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Published version

GEBRESLASSIE, Mulualem Gebregiorgis (2024). The role of community energy and the challenges in a state-led model of service provision in Ethiopia. In: BROTO, Vanesa Castán, (ed.) Community Energy and Sustainable Energy Transitions Experiences from Ethiopia, Malawi and Mozambique. Palgrave Macmillan, 147-169.

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CHAPTER 7

The Role of Community Energy and the Challenges in a State-Led Model of Service Provision in Ethiopia

Mulualem G. Gebreslassie

Abstract Community energy can drive sustainable energy transitions in Africa and beyond. However, the implementation of community energy systems is lagging because of the lack of appropriate governance frameworks. This paper aims to explore the critical challenges related to the governance and development of community energy systems in the context of state-led energy service provisions in Ethiopia and to recommend interventions to facilitate their implementation. The paper presents a systematic review of official energy policies, proclamations, and regulations documents, national and international publications, and a consultation with local energy agencies. The findings indicate huge gaps in energy governance, including technical, financial, and operational challenges.

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V. Castán Broto (ed.), *Community Energy and Sustainable Energy Transitions*, https://doi.org/10.1007/978-3-031-57938-7_7

Policymakers, the research community, and operators can take action to overcome these challenges. Strong commitment from all levels of government, international development organisations, and the private sector can make a difference in Ethiopia's community energy development. Dividing responsibilities for planning and implementing community energy is one critical step towards practical community interventions that can accelerate energy access, provide more reliable and affordable energy services, and meet the growing energy demand.

Keywords Community energy · Governance · Development, · Challenges · Electrification plans

7.1 Introduction

The world is experiencing a transition to the development and exploitation of renewable energy resources. This transition is driven by economies' dependence on the fluctuating cost of fossil fuels and the impact of fossil fuel exploitation on the environment (Bouzarovski & Tirado Herrero 2017; Evans & Phelan, 2016). Transitions are also driven by communities' social and behavioural transformations (Murphy, 2008). Community energy systems change energy governance from local energy resources because they provide models for citizens to own and manage energy systems. Community energy development commonly involves the exploitation of decentralised local renewable energy resources, ensuring lower carbon emissions and reduced transmission losses (Kiamba et al., 2022).

Community energy is growing in many parts of the world and is not just advanced in the context of international development. For example, the European Union member states acknowledge the contribution of community energy developments for sustainable energy transitions and are advocating for its development with greater participation of citizens (Fernandez, 2021). Examples include community energy projects in Denmark, Germany, the United Kingdom, and the Netherlands driven by renewable energy resources (Klein & Coffey, 2016; Thellufsen & Lund, 2016), contributing to sustainable energy transitions in these countries. These developments are driven by relatively better policies, incentive packages, and awareness of the advantages of collective action (Romero-Rubio & Díaz, 2015; Walker et al., 2010). Mini-grids are also cheaper and quicker tools to electrify remote areas where lower densities make extending networks unfeasible (Zebra et al., 2021).

In Ethiopia, the transition to renewable energy is comparatively faster in some rural areas (Erdiwansyah et al., 2021). Countries with low electricity access rates also have unaffordable, non-reliable energy infrastructures. Renewable energy-based off-grid systems are believed to be cost-effective in supplying power to remote areas (Bhuiyan et al., 2011). Off-grid energy developments could play a key role in bridging this energy access gap, but renewable energy still needs to be developed in the countries that need it the most. One of the reasons that prevents the development of off-grid and renewable energy is the need for suitable governance systems.

Ethiopia has seen massive changes in the energy landscape in the last three decades (Gebreslassie et al., 2022). One of the fundamental changes is the transition from a state-led model of a dominant centralised system to the development of integrated centralised and off-grid energy systems. This is driven by a combination of technological and institutional changes (Vargas & Davis, 2016) and the interest of communities and citizens to join in developing local energy resources. These changes offer an opportunity to develop renewable and off-grid energy systems that can support the Ethiopian government's ambitions of universal electricity access.

