Success in Rural Electrification
Regulatory Case Studies

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Transforming Energy Sectors Globally

UGANDA
A Bundled Approach to Mini-Grid Tendering

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Table of contents

Success in Rural Electrification

GET.transform Case Study Series on Off-Grid Frameworks and Industrialisation

Achieving the energy transformation begins with the identification of realistic approaches. For this Case Study Series, GET.transform has worked with governments, companies and industry experts to find real-world examples of where renewable energy solutions are truly working viably, to create value for communities, boost employment, or achieve national objectives.

The identified case studies focus on the one hand on renewable energy industry solutions built on revenue-driven business models, as well as on best practice regulatory frameworks that have solved common challenges in the development of the rural electrification and off-grid market. With a focus on Africa, the case studies aim to present policymakers and stakeholders with encouraging evidence from the renewable energy world.

This first case study features Uganda and draws on the experience of Uganda's Ministry of Energy and Mineral Development, Rural Electrification Agency, Electricity Regulatory Authority, National Environment Management Authority and GIZ's Promotion of Mini-Grids for Rural Electrification programmes, financed by Germany and the EU.

1 Distinguishing Feature of Uganda's Approach

This case study describes the development of the mini-grid framework in Uganda in recent years. The Ugandan framework is particularly interesting because it integrates several of the main building blocks of mini-grid development, such as planning, financing, licensing and procurement, under a single process and facilitates multi-site development. It has required additional work and time to develop these different framework elements in a way that they are well fitted to each other. However, once set up, the process can, and *is being* replicated and scaled up and private mini-grid developers can significantly reduce project development timeframes and costs for many projects in an integrated process.

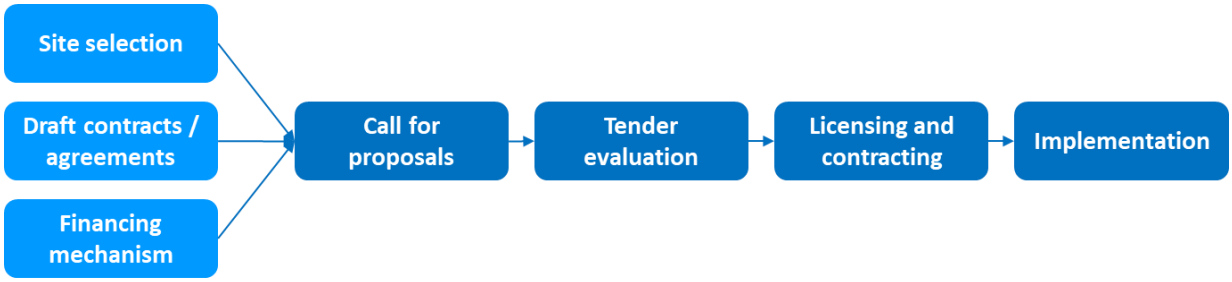
This approach has been developed and tested by the *Pro Mini-Grids* programme, implemented by the Ministry of Energy and Mineral Development (MEMD), its Rural Electrification Agency (REA) and the Electricity Regulatory Authority (ERA). Germany and the EU provided financial support as well as technical assistance through Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) for the first 40 mini-grids. USAID provided support to certain parts of the regulatory framework, and KfW is now scaling the *Pro Mini-Grids* approach up through the GET.Access project with around 100 MGs planned, as a very welcome sign to developers that more tenders are coming online. With the strategy now clear to policymakers, MEMD has engaged GIZ and other partners to roll out the approach, now envisaging

up to 1500 mini-grids in a new National Development Plan, for which funding is being discussed with various financiers.

1.1 Bundled Selection Process

As shown in Figure 1, the process begins by pre-defining a) the list (or potentially the area) of mini-grid sites and technical specifications for development, b) draft contracts and agreements needed and c) financing mechanisms (grant, results-based). Then, mini-grid developers are provided with this information as part of a call for proposals and a tender process is launched. Finally, the selected developer obtains the license (or 'exemption') from the Electricity Regulatory Authority (ERA), signs the pre-defined contracts and financing agreements and is ready to move into implementation. Key to the success of the integrated framework is the collaboration between REA and ERA, where the former is responsible for site allocation and finance, and the latter provides licensing and tariff approval. Hence, the specifications of the tender and financing must be completely aligned with regulatory elements, or a project risks becoming jammed between different requirements.

