

Section 11

Case study – Uganda

Uganda currently has 34 mini-grids known to be installed. For developers, the biggest obstacles to further build-out are cumbersome government approval processes and regulated tariffs that make it difficult to recover project costs without subsidies. In 2017, the government identified sites using a least-cost electrification approach and introduced a bundled tender scheme to scale mini-grids in the country.

11.1 Overview

Just one in four Ugandans had access to electricity at the end of 2018. In rural areas, the numbers are bleaker still, with just one in 10 having access. While the government has stated its goal of achieving 26 percent rural electrification by 2022, that appears quite unlikely unless the decentralized energy technology market scales rapidly.

Today, Uganda has 34 known mini-grids commissioned, of which have a known operating year (Figure 97, Figure 98). The combined total installed ca-

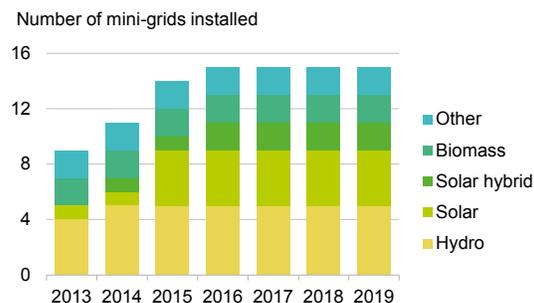
capacity of the 34 projects is 56.8MW, representing 6 percent of the country's total capacity of 940MW.

Uganda's Rural Electrification Agency (REA) has undertaken a master planning exercise and identified opportunities to build mini-grids providing power to 62,000 households across 10 service territories by 2029 (UOMA, 2019). Potential sites were selected based on the criteria of having more than 50 households clustered in one particular area and having expected grid extension costs not exceed USD 2,000 per customer.

Despite the opportunity for further mini-grid development in Uganda, the market has been slow to take off, largely due to a fragmented regulatory environment. Among other issues, the country's current policies fail to explicitly set an energy access target to be met through mini-grids. In addition, the current licensing process lacks transparency, and rules around main grid arrival at installed mini-grid sites are unclear. In 2017, as part of the efforts to achieve the 2022 target, the Ugandan government, with support from the German Agency for International De-

Figure 97

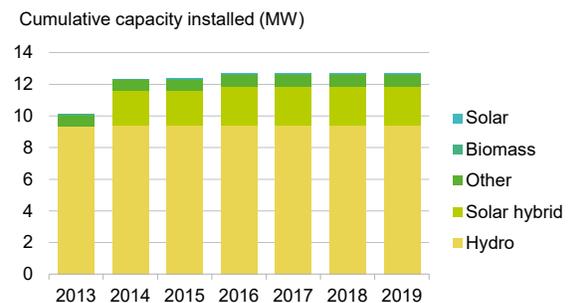
Uganda's installed mini-grids, by projects



Source: BloombergNEF, Carbon Trust, CLUB-ER, surveyed developers. **Note:** Operating projects without a specified commissioning year are not included.

Figure 98

Uganda's installed mini-grids, by capacity



velopment (GIZ), launched a bundled tender mechanism with a goal of installing 40 mini-grids. The target date of project completion is December 2020.

11.2 Distributed power market structure

In 2001, the Uganda Electricity Board (UEB) was split into three parastatal entities: the Uganda Electricity Generation Company Limited (UEGCL), the Uganda Electricity Transmission Company Limited (UETCL) and the Uganda Electricity Distribution Company Limited (UEDCL) (Figure 99).

In 2003, UEGCL subleased its generation operations to a subsidiary of the South African state-owned utility Eskom. Responsible for operating and maintaining generation assets, Eskom is now the largest generation entity in Uganda.

Similarly, in 2005, UEDCL awarded a 20-year concession for distribution and retail to the Ugandan