Different governments in Ethiopia have been putting effort into developing and changing energy governance. Still, these efforts have yet to deliver a full-scale development of off-grid systems (further compromised by the ravishing impacts of civil war). This paper asks what governance and development challenges prevent the development of community energy systems in Ethiopia.

The paper analyses current energy governance arrangements in Ethiopia by analysing policies, proclamations, regulations, and the legal basis of existing community energy initiatives. In doing so, it provides a snapshot of a moment in time, 2023, in which the transition may radically transform the landscape of energy access. An analysis of challenges in other developed and developing economies provides a reference for comparative analysis for developing measures that could help the development of community energy.

7.2 Community Energy in the Ethiopian Context

Klein and Coffey (2016) consider community energy as any energy project that could serve anything from a single household to medium-sized systems and that could be managed locally through institutions such as cooperatives. Röder et al. (2017) and Rogers et al. (2008) define community energy as a decentralised system developed by high community involvement in the development process for their consumption. The IRENA Coalition for Action defined community energy as "*the economic and operational participation and ownership by citizens or members of a defined community in a renewable energy project*" (IRENA Coalition for Action, 2018). Community energy is also defined as collectively owned local systems (Wirth, 2014).

In the Ethiopian context, community energy is not defined in energy policy, regulations, or investment proclamations. However, official documents in Ethiopia distinguish between national grid and off-grid energy systems. In practical terms, community energy is categorised as part of the off-grid energy systems, including standalone and mini-grid systems. Standalone energy systems serve single customers such as households and health and education institutions, while mini-grid systems serve a group of households that form a community. The current mini-grid systems, serving tens and hundreds of households, include solar-based mini-grid systems, micro-hydropower systems, and hybrid systems, grouped under the generic name of off-grid energy systems, even when communities own them.

In line with the literature definitions and current regulations, in Ethiopia, community energy systems are defined as mini-grid systems owned, managed, operated, or used by a group of households that constitute a community.

7.3 Off-Grid Energy Governance in Ethiopia

7.3.1 Existing Policy

The current Ethiopian Energy Policy was issued in 1994, during the period of the Transitional Government of Ethiopia. This was the first attempt for a policy document to consider the wide-ranging concerns of all sectors. The 1994 energy policy was conceived in the shadows of the country's flagship economic development strategy, the Agricultural Development Led Industrialization (ADLI). The ADLI placed agriculture as the economy's driving force and envisaged the Ethiopian economy's structural transformation through export-led growth, which feeds into an interdependent agricultural and industrial development.

The policy objectives focused on critical areas for transforming the county's economic and social goals. These consisted of giving high priority to state-led centralised hydropower resource development, as hydrological resources are Ethiopia's most abundant and sustainable energy forms; implementing appropriate policy measures to achieve a gradual transition from traditional energy fuels to modern fuels; ensuring energy efficiency through setting issuing and publicising standards and codes; developing human resources and competent energy institutions; providing the private sector with necessary support and incentives to participate in the development of the energy resources, and incorporating environmental protection in energy production and use.

A key focus was the involvement of the private sector in the development of energy resources, which could have facilitated community energy developments. However, community energy systems have yet to materialise, though few initiatives have started recently. The government, private sectors, cooperatives and the public could be involved in community energy.

When the policy was developed, it was intended to be dynamic—allowing for revisions occasionally to incorporate new developments in the sector and the broader economy. However, the policy was never updated.

An attempt to draft a new document, the "Ethiopian National Energy Policy," occurred in 2013 (MoWIE, 2013). This draft indicated the need to update the existing policy to respond to structural and transformational changes at national and international levels. Some of the key policy directions that were not included in the existing policy but envisioned to be included in the new policy document consisted of:

- Developing and using all renewable energy resources, including biofuels;
- Addressing the development and use of new technologies such as electric rail, electric cars, hybrid cars, and flex-fuel vehicles;
- Providing great attention to energy efficiency at the supply and demand side where there are substantial power losses;
- Promoting the localisation of technologies to minimise dependence on imported technologies and to reduce energy development project costs;

