

Success in Rural Electrification Framework Case Studies



Sierra Leone A Cost-Reflective Mini-Grid Tariff Framework

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Published by

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn, Germany

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Place and date of publication

Bonn, November 2020

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GET.transform is a European programme which offers developing and emerging countries comprehensive advisory services to advance their energy sector transformations. It is hosted on the multi-donor platform GET.pro (Global Energy Transformation Programme), and supported by the European Union, Germany, Sweden, the Netherlands, and Austria.



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1 Distinguishing feature

1.1 Description

Achieving universal electricity access by 2030 is one of the foremost priorities of the Government of Sierra Leone (GoSL). Following the civil war (1991-2002) and recent Ebola outbreak (2014-2016), public resources are scarce, making the **participation of the international private sector vital to reach electrification** and other development targets. To accelerate the pace of rural electrification and the deployment of mini-grids, the GoSL with support from international organisations, particularly the UK’s Foreign Commonwealth and Development Office (FCDO) and Department for International Development (DFID), and the United Nations Office for Project Services (UNOPS), has developed an enabling environment for the private sector. **Split asset mini-grid delivery models** have been introduced under the Rural Renewable Energy Project (RREP) to attract foreign direct investment (FDI) and scale up mini-grid deployment, with distribution assets including household connections financed and owned by the Ministry of Energy (MoE), while the private sector finances and owns the generation assets.

As part of the dedicated regulatory framework for mini-grids, the GoSL allows mini-grid operators to charge **cost-reflective tariffs**, serving to attract international investors and reduce dependence on government/donor funding for rural electrification. The Mini-Grid Regulations (2019) define the tariff determination methodology, based on a cost-of-service approach. Tariffs are set taking into consideration operational costs, depreciation of assets, reserves for maintenance and replacements of assets, taxes, capital-related costs, and a reasonable profit margin depending on the quantity of electricity sold. The regulation further determines the compensation in the event of the extension of the main grid to a mini-grid site.

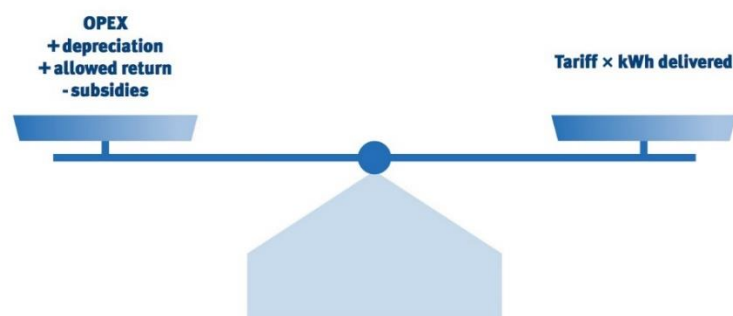


Figure 1. Tariff methodologies balance the costs and revenues of mini-grids. Source: INENSUS

The Mini-Grid Regulations classify mini-grids according to their size, with different licensing and tariff procedures for small energy systems up to 100kW of distributed power (basic license) and large systems between 100kW and up to 10MW (full license). For basic license holders, the tariff is mutually negotiated between the developers and their customers. For full license holders, tariff setting is subject to cost-reflective tariffs submitted for approval to the Sierra Leone Electricity and Water Regulatory

Commission (SLEWRC) utilizing a **standardised tariff calculation tool**. Sites can be bundled and portfolio-level licenses obtained for sites in close vicinity to one another, with the distribution power of several sites being summed up to obtain the size of the portfolio. Although the Mini-Grid Regulations allow a mini-grid developer with a small site to apply for a full license, which provides for compensation in the event of main-grid arrival, most developers opt for the basic license when developing small sites, considering the simplified licensing process.

1.2 Strengths

The RREP, developed and implemented by the GoSL with support from DFID and UNOPS, has so far resulted in the implementation of **54 privately operated mini-grids, with an additional 43 mini-grids currently under development** in 2020. Mini-grid developers hold single licenses for multiple sites with a total capacity of under 10MWp. For all projects, the tariff determination methodology and related tariff application process was applied as set out in the Mini-Grid Regulations. **Approved tariffs charged to mini-grid customers currently range from 0.80 to 0.90 \$/kWh**. By adopting a cost-reflective tariff approach coupled with clear mini-grid regulations and the split-asset model approach, Sierra Leone has been able to **attract significant international private investment despite challenging circumstances**. Among others, Africa’s largest mini-grid developer by number of mini-grids deployed, PowerGen, has invested in Sierra Leone, as have Winch Energy and Enercity.

