Success in Rural Electrification
Regulatory Case Studies

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Nigeria
Financing Instruments for the Mini-Grid Market

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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, and 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 case study features Nigeria and draws on the experience of the Nigerian Federal Ministry of Power, the Rural Electrification Agency, the Nigerian Electricity Regulatory Commission, the Nigerian Energy Support Programmes supported by the EU and Germany, and the Federal Government's Nigerian Electrification Project which receives support from the African Development Bank and World Bank.

1 Distinguishing Feature

1.1 Description

In 2005, with the introduction of the Electric Power Sector Reform Act (EPSRA), Nigeria set a strategy into motion leading to the privatisation of the electricity generation and distribution sector. While the introduction of private capital has paid off in many regards, including the move to cost-reflective tariffs in urban areas, large parts of Nigeria have remained unelectrified, and connected regions continue to receive relatively unstable grid electricity supply. As such, the government and partners see mini-grids as a viable alternative to main-grid power supply, albeit not without its challenges. Nigeria also has the second largest potential mini-grid market in the world with an estimated value of USD 8 billion[1].

To address the rural electrification gap, several regulatory measures and agencies have been established to provide an enabling environment for private sector investment. This includes the Rural Electrification Agency (REA) and the Rural Electrification Fund (REF) providing support and finance for off-grid energy systems. REA's main role is to promote rural electrification, coordinate programmes, and administer the REF. Furthermore, in 2017, the Nigerian Electricity Regulatory Commission (NERC) published the

[1] Mini-Grids Partnership (2020) *State of the Global Mini-Grids Market Report 2020.*

Regulation for Mini-Grids. The Regulation provides a sound and streamlined regulatory environment for the development of private sector-driven mini-grids.

Most mini-grids in Nigeria require subsidisation, either through capital subsidies or grants, or to a lesser extent, provision of concessional loans. Thus, the Nigerian government and its development partners set out to develop a particularly strong financing instrument, suitable for the newly evolving mini-grid business models we see today. While a number of approaches were trialled, the preferred mode of grant disbursement is through result-based financing (RBF) which is used under both the Nigeria Electrification Project (NEP) and the REF.

Through funding from both the World Bank (WB) and the African Development Bank (AfDB), REA was able to conceptualise the NEP, with the goal of providing electricity access to households and micro, small and medium enterprises (MSMEs) in off-grid communities through renewable power sources. One of the objectives of the NEP, planned for completion by end of 2023, is to provide power to 1 million households and 250,000 MSMEs. A number of other mini-grid financing initiatives have also been set up in Nigeria, allowing for rapid scaling of the mini-grid market (further described in Section 2.1).

In 2018, after 5 years of mini-grid pilots and framework preparation, largely through the support of the EU and Germany-backed Nigerian Energy Support Programmes (NESP I & II), the WB committed USD 350 million to the NEP, with AfDB dedicating a further USD 200 million jointly with the Africa Growing Together Fund. The clear regulatory regime, capacitated institutions, and dedicated fund and programmes channelling finance to projects has been crucial to attracting large investments.

1.2 Strengths

- While RBF is not an uncommon financing mechanism, the scale of the NEP stands out as it is far larger than others in Africa, also indicative of Nigeria's acknowledgement and commitment to electrification through mini-grids.
- One of the success factors in Nigeria is the series of power sector reforms and the regulatory regime put in place which provides for a strong basis for the development of mini-grids, boosts private sector confidence, and has allowed Nigeria to attract significant funding from donors like WB and AfDB to support its electrification endeavours.
- Another key strength of the financing schemes in Nigeria is that government and partners have successively built on experience of previous well-executed programmes. For example, the experience of the GIZ-implemented NESP measures, the Mini-Grid Acceleration Scheme (MAS) and Interconnected Mini-Grid Acceleration Scheme (IMAS), led to the development of the scaled-up NEP.
- The initial grant schemes by the Nigerian government and programmes like NESP (MAS and IMAS) partially included up-front grants, and therefore gave a boost to local developers, who now have a strong presence vis-à-vis international developers.

- The engagement of Nigerian banks, offering different financing schemes to complement government-funded programmes is another strength. For instance, the Central Bank of Nigeria's (CBN) Solar Connection Facility[2], the first large-scale initiative to provide suitable commercial loans will initially provide credit to developers who have been pre-qualified under the NEP. If successful, this initiative will be revolutionary as it can spur further low-interest and long-term lending by commercial banks.