- Aligning the policy with the Climate Resilient Green Economy (CRGE) strategy being implemented in the country;
- Promoting regional integration to get foreign currency and to play a role in regional geopolitical stability;
- Foreseeing the development of nuclear energy for power generation in the future;
- Implementing measures for a transition from fuel wood to modern energy to reduce deforestation;
- Considering cross-cutting issues such as energy regulatory frameworks, energy sector governance, building vital energy institutions and capacity, integrated energy planning, energy efficiency and conservation, energy pricing, research and development, environmental and social impact, gender, and regional and international cooperation.

These additions could be critical for transforming Ethiopia's energy landscape and promoting the massive development of community energy systems. The draft policy contains substantial and essential policy instruments to support the effective implementation of the policy objectives. Addressing cross-cutting issues may change the energy sector's ineffective governance and development to support the country's ambitious economic development plans. However, the civil war has delayed the policy development and implementation in every sector, including energy.

7.3.2 Energy Proclamations and Regulations

The Energy Regulation No. 447/2019 (Council of Ministers, 2019) outlines how to obtain generation, transmission, distribution, and sales licenses as well as licenses for importing and exporting electricity. The regulation provides clear rights and obligations for these licensees and customers. The duration of the licenses differs according to the type of power resources, with hydro and geothermal power generation up to 25 years; wind, solar, biomass, urban waste, thermal, and biogas power generation up to 20 years; transmission up to 30 years; and distribution and sales up to 20 years.

The Ethiopian Energy Authority (EEA) is the sole regulator for government and private energy developments. The authority has licensing and regulatory mandates for the generation, transmission, distribution, and sales within the power sector. The EEA defines and enforces licensing requirements, parties' rights and obligations, amendments, and certificates of competency. It also advises the Government on tariff proposals for both grid and off-grid energy systems (Council of Ministers, 2019).

Though the private sector is allowed to generate electricity, the Investment Proclamation No. 280/2002 (Council of Ministers, 2002) reserves the transmission and distribution of electricity as areas to be targeted through public investment or joint ventures with the government. Decisions on the electricity tariffs are still in the hands of the state-owned authority, which also holds exclusive rights for the transmission, distribution, and supply of electricity through the integrated national grid system. Consequently, the participation of the private sector has only been limited to Engineering, Procurement, and Construction (EPC) contracts. However, the private actors are given full responsibility to engage in off-grid generation, transmission, distribution, and sales of electricity, though the tariff is still decided by the state-owned authority in consultation with both the private sector and customers.

The regulation provides guidance for grid integration when the grid expansion overlaps with off-grid energy systems. Still, it lacks clarity on how to proceed if the off-grid system is unsuitable for grid integration.

The Energy Proclamation obliges transmission and distribution network owners (Ethiopian Electric Power (EEP) and Ethiopian Electric Utility (EEU)) to give access to other license holders after payment of a prescribed fee (Council of Ministers, 2013). This protection is important for Independent Power Producers (IPPs) because the electricity market is not fully unbundled, and the sole transmission network operator (EEP) is also active in power generation. The enactment of a third-party access rule can provide a guarantee for IPPs, ensuring that the transmission network operator will connect to all generation facilities without unduly favouring generation facilities owned and operated by the state-owned enterprise (EEP).

Several regulations support an enabling ecosystem to facilitate off-grid connections, including harmonised national quality standards (i.e. in agreement with the Global Lighting standards), an exemption of both duty and excise for importers of solar products under 15Wp, and lifting of testing (Pre-Verification of Conformity is sufficient). Microfinance institutions (MFIs) and private sector enterprises (PSEs) have been critical stakeholders in facilitating and supplying solar lighting, charging products, and solar home systems through a credit line at the Development Bank of Ethiopia (DBE). DBE is mandated to facilitate the flow of funding the World Bank provides for energy development. The following specific products are eligible under the credit line at the DBE: Solar lanterns, solar home systems, solar water pumps, mini-grid developments (solar, wind, biomass, diesel), waste-to-energy technologies, improved cook stoves, domestic biogas, and ethanol stoves. With this credit line, capacity-building activities are provided to the MFIs and PSEs in collaboration with the regional energy bureau to ensure proper implementation.