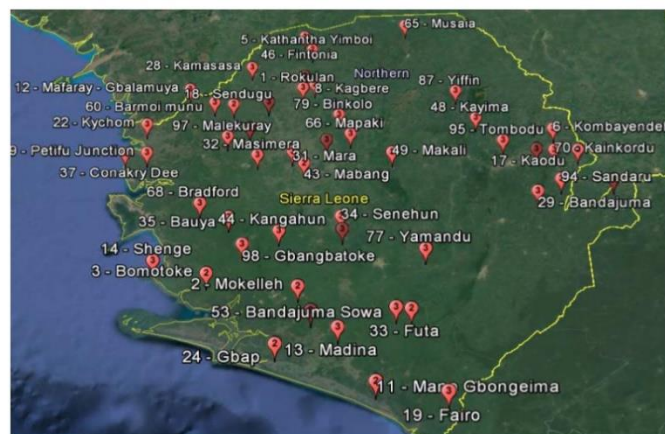


Figure 2. Mini-grids developed under the RREP. Source: DFID/UNOPS

The portfolio-based licensing approach has enabled lower cost-reflective tariffs through economies of scale than an individual licensing approach would have allowed. The government has put into place several policies and legislative reforms to make the electricity from mini-grids affordable to the rural population. Exemption from import duty is applied to solar products. From 2021, the Goods and Services Tax (GST) of 15% that is applied to the electricity sold by the main-grid will be waived for mini-grids, and

mini-grid operators will receive a corporate tax holiday for the first five years of operation, passing savings on to customers.

1.3 Weaknesses and mitigating measures taken

The tariff determination methodology for mini-grids in Sierra Leone has resulted in a cost-reflective tariff that is financially sustainable in theory, however its practical implementation has revealed some underlying issues. Thanks to the application of the split asset model, private investors do not have to invest in distribution assets. However, they were initially still required to finance generation assets, operational costs and a contribution to the reserve account for the replacement of publicly financed assets and maintenance through the tariffs applied. The low income per capita of the rural population in Sierra Leone has resulted in a comparatively low uptake of electricity, even for productive users, who have largely been using alternative means of electricity (i.e. diesel gensets) to cover their electricity needs. When compared to the main-grid tariff of approximately \$0.28/kWh, the mini-grid tariffs initially applied may be considered unviable.

However, the Government of Sierra Leone has demonstrated its willingness to find ways to further reduce the tariff and make mini-grid electricity more attractive. For four years of operation (2020-23), it has now been agreed that the capital required for the reserve account for public asset replacement and maintenance is funded by the Government (through donor support). Potential productive users of electricity have been offered grants to acquire equipment that is to be utilised with the mini-grid electricity. For the larger mini grid sites, the developers were required to fund meters and household connections, which have later been subsidised. Additionally, economies of scale are starting to take effect, with mini-grid developers now operating dozens of sites each.

To further align tariffs with the typical charges applied by the national utility, operators are considering to apply a standing service fee of USD 1.00 per connection per month, which would further reduce the tariff by another USD 0.05/kWh.

Additional subsidies from governments and donors to co-fund the private investors' generation assets could reduce tariffs further. This risk-reducing gap finance could be delivered in combination with a tiered tariff framework, where a small 'lifeline' number of kilowatt hours are supplied at a lower price, while further consumption for commercial and industrial use is charged at the cost-reflective rate (see info box on Ethiopia further below).

To address the issue of industrial customers choosing to run diesel gensets instead of using the mini-grid's electricity, the GoSL has supported a private sector solution known as the Key Maker Model (KMM) to integrate the mini-grid business model into the economic growth strategy of rural villages (see Rural Industrialisation).

Although the Mini-Grid Regulations allow time and energy bound ('flatrate') tariffs, the lack of transparency vis-à-vis expenditure per kWh for such tariffs and the lack of control of customers over

their consumption under such a tariff scheme had initially raised complaints from end-users. As a result, all private mini-grid operators have recently adopted tariffs based on the units of energy consumed (e.g. per kWh), allowing customers to be more financially flexible.