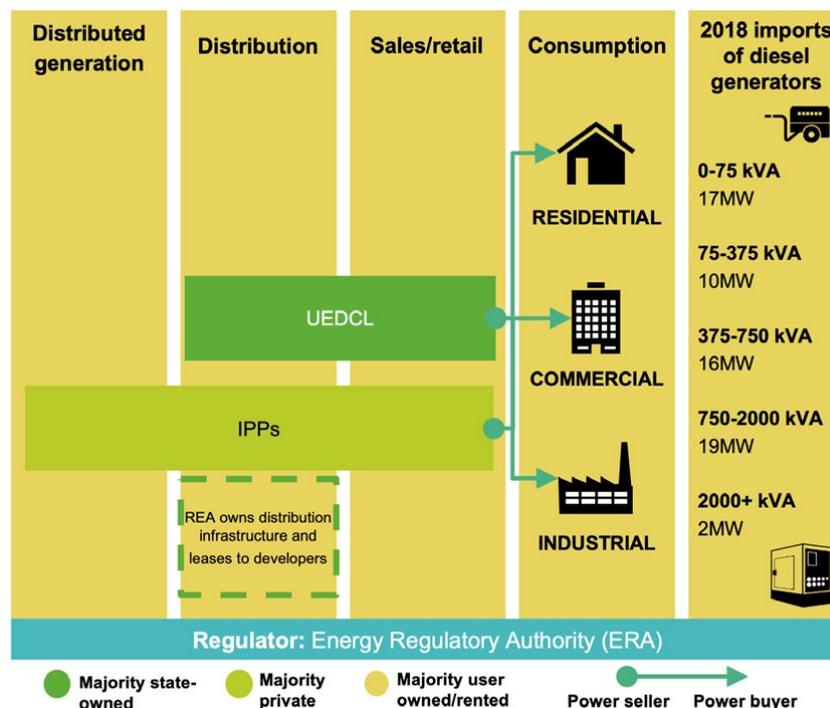
energy distributor Umeme. Umeme was formed in 2004, and currently distributes 98 percent of all grid electricity consumed. Outside Umeme’s control area, various private distribution companies operate government-owned assets in seven service territories. UEDCL operates assets in the six remaining territories.

In Uganda, utilities, private companies, communities, or some combination of the three operate mini-grids. Generally, a private-sector player develops and operates the mini-grid, owning the generating asset and bearing the cost of construction. Today, seven independent power producers (IPPs) operate mini-grids in the country, including the firms Equatorial Power and Pamoja Energy. UEDCL also runs a small number of mini-grids (Anton Eberhard, 2016).

The Electricity Regulatory Authority (ERA) is the primary regulator of Uganda’s mini-grids. It administers licence approval, sets tariffs and maintains technical standards. The REA has no direct regulatory authority over mini-grids, but ERA consults

Figure 99

Uganda’s distributed power market structure



Source: BloombergNEF.

with REA for reviews and approvals. REA finances and owns the distribution infrastructure of mini-grids through the Rural Electrification Fund (REF), leasing assets to private mini-grid developers (Nygaard, 2018).

11.3 Current market status

Uganda’s renewable-hybrid mini-grid market is less mature than those in neighboring Kenya and Tanzania both in terms of the number of projects completed and the number of players operating. Uganda has 34 installed mini-grids that serve approximately 20,000 households. That’s less than 1 percent of the 7.3 million households in the country.

Solar and hydro make up the vast majority of projects in Uganda – 40 percent and 34 percent respectively (Figure 100). Almost 70 percent of the projects are privately-owned while over a quarter are owned, operated and managed by local communities (Figure 101).

A number of private developers are currently operating in Uganda’s mini-grid market or plan to enter soon (Figure 102). In interviews with the authors, developers said Uganda lacked adequate regulations and experienced local labour. They also highlighted the complex processes for land rights acquisition. Despite this, however, they are examining opportunities in the country’s most isolated areas such as the islands in Lake Victoria. Already, Bugala

Island has a 1.6MW solar hybrid mini-grid to serve its 30,000 inhabitants. Kalangala Infrastructure Services (KIS) operates the project under a public-private partnership with the Government of Uganda, the government-funded InfraCo Africa, and the private infrastructure developer EleQtra.

Financial support for projects operating in Uganda today has come almost entirely from development financing institutions (DFIs) and donor agencies. Most of the funding has been grant-based with a small portion coming via equity investment. Developers have yet to access loans from commercial lenders as their business models fail to meet the 7–10-year tenors banks require (Sustainable Energy for All, 2019).

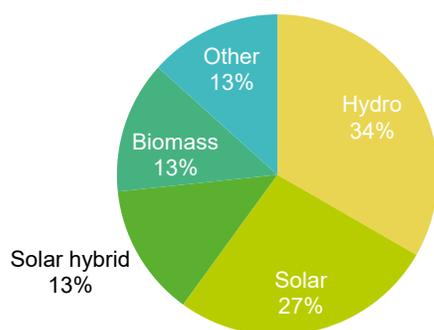
The mini-grid tender launched by REA in 2017 has the potential to be a game-changer for the local market for solar hybrid projects. Under the scheme, bidders were shortlisted at the end of 2018. Since, Winch Energy and WeLight Africa have been selected to install their projects by December 2020.

11.4 Policy and regulations

Historically, the Ugandan government has prioritized grid extension over distributed energy in its long-term electrification policies. In 2013, the government released its Rural Electrification Strategy and Plan (RESP), which called for 26 percent rural electrification by 2022. Specifically, REA said it

Figure 100

Uganda’s installed mini-grids, by technology



Source: BloombergNEF, GIZ, Carbon Trust, CLUB-ER, surveyed developers.

