# Microgrids in Emerging Markets—Private Sector Perspectives

## Global Context

Approximately 860 million people globally do not have access to electricity (IEA 2019). Of those, more than 87% live in remote or rural areas ("SDG Indicators Goal 7" 2020). Microgrids can offer a viable solution to energy access and related challenges in areas not connected to the main electricity grid, where it is more costly to extend the traditional grid. In addition, microgrids offer an opportunity to utilize local energy resources in the form of renewable energy. According to the International Energy Agency (IEA), microgrids will play a large role if the world is to achieve the energy access and renewable energy goals set out by the Paris Agreement[1] as well as the United Nations Sustainable Development Goals[2]. Microgrids may be better adapted to provide electricity in rural areas, where grid access is inconsistent, and access issues are concentrated (IEA 2018). In 2016, microgrids provided electricity access to approximately 8.6 million people (REN21 2019).

### Microgrid Definition

Microgrids are defined in different ways by different entities. The Quality Assurance Framework[3] (QAF) defines a minigrid as:

"an aggregation of loads and one or more energy sources operating as a single system providing electric power and possibly heat isolated from a main power grid. A modern mini-grid may include renewable and fossil fuel-based generation, energy storage, and load control. Mini-grids are scalable so that additional generation capacity may be added to meet growing loads without compromising the stable operation of the existing mini-grid system."

For the purposes of this paper, the term microgrid includes both minigrids and off-grid systems (e.g., solar home systems).

There is a gap between microgrid investment and the anticipated need for microgrids to enable electricity access. To achieve universal electricity access, $51 billion a year in investment is needed from now until 2030 (Coldrey et al. 2019). In that same timeframe, the IEA projects that renewable energy sources will power over 60% of new electricity access and microgrid solutions will comprise 40% of that new access (IEA 2017). Total financing for electrification in 2017 was $36 billion in high-impact countries (20 developing countries that are home to nearly 80% the world's population of people without access to modern energy), with investment in microgrid solutions contributing to a small portion of this total financing (Coldrey et al. 2019). In 2017, $430 million was invested in the microgrid sector (Coldrey et al. 2019). Microgrids are sometimes the most cost-effective solution for electricity access in rural and remote areas (Energy Sector Management Assistance Program 2019). Investment is currently insufficient to meet projected global electrification needs; there is space to leverage private sector investment in microgrids (REN21 2019).

### Methodology

Information presented in this paper is based on qualitative and quantitative data collection and analysis methods to provide an empirical understanding of barriers to private sector clean energy investment in emerging markets. Through literature review, a survey, and a series of webinar dialogues, the U.S. Agency for International Development (USAID) and the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) solicited input from private sector actors, including developers, project financiers, manufacturers, and technical assistance service providers, on the challenges they face to market entry in developing and emerging markets and their suggestions for improving market competitiveness.

## Results and Key Barriers

Private sector investment plays a critical role in scaling up the deployment of clean energy technology, including renewable energy microgrids in emerging markets. While the potential in renewable energy markets is high in emerging markets, the private sector faces several uncertainties, including a lack of supportive renewable

[1]Additional information on the Paris Climate Agreement is available here: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement
[2]Additional information about SDGs is available here: https://sustainabledevelopment.un.org/?menu=1300
[3]Additional information on the Quality Assurance Framework for Mini-Grids available here: https://www.nrel.gov/docs/fy17osti/67374.pdf

energy policies and incentives, political instability, off-taker ability to pay, inability to access finance, lack of technical expertise, and infrastructure obstacles. Figure 1 indicates how microgrid private sector representatives ranked the top barriers to market entry in emerging markets. Of the private sector respondents surveyed, political instability, access to finance, lack of renewable energy policies and incentives, and customer ability to pay were the top four barriers to market entry in the microgrid space in emerging markets. A webinar focused on renewable energy microgrids also supported these findings. Though political instability ranked high as a barrier to market entry, it is beyond the scope of this paper and will not be discussed.

This section presents an assessment of the three key barriers and risks faced by the private sector in deploying microgrids in emerging renewable energy markets. In addition to detailing private sector needs and constraints, this discussion offers insights into the role technical development work can play in enabling clean energy investment in developing countries.