Considering the end-user complaints and their expectations, the developed tariff model has been further reviewed and replaced by a multi-year tariff tool, which is currently in use. This multi-year tariff tool allows tariffs to be fixed for five years with the possibility of slight adjustments to reflect the actual inflation and currency exchange rate.

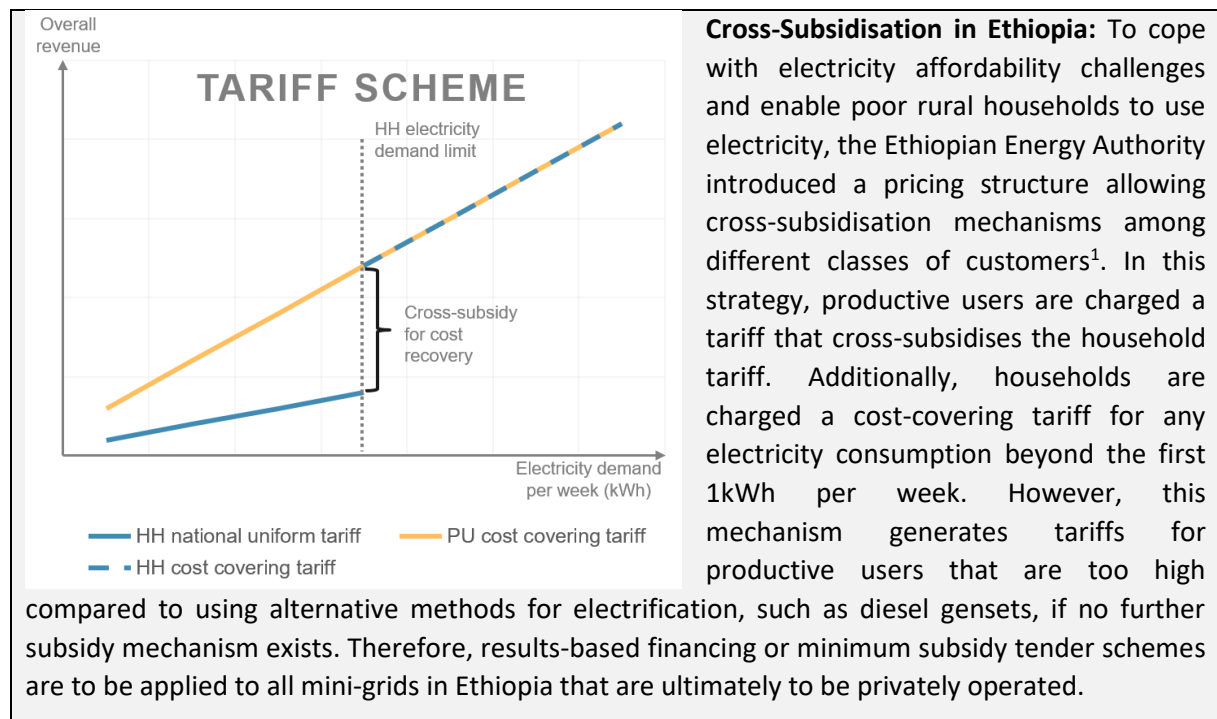


Figure 3. Cross-subsidisation mechanisms in Ethiopia

2 Framework elements

2.1 Mini-Grid Delivery Model and Decision on “tariffs vs. subsidy vs. govt control”

Through the RREP, and the implementation of the **split asset mini-grid model**, Sierra Leone was among the first countries in Sub-Saharan Africa to initiate a close collaboration between the public sector,

¹ Please refer to Tariff Guidelines and Methodology (2018). Accessible at: <http://eea.gov.et/media/attachments/directive/DRAFT%20DIRECTIVES/Economic/2ETHIOPIAN%20ENERGY%20AUTHORITY%20directive%20on%20grid%20tariff%20Methodology.pdf>

private mini-grid investors and operators and international organisations for the large-scale deployment of mini-grids.

Although Sierra Leone is one of the poorest countries in the world, main-grid electricity tariffs are amongst the highest in Sub-Saharan Africa, with an average rate of USD 0.28/kWh². Tariffs charged to rural consumers by mini-grid operators are even higher, as shown above, but this has led to acceleration of mini-grid deployment across the country (Section 2.8) and tariffs look to be coming down as the market develops and financial mechanisms are refined.