1.3 Weaknesses

- The NEP aims to catalyse the initial large-scale development of mini-grids by reducing capital expenditure costs to improve the ability of developers to recoup their investments over the project life cycle. However, although Nigeria has experimented with close to cost-reflective mini-grid tariffs, developers continue to struggle to balance cost-reflectivity with willingness and ability-to-pay on behalf of customers. To illustrate, while Nigeria's *Multi-Year Tariff Order* (MYTO) tool calculates due tariffs around USD 0.80/kWh or higher, community pressure is leading to imposed tariffs of USD 0.40/kWh to 0.50/kWh. Without truly cost-reflective tariffs or additional initiatives like rural industrialisation to enhance profitability, mini-grid businesses struggle to break even. As such, NEP is not an all-in-one solution for ensuring the sustainability of mini-grids in Nigeria.
- Nigeria, like several other countries, has had a track record of slow mini-grid deployment and subsidies, which has discouraged developers and investors. This has reduced the impact of the various de-risking measures such as revised policies and regulations, reduction of transactional costs, availability of data, and provision of financing mechanisms including grant and debt funding. The various delays to project commissioning are enough, despite all the other measures, to generate unbearable cost blowouts for investors.
- There is still insufficient public information on the network expansion plans of the 11 distribution companies (DisCos), as developers cannot deploy mini-grids in communities without prior approval from both the regulator and the DisCo that has the on-grid concession in that area.
- The transition to the mini-grid online application portal sought to shift the approval process online. Although the tool was created with simplification in mind, adaptation and adoption challenges have meant that approvals remain slow.
- Once developers manage to have their sites approved, information on exclusivity agreements are not publicly communicated. This has a complicating side-effect, as these agreements provide exclusivity rights to developers to prepare a project prior to receiving an operation permit. Hence, such information needs to be visible to other developers assessing potential project sites.
- Although the Regulation for Mini-Grids allows for bundled sites, in practice this has not yet been achieved. The application process (including the tariff tool – MYTO) allows for only one site per submission as does the permit process.

[2] https://www.cbn.gov.ng/Out/2020/DFD/Solar%20Connections%20Facility%20Guidelines%201.0.pdf

- The Performance-Based Grant window and the REF mechanisms results in risks for project developers, who need to provide/secure pre-financing throughout project preparation. Both funding mechanisms also suffer from a lack of well-developed and appropriately sized project pipelines due to a limitation in the capacities of local developers. REA, together with development partners, is trying to address these gaps.

2 Framework Elements

2.1 Financing Instruments

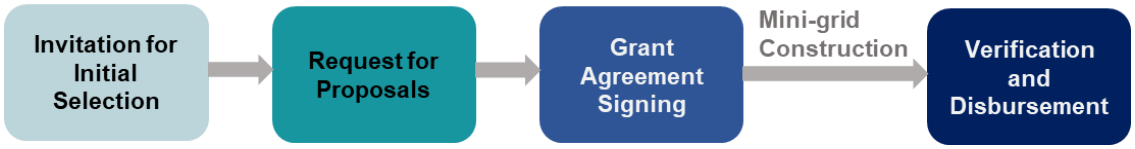
2.1.1 Nigerian Electrification Project

The NEP aims to electrify 1 million households and 250,000 MSMEs through several components. One of these is the **Solar Mini-Grid Component** with a target of 300,000 households and 30,000 MSMEs, with funding of USD 150 million delivered through two financing windows. While both windows are deployed in a result-based manner, the authorities in different states opted for slightly different developer procurement models under the two windows, reflecting the attraction of the market. Under the first window, REA provides market intelligence on selected sites and developers compete for a minimum subsidy per connection. Under the second window, developers are expected to carry out due diligence themselves on potential sites and submit offers for consideration in order to receive a grant of $350 per new connection. Performance under both windows will be tracked using an electronic GIS-ready data platform, 'Odyssey', by remotely collecting energy use data through smart meters.

1. **Minimum Subsidy Tender (MST) window**: Under the first window, REA demarcated 250 priority sites packaged into four lots, one for each of the four project states, which will be competitively tendered to determine the grant amount. Sites were selected through geospatial analysis to screen and prioritise high-potential sites, followed by validation to ensure they are fully off-grid, mapping of village infrastructure, and site surveys to collect data on customer segmentation and estimated consumption. This information is available to the bidders along with at least one suggested optimal mini-grid design for each site. Developers may also submit bids for more than one lot (up to four total).

   Successful proposals, i.e. proposals requiring the least amount of subsidy for a minimum number of connections, receive a subsidy to cover part of their capital expenditure from REA to build, own and operate the mini-grids. The nature of this grant window is performance-based, as grants are disbursed after the mini-grid has been constructed and the customers have been connected to REA's satisfaction. During the first phase, REA launched a pilot for 57 sites. The process is summarised in the figure 1.