FIGURE 1. Overview of the Uganda *Pro Mini-Grids* tendering process.



1.2 Bundled Project Licensing

An additional distinctive feature of this approach is the bundling of several mini-grids into a single contract rather than the tendering and licensing of individual sites, thus allowing for larger project sizes and economies of scale. Project preparation is a key challenge for developers, as the costs of identifying sites, surveying the technical requirements, and obtaining the permits are not always recoverable; the Ugandan framework was designed to attract the private sector into a landscape deemed high-risk, by reducing these unrecoverable planning costs in a similar manner as the government treats on-grid projects. Once a bundle of sites is confirmed through reconciliation with the (grid extension) master plan, the tender follows a BOOT (Build – Own – Operate – Transfer) approach, providing mini-grid developers with a concession period of currently 10 years.

2 Framework Elements

2.1 Delivery Model and "Tariff vs Subsidy" Decision

In 2015, Uganda's energy sector partners embarked on the development of a government-steered integrated mini-grid framework. At the time, the country only had around 11 operational renewable energy mini-grids, so the objective was to develop a financing concept that could attract international mini-grid developers through a competitive tender.

The mini-grids delivery model was structured as a Public-Private Partnership (PPP), defining a 10 years BOOT concession contract (which later may be renegotiated to 20 years), a subsidy covering between 60% and 70% of the total investment and a tariff to be determined competitively through a tender mechanism. When submitting their bids, private developers were asked to consider the amount of available subsidy and calculate the tariff levels allowing them to recuperate O&M costs, recover their share of the initial investment and meet their necessary rate of return – a so-called reverse auction.

On the "tariff vs subsidy" decision, there was an initial consensus around the idea that mini-grids require higher tariffs than those paid by grid customers (around 0.22 USD/kWh in Uganda), as a rollout leveraging private investment would otherwise be impossible. However, once the first two tenders were implemented, Government felt that the resulting tariffs (around 0.50 USD/kWh) were too high and a tariff cap of 0.30 USD/kWh was communicated. As a consequence of this decision, additional subsidies were needed in order to meet this tariff cap, representing up to 80% of the total CAPEX (distribution included). With a mini-grid tariff framework now under development, future programmes will be able to follow a Minimum Subsidy Tender (MST) approach, under which the tariff is set, and bidders propose the subsidy needed to meet it. As discussed in Section 3 below, it is important that the tariff framework be clarified and a sustainable methodology be identified to find a balance between the revenue model which is limited, and the subsidy framework. The change from allowing a cost reflective tariff to a ceiling during the programme obviously caused delays and uncertainties in the process.