Setting cost-reflective tariffs and providing legal protection and regulatory certainty reduces off-taker risks and lowers the risk perception (Section 2.6) of private investors, inviting international private mini-grid developers to participate in rural electrification.

2.2 Institutional setup

The **Ministry of Energy** (MoE) is responsible for the energy sector at large and the development of policies and programmes within the energy sector. Within the ministry, the Renewable Energy Unit oversees renewable energy and rural electrification. MoE is supported by several key public institutions, such as **the Sierra Leone Electricity and Water Regulatory Commission** (SLEWRC) and the Public-Private Partnership (PPP) Unit.

The **SLEWRC** regulates the power sector in issuing generation licenses, approving and setting tariffs, as well as formulating and monitoring quality and compliance with regulatory frameworks. The **PPP Unit**, under the President's Office, is responsible for enhancing the participation of the private sector and provides transactional support to MoE. It is supported by the National Public Procurement Authority, in charge of regulating public tender processes, including mini-grid tenders.

Despite a well-structured overall institutional setup, the rural electrification sector is poorly represented with **no dedicated agency responsible for rural electrification and no rural electrification fund**, which is crucial for the achievement of off-grid electrification targets. The 2030 Roadmap however foresees the establishment of dedicated institutions under MoE. According to the Roadmap, a rural electrification agency would be mandated to implement the rural electrification master plan and coordinate rural electrification strategies among governmental institutions and stakeholders. The mandate of the rural electrification fund will be to channel finance from the GoSL and international donors to rural electrification project developers or consumers. According to the MoE, the absence of these two dedicated institutions currently constrains the development of the off-grid sector. As the two institutions are not yet operational, the responsibilities are currently entrusted to the Renewable Energy Unit within MoE.

² Mini-Grid Market Opportunity Assessment: Sierra Leone (2019)

2.3 Policies and regulation

The GoSL has made several legislative and regulatory reforms to first allow and then enhance private sector involvement in the energy sector, such as the **National Energy Plan** in 2009 and the Electricity and Water Regulation Commission Act of 2011. The **PPP Act**, enacted in 2014, set the pre-requisites for the private sector to participate in key sectors, such as asset ownership, the content of PPP agreements, and governing laws.

Mini-grids first appeared in the regulatory framework in 2015 in the **National Renewable Energy Action Plan (NREAP)**. The NREAP lays down the rural electrification strategy and the role of mini-grids within the energy landscape, which was later strengthened through the Action Agenda in 2015 and the **Renewable Energy Policy** in 2016. In 2017, the **2030 Sector Roadmap** identified and highlighted the various challenges hampering the development of an attractive market for the private sector, and provided key recommendations to overcome these challenges, such as the establishment of a rural electrification agency and a funding facility for mini-grids and the use of cost-reflective tariff structure. As a result, the challenges were addressed in the **SLEWRC Mini-Grid Regulation (2019)**, simplifying renewable energy project requirements, reducing related development costs and setting the principles of the tariff determination methodology.

2.4 Financing instrument

Sierra Leone is only recovering slowly from the Ebola outbreak, and public investments in infrastructure remain limited. In 2017, the Finance Act provided incentives to stimulate private sector investment through duty waivers for imported solar products complying with the International Electrotechnical Commission standards and other taxes (such as the GST).

The lack of finance resulted in the participation of international donors to support private mini-grid projects. Several mini-grid investment programmes, initiated by Development Institutions (such as GIZ, ECOWAS, ECREEE, Power for All, USAID) focused first on developing and improving the mini-grid ecosystem. After aligning the policies and regulations, donors, international organisations and financing institutions were comfortable to invest in renewable energy mini-grid projects, with considerable funds allocated to the sector to accelerate the roll-out of mini-grids. Through the RREP, DFID allocated approximately GBP 34.5M to install 5 MW of renewable energy capacity in rural areas and provide technical assistance to MoE. The Ministry is currently in discussions with several donors to scale up the successful RREP, based on the same approach. Finally, the arrival of the Universal Energy Facility in Sierra Leone, a **Result-Based Financing** facility managed by Sustainable Energy for All, leads us to anticipate the arrival of additional financing mechanisms.