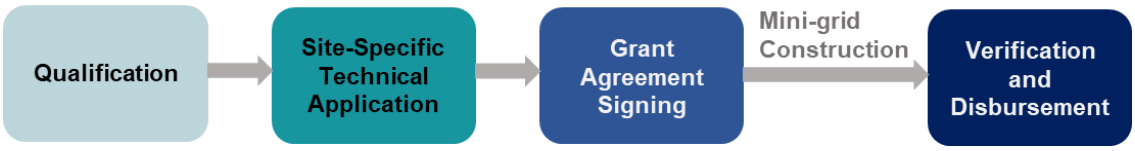
Figure 1. Process for the REA NEP Minimum Subsidy Tender (Source: REA Nigeria[3])



The selection process comprises two stages. After invitation for the initial selection, developers need to demonstrate that they are eligible and qualified. Second, preselected developers are invited to submit proposals to serve a pre-defined number of customers, with a pre-defined quality of service through the web-based platform 'Odyssey'. These proposals are evaluated on the basis of quality (technical proposal) and price (lowest subsidy required), and developers are not required to reach any tariff agreements with the communities. Tariffs are to be negotiated after the contract award. The number of connections to be made are defined by REA in the Request for Proposal documents along with a tariff ceiling which the developers are required to comply with. Successful developers enter into a grant agreement with REA, and the grants are disbursed upon verification that customers have been connected to the network and provided satisfactory service.

2. **Performance-Based Grant (PBG) window**: Under the second window, the developers are required to identify and validate their own sites/communities and receive a fixed grant amount of USD 350 per connection, with a minimum total grant of USD 10,000 per mini-grid. The grant is available on a first-come-first-served basis to eligible projects which include solar and solar hybrid systems with generation capacity <1 MW. Once the mini-grid is constructed and customers have been connected, the grant is disbursed after REA has verified that customers are connected and receiving satisfactory service. The figure below illustrates the PBG process.

Figure 2. Process for the REA NEP Performance-Based Grant (Source: REA Nigeria[4])



The PBG also comprises a two-stage process. At qualification stage, developers submit a programme application to demonstrate eligibility. Second, qualified developers are invited to submit site-specific technical applications, with details on the site, generation and distribution designs, and targeted number of connections per project. This of course depends on a critical assessment of the sites' suitability for mini-grid connection. The bidders must verify that the

[3] https://rea.gov.ng/mini-grid-tender/
[4] http://rea.gov.ng/mini-grid-pbg/

sites proposed truly are viable and unlikely to fall under a grid extension programme in the near future.

The NEP was using the Nigerian Energy Database (see 2.5) to provide bidders with potential sites, but not all data in this GIS repository has been ground-proofed. Developers are thus now turning to the Federal Ministry of Power's Nigeria SE4ALL electrification data platform[5] which is the most comprehensive and validated repository of GIS and other data. Once a site-specific technical application has been approved, the developer enters into a grant agreement with REA, with grants disbursed upon verification. The grant amount of USD 350 per connection is made available to the developers 90 days after providing service to a household, with validation undertaken through 'Odyssey'.

A **Result Based Financing for Productive Appliances and Equipment** component is also delivered under the NEP. This USD 20 million window from AfDB incentivises solar home system companies and mini-grid developers to supply energy efficient productive use appliances, and all mini-grid projects, including those developed under the NEP, are eligible to apply for this support. This scheme does not cover the cost of appliances but rather the incremental costs of integrating this line of service, like transport, marketing, end-user financing, installation, training, repairs, replacements etc. As with other result-based schemes under NEP, claims are verified after installation before grants are disbursed.