7.4 Off-Grid Energy Developments in Ethiopia

7.4.1 Evolving Electrification Plans

7.4.1.1 Universal Electrification Access Programme (UEAP)

The Universal Electrification Access Programme (UEAP) was launched by the government of Ethiopia in 2005 (MoWIE, 2019) with the objective of expanding the state-led model grid network to 60% of towns and villages and increasing the number of EEU customers from 800,000 to about 2.8 million from 2005 to 2015. Following this experience, the National Electrification Strategy (NES) was developed in 2016 with critical recommendations for new electrification plans. The NES was the starting point for the integrated National Electrification Programme 2.0 (NEP 2.0), whose implementation started in 2019. As part of the development of the NEP, a Multi-Tier Framework (MTF) household survey was conducted in 2017–2018 to map the electrification coverage. The access rate for the country overall was 44%, 33% provided through the grid, and 11% through off-grid connections, excluding the provision of lantern technologies. About 56% of the population lacked access to an adequate and reliable source of electricity (MoWIE, 2019). The survey also points out lower connectivity in rural areas as the main challenge for the poor access outlook of the country. The success and failures of the previous electrification plans and recent national and international transformations and dynamics of the energy sector have provided a foundation for the next electrification plan by diversifying its scope into the off-grid energy systems.

7.4.1.2 National Electrification Programme 2.0: Integrated Planning for Universal Access

The second national electrification programme (NEP 2.0) continues the previous plan, adding detailed planning, policies, and regulations to overcome the challenges encountered in the last electrification plan. NEP aims to achieve 100% electrification by 2025 while extending the grid to 96% grid connections by 2030. NEP 2.0 intends to facilitate government commitment to a technically sound geospatial least-cost rollout plan sustained by comprehensive institutional arrangements and a sustainable financing platform.

The Ministry of Water, Irrigation and Energy (MoWIE) has developed the NEP implementation framework identifying the responsibilities for both the grid and off-grid system developments. MoWIE leads the development of NEP's enabling policies with the support of development partners. The Ethiopian Energy Authority (EEA) is the sole accountable body for approving required technical standards and regulations, which means that the regional Ethiopian Energy Utility (EEU) branches are not able to draft their standards. This has multiple political and economic ramifications, including challenging the regional EEU branches' reliance on local manufacturing. At the same time, the power to issue licenses is partially delegated to regional EEU branches, but they are not always able to action it. EEU branches, cooperatives, and businesses within the private sector may develop off-grid energy systems. There is an assumption of full coordination among implementing actors at all levels, leveraging on their respective experiences and capacities, but this ideal model overlooks the difficulties inherent to the establishment and sustainability of institutions, their diverging interests, or the limited communication between them. Thus, there is a tension between the institutional order imagined in NEP 2.0 and the realities of action on the ground. Institutional rearrangement is, nevertheless, the essential means of change in NEP 2.0.

Expanding both on-grid and off-grid systems is core to the NEP 2.0 objectives, with 65% of the population connected through the state-led centralised system services and the rest through off-grid systems. Improving connectivity requires territorial strategies of densification (≤1 km), intensification (1–2.5 km), and extension (2.5–25 km) (MoWIE, 2019).

In addition, a considerable investment is required. NEP 2.0 total costs are estimated at US$6 billion, 42% of which should be directed towards off-grid systems. The national electrification programme intends to leverage public, private, and developmental partners (DPs) finances. For example, the Government is expected to contribute an estimated 40% (US$1 billion) of the cost of off-grid development, and the remaining 60% (US$1.5 billion) to be covered by DPs and private sector resources (MoWIE, 2019).