Figure 101

Uganda’s installed mini-grids, by ownership

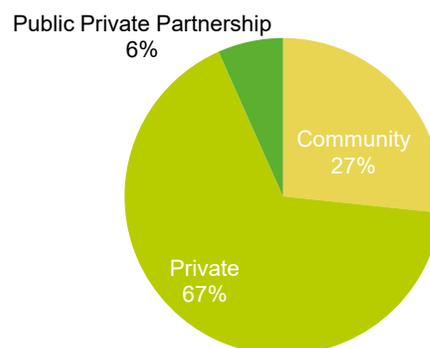


Figure 102

Mini-grid developer landscape in Uganda



Source: BloombergNEF, company logos.

would extend the grid to connect an additional 1.28 million households. By contrast, 8,500 households would receive service from mini-grids with 130,000 solar home systems also to be installed to meet the target. Under RESP, on-grid electrification efforts represented 91 percent of the projected total cost of USD 952 million. Only 6 percent of the total was allocated for off-grid energy technologies.

More recently, however, the government’s thinking on distributed energy has evolved to the point where it recognizes that over-emphasizing grid infrastructure will leave the majority of the rural population without electricity access. Released in 2018, the Electricity Connections Policy sought to address the low connection rates, which earlier policies were unable to improve. It recognized the high connection charges, high wiring costs for households and a lack of incentives to achieve electricity access under a plan aimed primarily at grid expansion. The new policy also aligned targets in earlier policies, aiming to achieve 30 percent national electrification by 2020, 60 percent by 2027 and 80 percent by 2040 (Ministry of Energy and Mineral Development, 2018)¹⁶ (Figure 103 and Figure 104).

¹⁶ A 30 percent national electrification rate by 2020 was set out in the Second National Development Plan, and an 80 percent target by 2040 was set in Uganda Vision 2040.

The authors expect that the 2020 national electricity access target of 30 percent will be achieved thanks largely to rapid distribution of off-grid solar kits. However, reaching the 2022 target is unlikely without further scaling of decentralized energy technologies given that just 10 percent of the rural population in Uganda had access to electricity at the end of 2018.

Mini-grid regulations

Inadequate regulations represent the biggest bottleneck to mini-grid development in Uganda by fundamentally undermining investor confidence. Appearing to recognize this, the government has been working in consultation with the German government on developing a more enabling environment for mini-grids, for example the previously mentioned tender scheme.

Licensing

Licensing is one of the biggest hurdles to mini-grid development in Uganda. According to the Electricity Order (ERA, 2007), off-grid mini-grids smaller than 2MW are exempt from any licensing requirements. In reality, however, a certificate of exemption for each project from the ERA is still required. Securing such an exemption can be a lengthy process taking a year or longer.

Figure 103

Uganda’s national electrification rate and associated targets

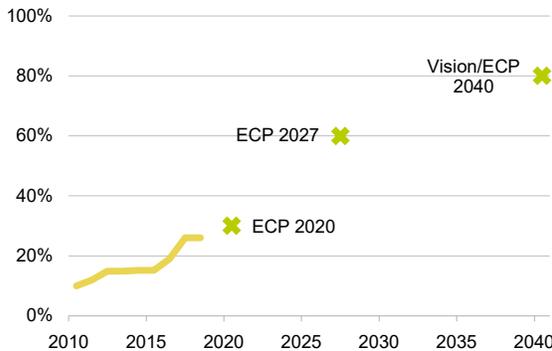
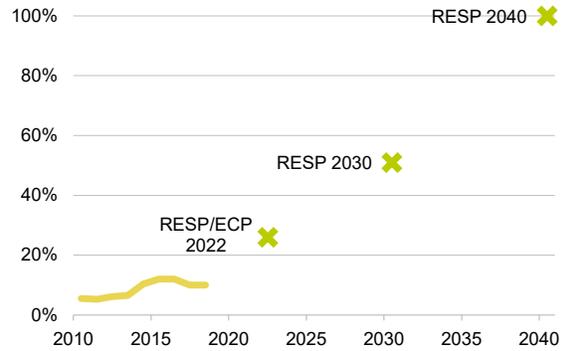


Figure 104

Uganda’s rural electrification rate and associated targets



Source: BloombergNEF, Climatescope 2019, Rural Electrification Agency, National Planning Authority.

Developers must complete feasibility studies and acquire approvals from the National Environmental Management Authority (NEMA) for any site. They must submit environmental reports to NEMA for review with ERA having no role in that part of the

process. After submitting these reports, developers can apply for a licence exemption that costs USD 3,500. Only those granted exemptions then have exclusive rights to generate, distribute and sell electricity in the given area (USAID, 2017).