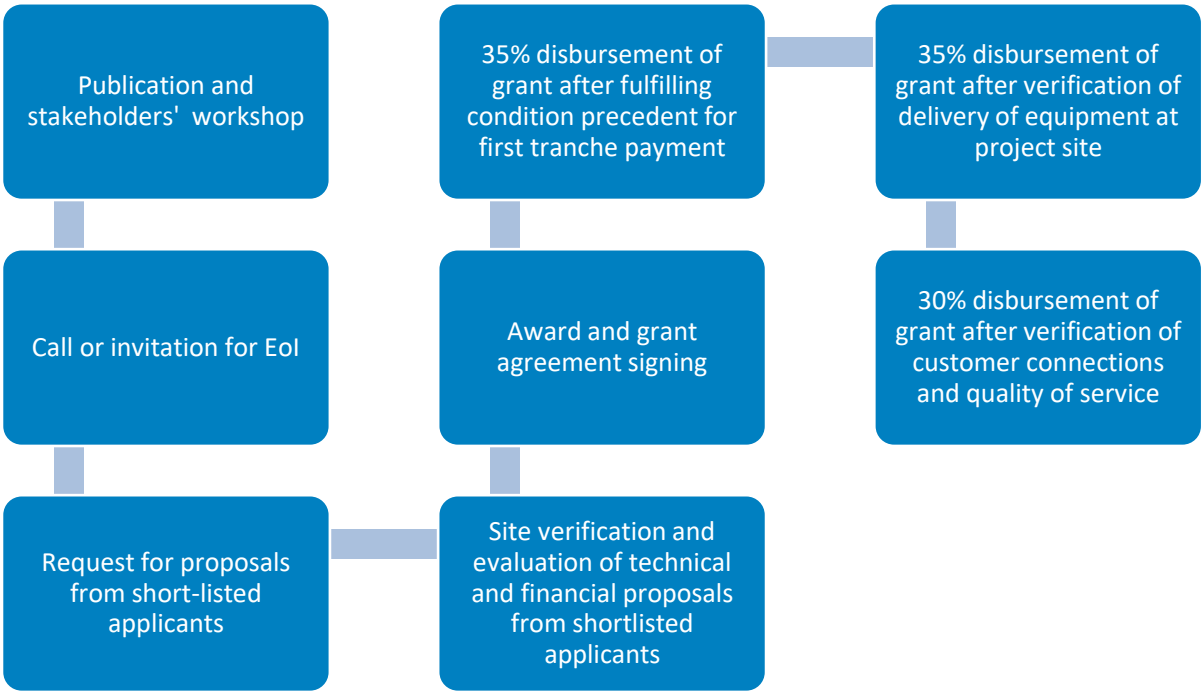
2.1.2 Rural Electrification Fund

REA also administers the REF, which is funded partially under the Electric Power Sector Reform Act (EPSRA) and additionally through fines charged by NERC, donations, loans or monies from the National Assembly or other funds. REA uses these funds to provide capital grants to mini-grid developers, among others, in accordance with the Rural Electrification Fund Operational Guidelines (REFOG) which were developed and implemented in 2017. As per the guidelines, the REF provides grant funding through open tenders. Selected project developers sign a grant agreement, and grants are again disbursed on the basis of performance, after verification of conditions.

REF supported projects must have a minimum 30% proportion of renewables, which may stem from any renewable energy technology on both isolated and interconnected mini-grids. REF grants are available to successful developers of systems of a generation capacity <1 MW, in each lot (geopolitical zones in Nigeria). The grant amount per connection is US$500 for residential customers and US$600 for commercial and productive users, with a minimum investment size of US$10,000 and a maximum of US$300,000 per project, or 75% of the total capital costs. Figure 3 below shows the application and disbursement process of the REF mini-grid window.

[5] https://nigeriase4all.gov.ng/ developed under NESP.

Figure 3. Process for the REA Rural Electrification Fund



2.1.3 Earlier Piloting of Financing Instruments and Approaches

In the early stages of market development, the Nigerian Energy Support Program (NESP, implemented by GIZ) also provided capital support for development of mini-grids through REA by launching the Mini-Grid Acceleration Scheme (MAS) and the Interconnected Mini-Grid Acceleration Scheme (IMAS). Under both schemes, an in-kind grant in the form of distribution hardware, metering and some of the PV generation assets made up for 50-60% of the capital costs. It was envisaged that the in-kind grant together with the existing grid infrastructure (10%) would make up for 70% of the capital costs. Developers were to raise 10% in equity and 20% through debt financing. The selection of developers was done through a competitive tender and a staged process was envisaged for transfer of ownership. At the first stage, possessory rights were transferred to the selected developers upon meeting certain conditions like execution of grant agreement, certification of business plans, execution, and approval of a tripartite agreement with the DisCo and community. At the next stage, ownership of the mini-grid was transferred upon meeting additional conditions like minimum number of effective connections, certificate of installation and proof of operation as per the set standards. The MAS and IMAS, particularly the performance-based grants invoked, led to the creation of the NEP's financing instruments, once scaling became possible through regulatory developments.

In order to match the availability of grants with commercial debt instruments, Nigeria's Bank of Industry (BOI) established a Solar Energy Fund with a corpus of 6 billion Naira (approx. USD 14.6 million) which

may be accessed directly from the BOI or indirectly through Deposit Money Banks (DMBs) or Microfinance Banks (MFB) by end-users or solar energy companies. There is a cap of 350 million Naira (approx. USD 850,000) per end-user. The BOI's direct lending interest rate stands at 9% per annum, paid on a monthly or quarterly basis with a tenor of maximum 5 years inclusive of the moratorium period. For on-lending, BOI refers to the rules of the DMBs/MFBs.