In November 2020, a civil war erupted in Ethiopia, which directly impacted the implementation of NEP 2.0. The war devastated the country's economic activity, leading to the suspension of programmes and projects due to security, shortage of resources, and lack of sustained commitment from the government. The impact of the war is continuing, and the future of NEP 2.0 is still compromised.

7.4.2 Progress of Off-Grid Energy Deployments

A government survey investigating the expansion of the off-grid energy systems recorded 2.2 million connections by the end of 2018 (MoWIE, 2019), involving public and private sectors and a heterogeneous set of funding mechanisms.

7.4.2.1 Solar Home Systems and Lanterns

Massive expansions of solar lighting were initiated in 2003 by establishing public funding mechanisms, such as the Rural Electrification Fund (REF). REF has supported the deployment of solar PVs for nearly 45,000 solar home systems, 1,049 schools, 1,576 health posts, and 696 rural electric service cooperatives. In addition, the private sector has been heavily involved in the deployment of solar lighting and solar lanterns. A World Bank and the DBE partnership enabled a two-phase credit facility, the Market Development Credit Line (MDCL), from 2012 to 2019 to finance standalone solar projects. The MDCL supported private actors to deploy nearly 1,124,838 solar lanterns and 72,370 solar home systems from 2012 until 2018 (MoWIE, 2019).

7.4.2.2 Community Energy Initiatives

Community energy development has been ongoing in Ethiopia for some time, supported by technical and financial support from NGOs, the private sector, government, and development partners. The Ethiopian Electric Utility owns 31 isolated diesel-based mini-grid systems with a capacity ranging from 100 kW to 520 kW. These mini-grid systems connect nearly 8,000 customers (MoWIE, 2019). The systems are operated by the EEU, and in the event of grid arrival, these systems are easily connected to the national grid. As part of their plan, they have already connected five diesel-based mini-grid systems to the grid and will do it for the remaining 31 mini-grids in the event of overlapping.

Under the new NEP 2.0, 13 mini-grid systems have been initiated since 2019, with a capacity ranging from 6 kW to 52 kW from hydro, solar, and wind resources. The development partners supporting these initiatives include GIZ/EnDev, Power Africa, and the United Kingdom's Department for International Development (DFID), with a combination of private and cooperative business and institutional models. The progress of these initiatives is not clear, considering the conflict that has ravishing the country since November 2020.

A few mini-grid energy systems owned by the community have also been developed based on the two electrification plans. Accordingly, 17 community energy systems have been developed in Ethiopia. Most of these energy systems are based on hydro, solar, and one hybrid with diesel energy resources, as indicated in Table 7.1. These initiatives are mainly based in three regions of Ethiopia, namely Tigray, Southern Nations Nationalities People's Region (SNNPR), and Oromia.

According to the regional Mining and Energy Agency, the solar-based mini-grid system found in Tigray, inaugurated in 2020, has a capacity of 20.4 kW serving nearly 200 households. This system has state-of-the-art technologies to control each household's energy consumption remotely. The communities use the system for lighting, television, and charging, but they still use traditional fuels for energy-intensive cooking and baking applications.

The Oromia region has seven community energy systems based on the information obtained from the regional energy agency. Six of these energy systems are hydro-based and one is a hybrid of solar and diesel-based

Table 7.1 Community energy initiatives in Ethiopia

Region	*Type of energy*	*Number of community energy systems*
Tigray	Solar mini-grid	1
SNNPR	All Hydro	9
Oromia	6-Hydro, one solar-diesel hybrid	7

Table 7.2 Micro hydropower community energy schemes in SNNPR

No	*Name of Zone*	*Name of a specific area*	*Status*
1	Sidama zone	Keramo	Functional
2	Sidama zone	Murago	Non-functional
3	Sidama zone	Allo	Functional
4	Sidama zone	Gobecho 1	Non-functional
5	Sidama zone	Gobecho 2	Non-functional
6	Sidama zone	Hagere Sodicha	Functional
7	Sidama zone	Erertie	Functional
8	Gedeo zone	Rago Senbete	Non-functional
9	Gedeo zone	Rasa Dango	Non-functional

energy resources. Similarly, nine community energy systems are derived from hydro in SNNPR, five of which are non-functional (55.6%), and the rest are functional, as shown in Table 7.2.

