# Off grid renewable energy systems

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With more than a billion people lacking access to electricity, local power-generation solutions are essential to provide sustainable energy to all - particularly those consumers expected to remain isolated from national or regional grids for the foreseeable future. Renewable power generation provides low-cost solutions to bring reliable electricity to rural households or island communities off the main grid. But while off-grid renewable energy systems are expanding rapidly on the ground, data that systematically tracks this progress remains limited.

This working paper from the International Renewable Energy Agency (IRENA) provides an overview of current data sources for off-grid renewable energy systems. It suggests methodological improvements to help categorise such systems, evaluate and aggregate data and measure progress in deployment. The working paper comes as IRENA’s contribution to the Global Tracking Framework of the Sustainable Energy for All (SE4ALL) initiative.

Off-grid and decentralized energy systems have emerged as an alternative to facilitate energy access and resilience in a flexible, adaptable way, particularly for communities that do not have reliable access to centralized energy networks both in rural and urban areas. Much research to date on community energy systems has focused on their deployment in Europe and North America. This paper advances these debates by looking at how community energy systems can support energy transitions in Africa. Specifically, it asks: what role can community energy systems play in the energy transition in East and Southern Africa?

Energy transitions in Ethiopia and Mozambique, and many other countries with significant gaps in access to centralized energy systems, require putting inclusivity at the forefront to ensure that energy policies and infrastructure support the well-being of society as a whole. As long as investments in off-grid energy continue to depend on international organizations" goodwill or development aid programs outside the ambit of national energy plans, energy access gaps will remain unaddressed, and there will not be a genuine and just transition to sustainable energy.

The team of co-authors includes some of the key experts on energy transitions in both countries. The methodology focused on comparing the experiences of both countries through a series of collective dialogues held occasionally since 2017 and every month between April 2019 and Sept. 2021. Independent country investigations, including a review of available grey literature, current legislation and regulations, and informal interviews with policymakers, were conducted to produce two reports on each country"s energy policy landscape. The team of co-authors discussed these reports to elucidate the different comparative factors that shape energy transitions in Ethiopia and Mozambique.

Ethiopia and Mozambique are large countries in their respective regions of Africa, each facing enormous energy access challenges. Table 1 summarises the latest SDG7 indicators for each country.

Mozambique and Ethiopia also face violent socio-political conflicts. In Mozambique, an armed conflict has sprouted in the northern area of Cabo Delgado since 2017, led by a local Islamist group. The conflict intensified in early 2021 [41]. In Ethiopia, the recent war in the Tigray region and other parts of the country have affected the country"s economic and social development. These armed conflicts are likely to impact the lives of millions of people and the energy futures of both countries.

This section explores the dynamics of change in Ethiopia and Mozambique"s energy landscapes. Specifically, we look at how changing governance (i.e., regulatory, political and legislative context) in both countries shapes energy resource flows and communities" access to energy. Attending to these political and material processes of change enables us to understand how energy landscapes are reconfigured through political choices and everyday energy access and use practices. This conditions the possibilities for the inclusion of communities in renewable energy transitions.

At the opening of the solar power plant of Cuamba in northern Mozambique in 2021, Max Elias Tonela, the Minister of Mineral Resources and Energy (MIREME), declared: "We intend to invest in a mixed model of public-private partnerships, to promote the development of infrastructure in a more efficient, faster way and without recourse to public financing or debts to the State." This language, now common among politicians in Mozambique, reveals a generalized strategy of diversification of forms of energy governance and a desire to facilitate the entry of private producers into energy governance. This approach, however, clashes against the realities of an institutional history dominated by state actors.

The leading state actor in energy governance in Mozambique is MIREME, responsible for energy policy and planning, monitoring sector performance, and governance. In May 2017, the Parliament approved the creation of the Energy Regulatory Authority (Autoridade Reguladora de Energia, ARENE) to separate regulatory and policy functions in MIREME. The new regulatory body has the mandate to regulate electricity tariffs, promote and monitor competition, and monitor and enforce the terms and conditions of the licenses or concessions in the power sector. MIREME oversees the operation of the two central institutions governing the provision of electricity, Electricidade de Mo?ambique (EDM) and the Fundo de Energia (FUNAE). At the same time, ARENE upholds quality standards (see Fig. 1).

Institutions regulating the power sector in Mozambique (own elaboration, adapting a design from World Bank, 2017)

Key institutions involved in the energy sector in Ethiopia, with particular attention to the electricity sector (own elaboration)

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