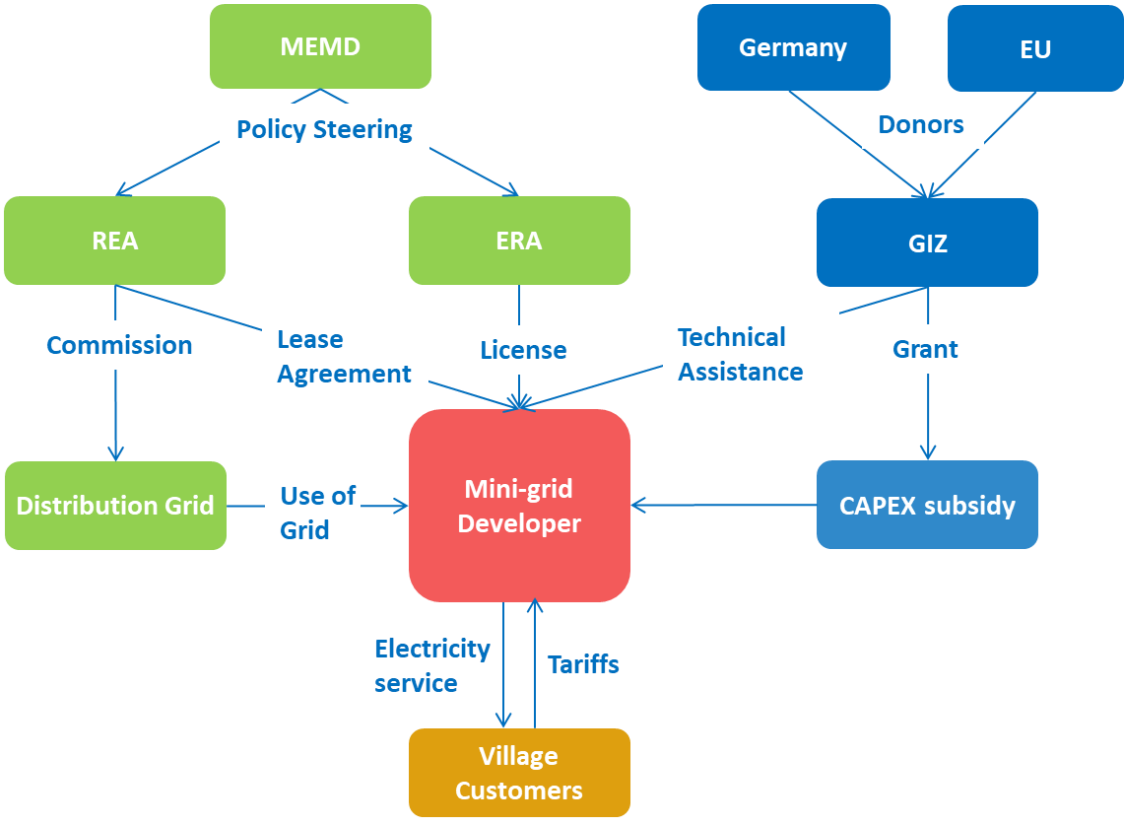
2.2 Institutional Setup

ERA and REA, under the policy steering of MEMD, are the two main institutions with a role in mini-grids. ERA is responsible for issuing licenses, approving and setting tariffs and overseeing technical standards, both for on-grid and off-grid contexts. ERA also provides additional aspects of investment security, for instance, by regulating the conditions under which a mini-grid can be connected to the national grid. REA's mandate is to facilitate rural electrification goals set by the government, and implement relevant strategies, funds and policies. This includes the responsibility of developing rural electrification master plans and designating potential mini-grid locations.

In the Germany/EU-supported project which was designed with government as the preferred national approach, the site selection, tendering process and financing mechanism are hosted by REA. GIZ

appointed an independent tender agent to supervise, and support with the technical tender specifications and procedures. ERA pre-approves the technical specifications published in the call to ensure that the tendered objects are licensable upon selection of a developer and participates in the evaluation committee to confirm regularity. Once the winning bidder is selected, ERA receives the licence exemption application materials (mostly taken from the tender application documents) and tariff proposal and grants the license exemption with a tariff approval. REA finances, commissions and owns the distribution grid, which is then leased to the mini-grid developer.

FIGURE 2. Institutional setup for bundled tenders under *Pro-Mini Grids* (Source: GIZ).



2.3 Policies and Regulations

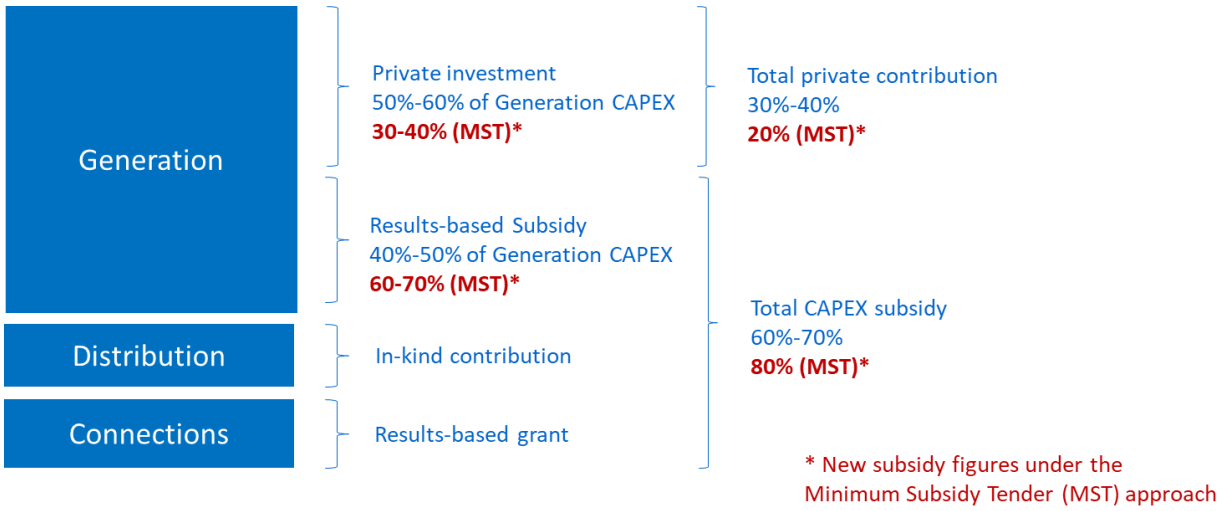
The policy framework for rural electrification including mini-grids is not unique, and indeed most countries with an SE4ALL agenda provide the necessary policy framework to promote mini-grids as part of their electrification objectives. In Uganda the Rural Electrification Strategy and Plan (RESP) defined the main priority areas, funding requirements and electrification goals to be achieved, and defined the space to be played by grid extension vis-a-vis off-grid solutions. An Off-grid Rural Electrification Strategy and a more granular Master Plan was developed in 2018 for electrification of rural areas and the identification of initially around 600 potential mini-grid locations country-wide.