2.5 Site identification and planning

According to the NREAP and the 2030 Roadmap, electrification access targets are set to 92% in 2030. Of these, 55% of the population are to be served by the existing and/or extended main grid, while mini-grids should reach 27 % and standalone systems 10% of the total population.

Although official documents recognise the role of mini-grid projects in the rural electrification effort, national electrification planning highlights areas reserved for grid extension only and does not currently consider specific areas for mini-grid implementation, which significantly delays projects.

2.6 Risk mitigation

The Mini-Grid Regulations prescribe financial **compensation in the event of the arrival of the main grid to a mini-grid site**. Upon grid arrival, basic license holders are required to decommission and remove their assets in a short timeframe without any compensation. A full license holder can choose between two options: either the licensee claims compensation equivalent to the depreciated assets and removes the assets, or the license is converted into an interconnected mini-grid license. Processes have not been tested yet. Improvements here should reduce the investors' risk premium and potentially lower tariffs.

Cost-reflective tariffs are a risk mitigation instrument in themselves, if they allow meeting the basic electricity demand of households based on their available energy budgets and ensure sustainable operations of the mini-grid. Medium-term electricity demand projections are a considerable risk experienced by mini-grid developers. As electricity demand can be easily over-estimated by mini-grid developers, cost-reflective tariffs per definition reduce the risk of deviation of electricity demand from the initial estimate.

2.7 Rural industrialisation

Providing access to reliable electricity at affordable tariffs while ensuring the financial sustainability of mini-grids is one of the main challenges for mini-grid developers. To address this challenge, the RREP introduced the so-called Key Maker Model (KMM), aiming to improve mini-grid projects' economics while unlocking rural industrialisation and development. Under the KMM, synergies between the operation of a mini-grid business and a value chain-based processing and trading business are leveraged to minimise operational costs of both businesses for the developer, improve village revenues and integrate the energy supply in the local economy. This model is being embraced by mini-grid operators for its potential to solve the financial issues in rural electrification, with government observing carefully.

2.8 Degree of success and prevailing barriers

Some of the efforts by the GoSL considerably strengthened the role of mini-grids and contributed to the growth of the sector:

- Since the deployment of the mini-grid framework and the related programmes, the number of mini-grids in the country has more than tripled through the collaboration between the public and private sector, reaching 63 private mini-grids in Sierra Leone by the end of 2019. The RREP aims to deploy a total of 97 mini-grids across the country (see figure 2);
- The MoE and several donors are currently in discussion on scaling-up the RREP’s split-asset model in mini-grids;
- The cost-reflective tariff, the mini-grid framework, and the related programmes reduced the perceived risks considerably and attracted a variety of private international mini-grid developers such as PowerGen, Winch Energy and Enercity (SL Ltd).

Nonetheless, several challenges need to be addressed to scale-up private mini-grids roll-out:

- The recommendations of the 2030 Sector Roadmap are necessary. The rural electrification sector remains unrepresented. The establishment of a rural electrification agency and a rural electrification fund will allow the country to coordinate mini-grid investment programmes and funding and mobilise private investments;
- Despite an elaborated framework allowing cost-reflective tariffs, the low income per capita of the population might affect mini-grid economics. Hence private mini-grids still require subsidies;
- Limited capacity and experience can hinder mini-grid rollouts. Reinforcing and harmonizing capacities among institutions would enhance deployment by improving the enabling environment.

3 List of key documents, regulations, and policies.

The SLEWRC Mini-Grid Regulation (2019)

<https://ewrc.gov.sl/wp-content/uploads/2020/08/Mini-Grid-Regulations-2018-1.pdf>

Public-Private Partnership Act (2014)

<http://www.sierra-leone.org/Laws/2014-11.pdf>

The Electricity Sector Reform Roadmap (2017)

<https://rise.esmap.org/data/files/library/sierra-leone/Energy%20Access/EA%2014.1B.pdf>

The Finance Act (2016)

<http://www.sierra-leone.org/Laws/2016-06.pdf>

Sierra Leone Renewable Energy Policy (2016)

http://www.energy.gov.sl/PR_Renewable%20Energy%20policy%20of%20SL_FINAL%20for%20Print.pdf

Rural Renewable Energy Project Website

<http://www.energy.gov.sl/home/rural-renewable-energy-project/>

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