7.5 Community Energy Governance and Development Challenges

7.5.1 Challenges of the Energy Governance

Institutional flaws such as weak policies, regulatory frameworks, and lack of strong institutions hamper the deployment of decentralised community energy systems (Feron, 2016). The developed world, such as the European Union, is still lagging in the development of a conducive regulatory framework to make the community energy systems competitive with large utility companies, though there are encouraging developments in some of the member states (Fernandez, 2021). The regulation favours large companies affecting the small community energy initiatives to compete in the tendering process. This is a clear indication that developing a suitable regulatory framework is a challenge for most countries, as it requires a learning time on how to make the development competent and attractive for any stakeholders involved in the sector.

In Ethiopia, the lack of timely policy revisions has a huge impact on the development of community energy systems. There is a lack of clear policy instruments that support the effective implementation of the outlined policy objectives, a lack of clear legal and administration directions from the policy document on how to manage the community energy systems, and weak community involvement in the development and decision-making process such as planning, engineering work, operation, and management. Similar studies in two existing mini-grid systems in Namibia indicated that the lack of community involvement in the design phase combined with the lack of standards and suitable regulations pose huge challenges for the implementation of off-grid energy systems (Hoeck et al., 2022). A study by Lennon et al. (2019) proved that the lack of greater participation of the community in the development and decision-making process is a source of resistance and frustration affecting the effectiveness of community energy developments and their sustainability.

There is an overlapping of the grid and off-grid energy systems and thus the lack of clear grid arrival policy is a critical barrier for investments in community energy systems (IRENA, 2019). The current energy regulation in Ethiopia lacks clarity on how to proceed if community energy systems are not suitable for grid integration. This has a huge impact on the involvement of the private sector to develop community energy. Coupled with the lack of a precise definition of community energy in the current energy policy, the lack of procedural clarity poses barriers for the administration, operation, and maintenance of the systems.

Ethiopia lacks cost-reflective tariffs to attract the private sector and reduce the need for public support for community energy developments. Empirical studies show that grid-based electricity is cheaper compared to off-grid-based generation of electricity (Lukuyu et al., 2020 and Franz et al., 2014), which also tends to discourage the private sector from investing in community energy. Moreover, there are huge transaction costs, such as, for example, the need to obtain separate licenses for each of the energy supply chains (generation, transmission, distribution, and sales) regardless of size or location. In summary, the governance structure not only impacts the working of regulations but also the administrative arrangements required to make community energy possible.

7.5.2 Lack of Integrated Planning for Energy Development

Though NEP 2.0 stipulates the development and implementation of integrated planning, it is yet to be materialized. The development of community energy is being implemented without national integrated planning. When both off-grid and on-grid systems are available, prospective users tend to shift to the on-grid system: mini-grid systems are abandoned in the event of overlapping (Tenenbaum et al., 2018). At the moment, grid systems are perceived as being relatively better in terms of quality of services, price, and sustainability. Though energy regulations allow for the integration of community energy systems in the event of overlapping (provided that it is suitable for integration), there is no clear mechanism or enforcing laws to ensure that off-grid systems must conform to such settings. The integration of renewable energy systems into the grid is always challenging due to the changes created in the system inertia affecting the voltage and frequency control (Holjevac et al., 2021; Meliani et al., 2020), and thus careful design of the systems is required to maintain such option open.

7.5.3 Technical and Operational Challenges

Sustainability of service provision is also a challenge for community energy systems. The systems quickly malfunction after a service of a few years. Maintaining the system is often a challenge because many governance arrangements do not distinguish between developers, owners, and operators (Avelino et al., 2014). The lack of well-structured organizational, technical, and management systems, improper power demand assessment, limited knowledge about the development of projects, ownership ambiguities, and lack of maintenance capabilities further hinder the success of community energy projects (Madriz-Vargas et al., 2015).