ERA's license exemption mechanism for isolated grid systems, established in 2007, allows systems under 2 MW to undergo a slightly simplified application. Some adjustments were added during the two mini-grid bundles tendered by REA and GIZ, including streamlined application procedures and a waiver of the Environmental Impact Assessment on the basis of a simple Project Brief for solar/battery-based projects. In 2019 ERA began drafting new mini-grid specific regulations which will provide more clarity on the tariff calculation, technical standards and grid interconnection scenarios.

2.4 Financing Instrument

Mini-grids in Uganda have been financed through a mix of public funding (provided by government partners and international donors) and private investment. Figure 3 shows how financing is structured in the case of the mini-grid tenders currently ongoing.

FIGURE 3. CAPEX financing structure of the *Pro Mini-Grids* programme (Source: GIZ).



Generation assets are subsidized through GIZ by approximately 50% (planned), based on milestones/results, while the remaining fraction is contributed by private investors. The subsidy fraction is achieved indirectly, by supporting projects on the basis of their installed capacity. In particular, past tenders have paid between €2 and €2.5 per Wp installed, provided that storage capacity keeps a sound ratio[1] with the specified generation capacity. This approach was designed to encourage bidders to size their projects realistically: given that only a fraction of the investment is subsidized, plant size should match the expected demand, allowing developers to recover their investment fraction through energy sales and promote productive use of energy.

[1] A minimum of 1.5 Wh of usable (typical cycle) battery capacity per Wp of solar generation.

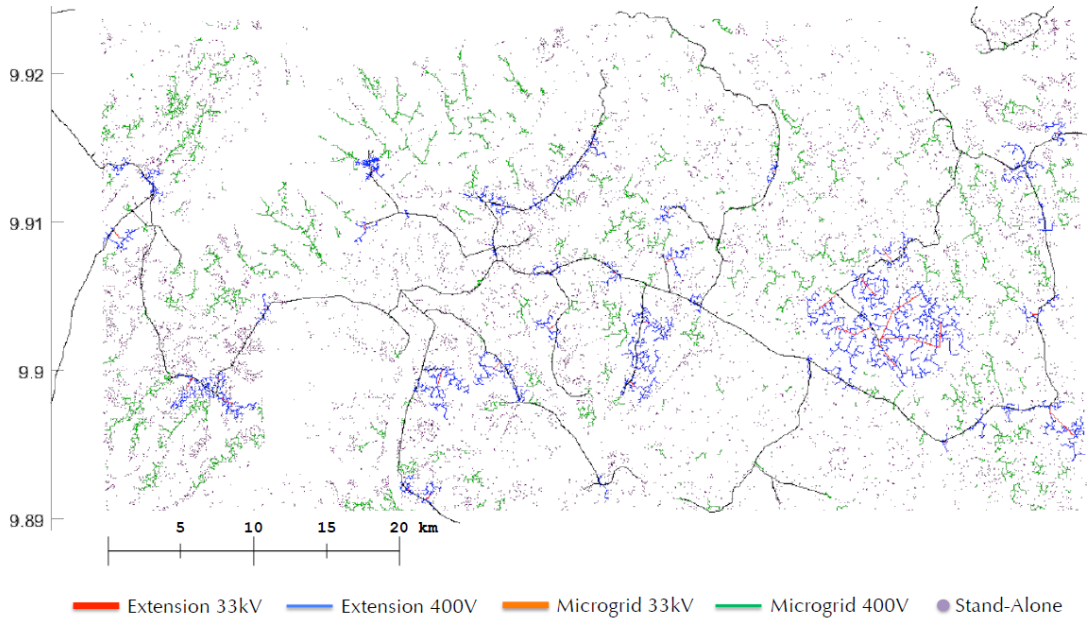
Finally, distribution assets are provided by REA (in a similar way to grid extension projects) and end-user connections are performed by the mini-grid developer but are repaid on a results-based approach. The reimbursement to developers for connection costs ranges between €150 and €200.