**Access to Finance:**
Microgrid deployment is a priority for many national governments and is often the least-cost option to provide energy access. Despite this, it can be difficult for developers to get microgrid projects financed (IEA 2017). This makes it challenging to scale up microgrids for widespread deployment. Microgrid investments are considered high risk due to the lack of long-term track records, limited examples of effective business models, challenges in evaluating community energy demand and growing it over time, and the unique characteristics of each community and project. Traditional investors do not typically have experience valuing microgrid projects. In addition, many microgrids are expensive because they are unique, custom installations and can have high upfront costs, which makes


**Figure 1:** Top barriers to microgrid market entry in emerging markets based on feedback from private sector representatives

obtaining financing difficult. The lack of standardization can make it harder for microgrids to access economies of scale that would bring costs down.

**Renewable Energy Policy Incentives and Regulations:**
Private sector investment in microgrids can be catalyzed and supported with a stable, transparent and favorable

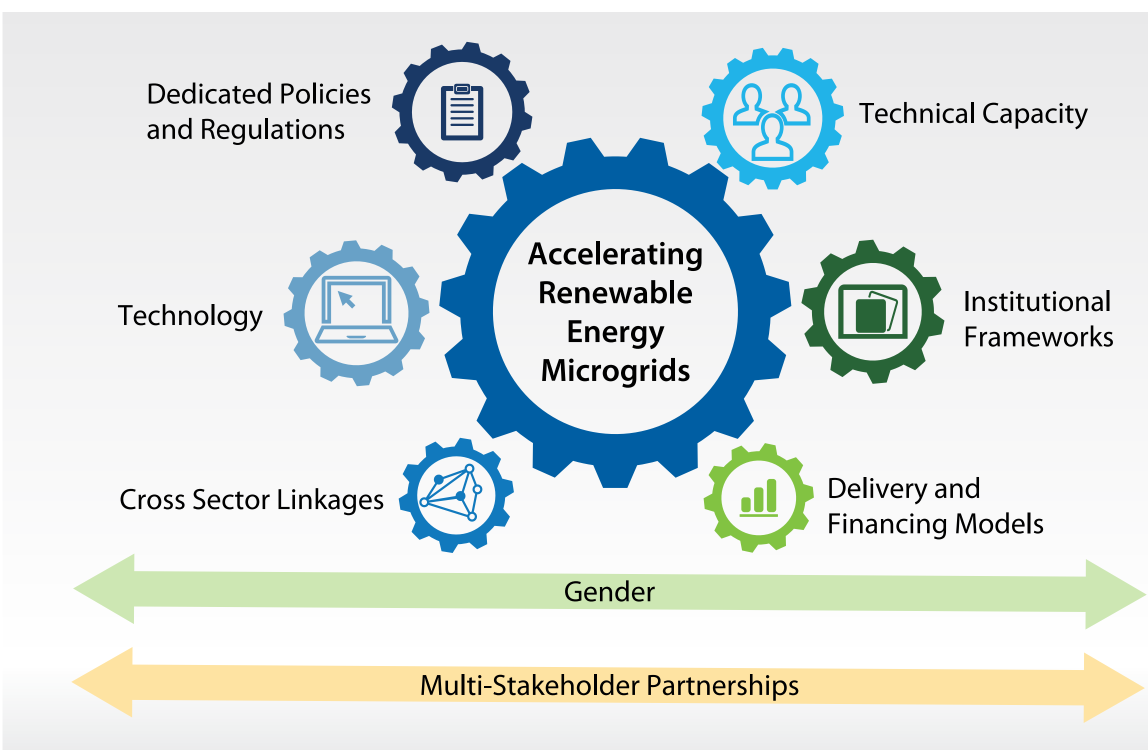


**Figure 2:** Elements of an enabling environment for renewable energy microgrids.
*Adapted from IRENA 2018*

regulatory environment (IRENA 2014). The policies and regulatory frameworks currently in place for the traditional power sector are often not suitable for micro-grids, as microgrids differ greatly in size, customers, and cost structures, and level of service (availability and power quality) (Nagpal and Parajuli 2018). Detailed microgrid regulations that address issues such as size, the role of utilities, and the role of regulators can support microgrid development by providing certainty through a clear legal framework.