Mini-grids are uniquely exposed to technical, operational, and financial risks (Keisang et al., 2021). Empirical evidence shows that, in practice, limited knowledge of the operation of the systems, high maintenance costs, and lack of spare parts are some of the main reasons why off-grid projects fail in Tigray, a regional state of Ethiopia (Gebreslassie, 2020). Lack of technical know-how and monitoring systems is compounded by a lack of technical standards to facilitate its use and maintenance, and limited possibilities to access education among the communities that are purported to receive the benefits of community energy (Hoeck et al., 2022). Financial returns are risky because community projects often serve areas with low electricity demand where people have limited ability to pay, and hence, profit margins are very low (Manetsgruber et al., 2015; USAID, 2018).

7.6 Enabling Governance that Supports Community Energy

The governance and development challenges described above constitute critical bottlenecks for community energy projects and require policy and regulatory interventions. Specific revisions could be made to the existing policy framework to remove some barriers that prevent community energy. First, there is a need to gain clarity in the regulation, for example, by establishing a clear definition of community energy that relates to the practice of community energy on the ground and that reflects the growing enthusiasm for cooperative models of energy management. Such definition needs to take into account the forms of social organisation in Ethiopia and the structures of social organization that they provide. In Ethiopia, this kind of sociological analysis still needs development but the possibility to develop a consensual definition of community energy among relevant stakeholders is within reach.

Second, licensing constitutes a major administrative barrier. As explained above, current licensing requirements increase the administrative burden for public authorities and it is time-consuming for community energy developers. This can be addressed through a capacity-based license requirement, something already piloted in other countries. For example, in Tanzania, generation licenses are not required for mini-grids with less than one MW capacity (IRENA, 2016). In Rwanda, the exemption is applied for projects with less than 50 kW capacity (Zebra et al., 2021). Those regulations also allow a single license for multiple sites. The current licensing regulation in Ethiopia requires separate licenses for generation, transmission, distribution, and sales while simultaneously does not specify if a developer can acquire full licensing for the whole energy supply chain. Single license for the whole supply chain could reduce the burden on the government and the licensee. Countries like Sierra Leone have already experienced using whole supply chain licenses (SEforALL, 2020).

Third, better integration assurances are required. The energy regulation in Ethiopia allows for the integration of community energy systems into the national grid in the event of overlapping if the system is suitable but it remains unspecified if integration is not possible. This requires addressing two challenges. First, there is a need to condition standards for off-grid development with a view to facilitate their future integration. Second, assurances must be provided for investors to ensure that projects will be retained or compensated in the event of overlapping (Antonanzas et al., 2021). For example, countries such as Nigeria have developed provisions to address the event of grid overlapping such as providing full compensation or enabling off-grid providers to continue getting revenue by allowing the operation of the off-grid system alongside the on-grid one (SEforALL, 2020).

Finally, addressing financial barriers is a key aspect of facilitating community energy. A Feed-in Tariff (FiT) is a means to encourage renewable development and can play a key role in supporting community energy projects that may face insurmountable barriers until the market is established, by providing a framework for negotiating power purchase agreements between producers, investors, and public authorities. FiTs encourage private sector involvement in community energy because they assure long-term purchase agreements for developers and reduce financial risks (Couture et al., 2010). For example, in Vietnam, the government has implemented FiTs since 2011 (Le et al., 2022). By the end of 2020, the country had reached 600 MW of installed wind power capacity and 17.6 GW of installed solar power capacity. A study of 30 OECD member countries in the period 1990–2011 demonstrated that FiT policies accelerated the deployment of solar PV (Dijkgraaf et al., 2018). Other countries like Algeria, Kenya, Mauritius, Rwanda, South Africa, Tanzania, Philippines, and Uganda have already implemented FiT policies subsequently seeing encouraging progress in the deployment of renewable energy-based off-grid energy systems (Lagac & Yap, 2021; Nganga et al., 2013). Based on different experiences of the existing FiT in different countries, payments are recommended to vary based on location, resource quality, project size, grid and off-grid systems, and type of technologies (Cox & Esterly, 2016).