2.5 Planning and Site Identification

Rural electrification Master Plans covering all Service Territories were developed by REA in 2018. Areas where grid extension costs were estimated to be above 1100 USD per connection were evaluated as potential mini-grid locations. This process initially resulted in the identification of an approximate number of 600 mini-grid sites in the country, though the master plan is now being revised with more accurate data. Given that the cost per connection of mini-grids can be significantly lower than the grid extension threshold used, an updated least cost approach will likely result in higher numbers of mini-grids.

Site identification for the first bundled tenders was performed by using GIS tools and computer-based optimisation models. A collaboration with the Massachusetts Institute of Technology (MIT) provided the groundwork to identify viable mini-grid villages in Southern Uganda, as seen in Figure 4. Once a shortlist of candidate villages was available, field trips were conducted to verify the locations in alignment with the masterplan, and to estimate system sizes, demand profiles and productive use potential, significantly reducing the project preparation costs for the many potential bidders. This information was then shared with bidders at the beginning of the tender process.

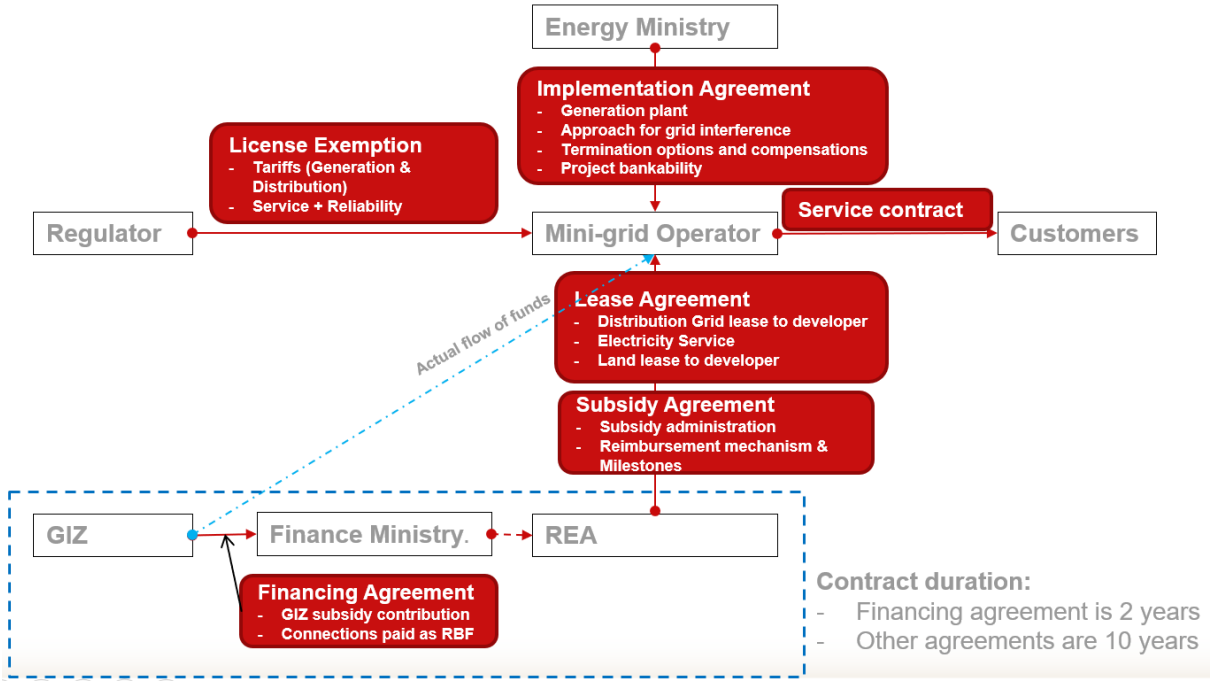
FIGURE 4. GIS-based mini-grids identification in Southern Uganda (Source: MIT and IIT Comillas).