Mini-grid on Kitobo Island, Lake Victoria

A project commissioned in Uganda in 2016 highlights the inherent challenges of operating a mini-grid when tariff rates are relatively regulated and power demand is both limited and uncertain.

Italian developer Absolute Energy operates a mini-grid on Kitobo Island consisting of 230kW PV, 520kWh vanadium redox flow batteries and a 70kVA diesel generator to serve its 2,000 inhabitants. The island is one and a half to three hours by boat from the nearest largest city of Entebbe. ERA granted Absolute Energy a framework concession for over 23 islands and a licence exemption.

Under the current regulatory tariff environment in Uganda, mini-grid developers cannot set cost-reflective tariffs. This is primarily because the regulator seeks to shield consumers from high electricity bills. On Kitobo, Absolute Ener-

gy has charged UGX 903 (USD 0.2675) per kWh, a rate determined by the regulator after negotiation. A 50 percent capex subsidy equivalent to USD 0.2675/kWh was granted. In contrast, the authors estimated the levelized cost of electricity (LCOE) to be USD 0.86/kWh – more than triple the tariff.

In addition, the output from the Kitobo project at times went largely to serve a single customer – a nut-grinding machine, which requires 22kW to operate but does not run full-time. The result was strain on the mini-grid at the times when the grinder operated. As of September 2017, Absolute Energy and the local community had plans to install a water purification machine (5kW) and an ice machine (30kW) but these machines were not envisaged to run at the same time. This suggests that it is not easy to manage load at a lower cost of electricity even when there are only very few demands centred on the mini-grid.

Above 2MW, developers of stand-alone and grid-connected mini-grids must obtain licences for generating, distributing and selling electricity. This licensing process is unpredictable, opaque and time-consuming, according to market participants. Developers say there is lack of clarity on documents required and on how the licence approval process actually works (USAID, 2017). Developers receive no provisional development rights during the review, adding further uncertainty.

Mini-grid tariffs

Mini-grid developers can propose tariffs higher than on-grid alternatives to the ERA for review. However, in response, the ERA can amend the proposed tariffs to come closer to matching prices paid on the grid of approximately USD 0.20/kWh. This may be particularly challenging for developers who find that the revised tariffs render their projects unworkable without subsidies. The REA funds distribution infrastructure via REF, and this covers both connection and house wiring costs. This serves to reduce project capex (REA, n.d.).

Arrival of the main grid

There are no clear rules in Uganda for how a mini-grid is to interact with the central grid in the future when the main grid gets built out to where a mini-grid is located. However, developers recognize that the grid is unlikely ever to get connected to where they have been operating on Lake Victoria. According to the Ugandan government, there are more than 100 inhabitable islands on the lake with 300–600 households each, and all will gain electricity access by mini-grids.

Tenders

The Uganda Ministry of Energy & Mineral Development (MEMD) leads the Promotion of Mini-Grids for Rural Electrification (Pro Mini-Grids) initiative with support from the German Federal Ministry for Economic Cooperation & Development (BMZ), the German Climate Technology Initiative (DKTI), the European Union and (GIZ). The initiative started in 2016 and is due to conclude in 2020. GIZ aims to spur private investment through assisting government and the private sector in four areas: policy and steering, regulatory instruments, technology and design, and productive use.

The Pro Mini-Grids initiative also includes a tender process launched in September 2017 that aims to ensure long-term quality of supply and accelerate private investment. Within the initiative, the tender mechanism is a government-led approach that bundles sites that developers can bid to serve. A simplified licensing procedure cut the time in half, to three months from the standard six. Using a least-cost electrification planning model developed by the Massachusetts Institute of Technology, the tender sought to estimate grid-extension costs versus mini-grid costs. The pilot phase aims to use this mechanism to provide power to up to 15 villages in the south of the country and 25 in the north. The winning bidders, Winch Energy and WeLight Africa, are eligible to receive a subsidy of up to 70 percent of the low-voltage distribution capex with the 10-year concession. Given that low-voltage distribution is typically 20–40 percent of the overall capex, the subsidy equates to a sizeable 14–28 percent of the overall capex. Interestingly, GIZ has stated that successful developers have been able to access debt financing due to the increased economies of scale and lower perceived risk.

Table 20

Uganda's licensing and tariff requirements for mini-grids

Generation capacity (kW)	Generation licence required?	Tariff approval required?
<100	No	Yes
100-2,000	No	Yes
2,000+	Yes	Yes

Source: BloombergNEF, Uganda Electricity Order 2007, Electricity (Application for Permit, Licence and Tariff Review) Regulations, 2007.