Ethiopia is one of the African countries that has already developed FiT proposals but has not yet implemented them. NEP 2.0 proposes cost-reflective tariffs that are expected to be within a range from 0.30 US$/kWh to 1.20 US$/kWh based on international experiences, which is much higher than the current grid-based electricity tariff. This could attract the private sector to be involved in the development and support the government's ambition of universal electrification access, but the tariffs have yet to be approved and implemented. Energy and economic planning should go hand in hand to facilitate investors' confidence. For example, community energy can contribute to diversify the economy through productive applications, such as irrigation systems, which not only increases community confidence and sense of ownership but also facilitates investors' confidence (Chirambo, 2018).

Developing enabling regulations and providing resources are necessary but not sufficient preconditions for community energy developments (Ambole et al., 2021). Community energy also requires specific governance instruments addressing the need for participatory business models, innovative financing mechanisms, mechanisms for greater participation of communities, and incentive packages (e.g., tax incentives). Regulations must recognise community-based governance models, distinct from private-led or utility-led models prioritised in development plans (Pokhrel et al., 2013). Community energy depends on the establishment of participatory business models that provide communities with the opportunity to engage in the decision-making processes and invest in the development of community energy projects while simultaneously addressing the inequalities within the community that may hinder participatory energy governance (Lennon et al., 2019). This means that community energy requires distinct forms of support not currently contemplated in policies such as the NEP 2.0.

The success of community energy depends on achieving and maintaining a strong sense of ownership by the communities; to build community capability to manage, operate, and resolve conflicts; technology selection and sizing, to build strong capability and involvement of the community in the operation and maintenance; and to ensure energy service reliability (Madriz-Vargas et al., 2015). Greater community participation throughout the project development, capacitating the community, and developing workable governance with clear structures is essential for the sustainability of community energy projects (Gill-Wiehl et al., 2022; Katre et al., 2019). Solid and effective collaboration among stakeholders is also critical for mini-grid developments (Korkovelos et al., 2020). This requires coupling engineering and economic analysis with sociological analysis on the relationship between the energy transition and the social relations that make it possible.

7.7 Conclusion

In summary, there are important challenges that prevent community energy in Ethiopia. Some of these challenges may be administrative or technological, and can be addressed through relatively feasible regulatory reforms. However, many challenges relate to misunderstandings regarding the systems of provision of electricity and political factors that structure energy governance in the country. Policymaking in the energy sector has been characterised by a lack of timely policy revisions and unclear policy instruments, translating, for example, into ambiguous requirements for off-grid integration or increased investment risks. The institutional landscape is also not conducive to community energy development, sometimes directing my misunderstandings about the possibilities of community involvement or the prioritization of interests that favour large companies.

For the government's ambitious universal electrification programme to succeed, it is essential to actively engage in regulatory reform to implement internationally proven successful tools in developing and managing community energy systems. Facilitating licensing for small projects, developing a grid arrival policy, and implementing FiT proposals are feasible steps towards an enabling environment for community energy. Further, explicit recognition of community energy will facilitate planning that encourages its development.

The real challenge however lies in the means to devise mechanisms to facilitate greater participation of the community throughout the community energy development from inception to operation of the systems and facilitate the generations of business models that enable communities to manage community energy systems. Such intent raises complex demands including frameworks for conflict resolution, developing the community's operational capacity, and facilitating multi-stakeholder partnerships to support investment and facilitate project sustainability. Community energy calls for rethinking current energy systems in relation to their social function. Diversifying the knowledge base (Chapter 8) is essential. On the one hand, diversifying the knowledge base means that engineering knowledge should be complemented with social research skills to understand the heterogeneous systems of governance that will facilitate a transition to sustainable energy. On the other hand, diversifying the knowledge base also requires recognising the expertise held within communities and expanding it to facilitate their participation in the implementation and operationalisation of community energy. Community energy calls for nothing less than the democratisation of energy knowledge.

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