Private sector representatives noted that they were hesitant to work in countries where they would be working in essentially a "black market," where there were no protections against governments or utilities claiming sites later in the development process. Microgrid developers stressed the need to be able to ensure long-term capital investments would not be taken by the government. Clarity on what happens if the traditional grid reaches a microgrid will provide more assurance to the private sector. A stable regulatory environment can engender investor and developer confidence and support more microgrid development.

**Customer Ability to Pay**

Off-taker (energy consumer) risk can make it challenging for the private sector to obtain financing. To add to this, the cost of energy for a village-level microgrid can often be higher than the cost of centralized grid connected electricity (BNEF 2018). This impacts consumer demand and ability to pay. The resulting demand uncertainty may make it difficult for private sector developers to approach lenders. Government- (or donor-) backed guarantees can help improve lender confidence and support microgrid development. In addition, developers could pursue anchor tenants, such as telecom towers or solar pumps, or invest in productive-use expansion for improved demand certainty.

***Manoj Sinha, Co-Founder and CEO, Husk Power Systems***

"A properly defined regulatory framework is absolutely needed for investors to get comfortable deploying their capital."

## Possible Solutions

Creating an enabling environment for investment in microgrid development requires the establishment of stable and transparent policy and regulatory frameworks, strengthening technical capabilities within the government, the finance community, and local populations, and improved access to early stage finance.

The following policy and technical support solutions can help remove barriers to private sector investment in microgrids in emerging markets. They can be implemented by national government stakeholders themselves or supported by members of the donor community:

**Financing**

- Expand public and private financing availability, including leveraging public-sector funding to catalyze increased private capital flows into the sector and creating financial mechanisms to support the early stages of microgrid development, such as concessional loans or loan guarantees
- Develop cost recovery and tariff regulations so developers and investors can recoup costs with more certainty
- Develop regional development or deployment models to expand the economies of scale through leveraging multiple projects. Collect and share information that allows new ideas to build on documented successes and failures of other projects.

**Enabling Policies and Effective Regulation**

- Strengthen enabling policy and regulatory framework and design dedicated microgrid policies and regulations that support a streamlined development and permitting process
- Establish transparent standards that manage risks posed by the potential arrival of a main grid
- Promote the use of super-efficient appliances, equipment, and other end-use technologies to assist with reducing service costs for customers
- Support research and development and demonstration projects to enable experimentation with technologies and business models. Encourage local involvement and provide ongoing training and capacity building.

**Knowledge Sharing**

- Implement quality assurance standards for microgrids, such as the Quality Assurance Framework for Mini-Grids. The QAF defines standard sets of tiers of end-user service and links these tiers to technical parameters (power quality, power availability, and power reliability). The QAF also provides a framework for accountability and performance reporting.
- Strengthen technical understanding for policymakers, utilities, regulators, laborers, and financial institutions to hasten and improve project development processes. This can be supported by the USAID Mini-Grid Support Toolkit
- Promote peer-learning and sharing of best practices, modeling and design support, study tours and utility exchanges to learn from other microgrids and decision makers.

