid developers' market-led approach leaves out large swathes of communities that, in these developers' assessments, are not financially attractive. In addition, the lack of a strong sense of community ownership in such projects, when implemented, tends to undermine the performance and sustainability of the mini-grid system.

However, COMG projects face major barriers to implementation and scale on the African continent. In order for more rapid progress in advancing COMGs to occur in Africa, the following measures need to be taken:

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Production of Case Studies:
In-depth case studies need to be produced and publicized on COMGs from different countries to highlight their operational and governance dynamics, techno-economic conditions, socio-economic impacts, expansion planning, legal experiences, success factors, risk factors and other relevant information that could benefit decision makers in other countries.
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Resources
In order to aid similar efforts in establishing COMGs, there needs to be a repository of template articles of association for RECs, operation and maintenance service agreements between RECs and mini-grid operators, community solicitation letters for financing, community project implementation plans for soliciting project partners, etc. These would aid stakeholders and community-based organizations to initiate COMG projects without re-inventing the wheel.
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Regulatory Assessment:
A comparative analysis of the legal and regulatory provisions for COMGs needs to be undertaken for Africa. This would allow stakeholders to better understand how various regulatory provisions affect different aspects of REC operations and COMG survival. For example, regulatory frameworks may limit local initiatives in tariff innovation and may place excessively stringent licensing requirements for

[1] Using a USD/NGN exchange rate of 1,300.

RECs (Reiner Lemone Institute, 2024). Regulatory assessment should also include assessment of cases whereby grant-funded mini-grid projects are owned by private mini-grid developers which are required to transfer ownership to the community after a certain number of years. The conditions of the mini-grid at the point of ownership transfer may be an important thing to consider in such regulations.

-  **COMG Alliance Formation:**

  National associations of RECs and a continental alliance for RECs need to emerge in order to represent the interest of COMGs within countries and at the continental level. In addition to knowledge exchange and collective advocacy for policy and regulatory support, national REC associations can enable peer-to-peer REC support, by allowing better-off RECs to donate to struggling RECs (Toomer-McAlpine, 2023).

-  **Financing Facilities:**

  Dedicated financing facilities are required to fund feasibility studies on COMGs covering key African countries with high mini-grid potential, to fund the establishment of RECs and installation of COMGs, and to fund the introduction of improved technology and finance key investments by RECs. Donors may replicate the USAID Zambia Electric Cooperative Development Program and Malawi Clean Energy Cooperatives Program in funding REC establishment and COMG installation, and replicate the Rural Electrification Finance Corporation (REFC) to support existing RECs in introducing improved technology and financing key investments.

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