2.6 Risk Mitigation

The Government of Uganda acknowledges the risks inherent to mini-grid business models and have tried to contribute to their mitigation. In the case of early grid arrival, the likeliness of this scenario is reduced by referring to master planning results and not allowing mini-grids in grid extension designated areas. Should early grid arrival happen, the new regulation currently under approval offers a number of options for mini-grid developers, allowing them to continue activities (as Small Power Generators and Distributors) or to transfer the generation assets. Under each of these options, the new regulations define the economic compensation that can be claimed by mini-grid developers. The contractual structure also secures the developers and ensures the projects are bankable through Government of Uganda commitment even including compensations for force majeure. REA also reduced the risks with community land acquisition by the developers, by directly securing land as the government and then only leasing it to developers.

FIGURE 5. Contractual arrangements of the *Pro Mini-Grids* programme (Source: GIZ).



As for demand risk, the general assumption in Uganda is that mini-grid developers should assume part of this, as it is seen as an incentive for making sound business model decisions. The framework allows developers to make their own sizing decisions and to use tariff structures that mitigate this risk, by promoting heavy use during daylight hours and others. GIZ however supports further through promotion of productive use and awareness creation in the communities.

2.7 Rural Industrialisation

Mini-grids represent an opportunity to develop productive uses and further economic development in the villages where they are installed. This has been the main rationale behind mini-grid efforts in Uganda and the reason why their higher cost compared with individual solutions (such as pico Solar Home Systems) is justified. In addition, given that the average off-grid village in Uganda is rather small (often below 200 households), productive uses of electricity (PUE) are also a prerequisite for mini-grids to be economically viable.

There are two types of PUEs. First, the local villagers use electricity in mills, welding machines, fridges, etc. for productive and income generating purposes; second the mini-grid operator or a third party investor sets up a rural processing facility (a small factory) resulting in rural industrialisation. The latter cannot only channel significant cashflows into rural areas and create rural jobs but also improve the mini-grid operator's profitability. REA and GIZ specifically require developers to submit a "productive use" strategy to be evaluated as part of their technical proposal. Additionally, GIZ provides additional financing and technical assistance support to promote productive uses in these mini-grids.

3 Degree of Success and Prevailing Barriers

While the completion of this integrated mini-grids framework took longer than expected to develop, it is now a replicable reality. Considering the subsidy fraction offered, the resulting tariffs were competitive compared with mini-grid programmes in other countries, suggesting that the procurement mechanism has worked efficiently. Even more promising, the approach has attracted the attention of international donors including the Green Climate Fund alongside Germany, Sweden, the EU and others.

On the other hand, some weaknesses remain, the main one being the lack of a consistent answer to the "tariff vs subsidy" trade-off. In the case of the two tenders already implemented, tariffs submitted were higher than government expectations (0,50 USD/kWh vs 0,30 USD/kWh). This has led to implementation delays and negotiations about potential solutions, such as increasing the subsidy ratio. This exemplifies the need for a clear "tariff vs subsidy" decision, ideally as early as possible in the process of developing mini-grids in a country.

Secondly, the limited runtime of the BOOT arrangement in the pilot tenders, with transfer after 10 years, reduces the attractiveness of the project for private developers. Without the transfer clause in the contract and an extended licensing period, subsidy requirements and/or tariffs could be reduced significantly in Uganda.

Finally, delays in putting the whole framework together have frustrated some developers eager to install early-mover projects, as the integrated regulatory and financing approach encompasses numerous actors and individual pieces of regulation before projects can begin to scale up.

4 Key Documents

ERA Resource Centre: regulations and codes
https://www.era.go.ug/index.php/resource-centre/regulatory-instruments/regulations-codes

Uganda Electricity Connections Policy (2018)
http://www.rea.or.ug/wp-content/uploads/The-Electricity-Connections-Policy.pdf

Uganda Rural Electrification Strategy and Plan (RESP) 2013-2022 (2013)
https://rise.esmap.org/data/files/library/uganda/Renewable%20Energy/REA,%20Strategy%20and%20Plan%202013-2022.pdf

Uganda's Sustainable Energy for All (SEforAll) Initiative Action Agenda (2015)
https://www.seforall.org/sites/default/files/Uganda_AA_EN_Released.pdf

GIZ Promotion of Renewable Energy and Energy Efficiency Programme (PREEEP)
https://www.giz.de/en/worldwide/19268.html

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