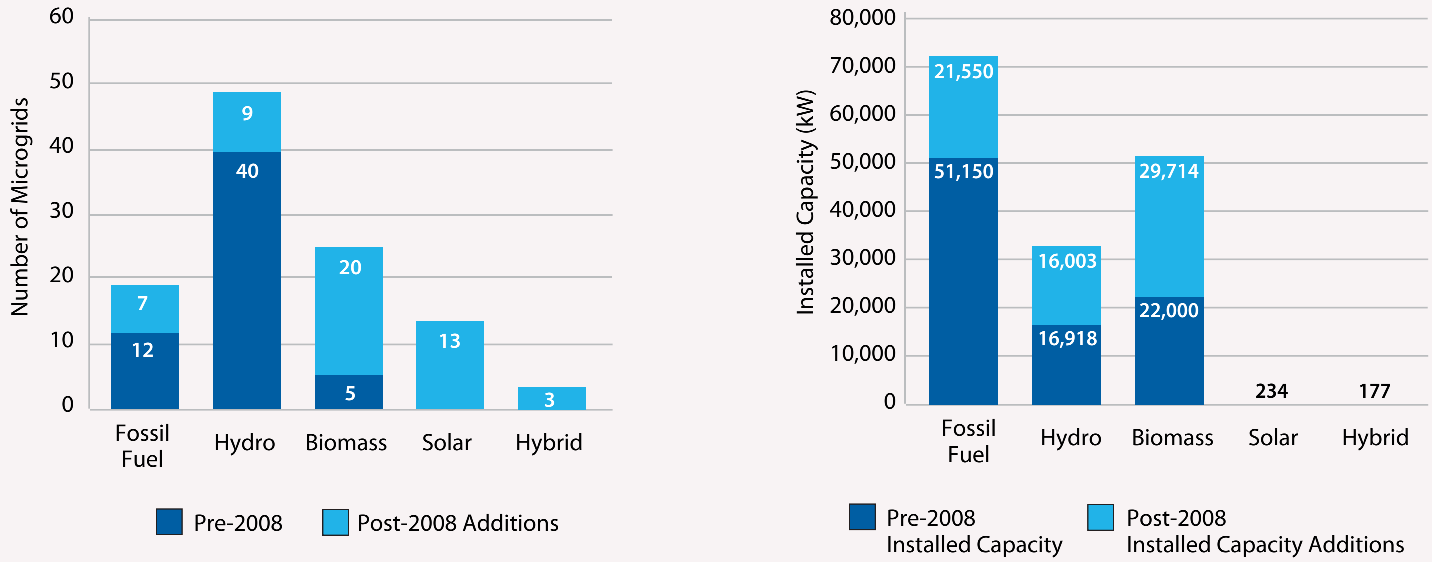


**Figure 3:** Microgrids in Tanzania before and after the 2008 SPP Framework. *Adapted from Odarno et al. 2017.*

## United Republic of Tanzania: Small Power Producers Framework

The United Republic of Tanzania introduced the Small Power Producers (SPP) Framework in 2008, a regulatory framework for microgrids. Tanzania defines an SPP as a generating facility producing less than 10 MW ("Tanzania Small Power Producers Framework" 2019). The framework streamlines the licensing process; microgrids under 100 kW are exempted from the licensing process, and microgrid developers can hold a single license for multiple sites.

In addition, the SPP Framework provides certainty for the future by incorporating certain provisions, such as: (1) the 2014 SPP iteration allows microgrids to interconnect as an SPP or as a small power distributor upon the arrival of the main grid; and (2) the 2017 SPP iteration provides compensation to microgrid operators if they chose to not interconnect upon the arrival of the main grid (Nagpal and Parajuli 2018).

Tanzania has also set a fixed tariff for SPPs as per the Second Generation Framework for Small Power Projects, released in 2016, where SPPs receive a fixed tariff for the entirety of a power purchase agreement. Previously, rates changed annually ("Tanzania Small Power Producers Framework" n.d.). The fixed feed-in tariffs differentiate between the technologies powering the microgrid to account for different technology costs. Finally, the feed-in tariff price is pegged to the U.S. dollar, which allows microgrid developers to raise debt financing in dollars (Odarno et al. 2017).

As a result, the number of microgrids deployed in the country doubled between 2008, when the first SPP Framework was introduced, and 2017, with approximately an additional 67MW of new capacity installed during that time (Odarno et al. 2017). Figure 3 illustrates this growth.

Microgrids are also supported in sub-Sarahan Africa, including Tanzania, by Power Africa.[4] Power Africa provides funding that can help bridge the financing gap and also aids in risk management. The initiative also supports commercial companies in Tanzania like Devergy, a company that offers microgrid connections for rural communities (Power Africa 2018).

***Alexia Kelly, Sustainability Solutions, Engie Impact***

"Challenges associated with increasing investment in the microgrid market center on the fact that we're asking folks to take venture-level risk for infrastructure-level returns. The fundamental barriers we face in the microgrid sector include the early stage of the market, high regulatory uncertainty, difficult operating environments, relatively higher capital expenditure costs than fossil fuel incumbents, high install costs, and the need to invest heavily upfront for slow payback over an 8-15-year period, combined with the lack of certainty about steady and reliable customers with a strong ability to pay. Even one of these elements will scare away investors, never mind all of them taken at once. However, as capital costs continue to fall and the market matures, we expect the investment outlook to improve dramatically."

[4] Additional information on the Paris Climate Agreement is available here: https://www.usaid.gov/powerafrica

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