In 2020, the Central Bank of Nigeria also issued a framework for the implementation of a Solar Connection Facility to provide long-term low-interest credit facilities to enterprises in the solar value chain which have been pre-qualified by the NEP. This includes mini-grid developers who can receive term loans for civil works, project expansion, equipment purchases etc. amounting to a maximum of 70% of the project cost. The tenor for such loans is set at 7 years with up to a 2-year moratorium, at 10% interest. Having only been introduced in September 2020, this facility is yet to be operationalised at the time of publication.

2.2 Mini-Grid Delivery Model and Decision on "tariff vs. subsidy vs. govt. control"

Initially, Nigeria took a public-private-partnership (PPP) split-asset model approach, though we now see a fully private owner-operator model. Still, all the Nigerian mini-grid projects have been subsidised by government and donor organisations to ensure lower tariffs and promote affordable access to power. These subsidies are accounted for in the MYTO methodology, for calculating a cost-reflective tariff.

Although cost-reflective tariffs were planned in Nigeria, the high resulting tariffs led to low demand and community pressure. As such reduced tariffs in the range of USD 0.40/kWh to 0.50/kWh are being imposed and the level of subsidisation through the financing instruments has been adjusted to match these reduced tariffs.

2.3 Institutional Setup

Nigeria has a relatively liberalised power sector. With the introduction of the EPSRA in 2005, Nigeria unbundled its single state-owned National Electric Power Authority (NEPA). This resulted in 6 private generation companies and 11 distribution companies with partial government ownership. Control of transmission and system operation is however retained by the government through the Transmission Company of Nigeria (TCN). The EPSRA envisages a phased implementation of privatisation, with full competition in the wholesale and retail sector in the long term. For the transition, government established the Nigerian Bulk Electricity Trading Plc. (NBET) in 2010, to act as the bulk electricity purchaser and financial guarantor.

The EPSRA established the Nigerian Electricity Regulatory Commission (NERC) in 2005 as an independent agency for regulating electricity tariffs, issuing licenses, and ensuring compliance with market rules, and this body is responsible for the Regulation for Mini-grids, 2017. The EPSRA also recommended the

creation of the Rural Electrification Agency (REA) to coordinate feasible electrification projects in rural areas and to administer the REF for provision of capital grants. REA supports private rural and peri-urban investors through pre-development activities which include site identification, and facilitation with local and state governments. REA is also responsible for the implementation of the NEP in collaboration with the World Bank, AfDB and other partners.

2.4 Policies and Regulations

In 2015, as part of its Nationally Determined Contribution, Nigeria envisaged development of 13GW of off-grid solar PV to contribute towards reducing CO2 emissions by 2030. In 2016, it declared its Vision 30:30:30, articulated under its Sustainable Energy for All Action Agenda 2016 (SE4ALL-AA), whereby Nigeria set a generation capacity expansion target of 30 GW by 2030, of which 30% is to be derived from renewables including solar PV. In line with these targets, the NEP plans to electrify 300,000 households and 30,000 small and medium enterprises via 1,000 mini grids over 5 years.

Exercising its powers under the EPSRA, NERC launched the Regulation for Mini-Grids in 2016, stipulating a comprehensive regulatory environment for private mini-grid projects including licensing procedures for different thresholds, a procedure for tariff setting and approval, interconnection, main grid arrival, a compensation mechanism, health and safety guidelines, and contract templates.

These regulations provide for different licensing conditions as per the thresholds established: *Registration* for <100 kW, and *Permits* for >100 kW of Isolated Mini-Grids. *Interconnected Mini-Grids* require Permits, regardless of system size. The regulations do not prescribe any explicit permit fee, however procurement of other necessary permits for developing mini-grids does require fee payment. Applications for an Isolated Mini-Grid Permit require an agreement with the community, while applications for Interconnected Mini-Grids require a tripartite agreement with the local DisCo and the community, including agreed community tariff, tariff for sale to the DisCo, and usage rights for the DisCo's distribution assets.

Registered mini-grids may set their own tariffs, while those requiring a Permit must apply the Mini-Grid MYTO methodology, published by NERC, for calculating a cost-reflective tariff. Tariffs calculated by the operators must be approved by NERC. The regulations also allow tariff revisions if either the developer or the community raise an objection to an existing agreement. They also provide standardised due diligence templates to ease the bureaucracy and lower the transaction cost across the sector.

2.5 Site Identification and Planning

The Nigerian government supports the difficult process of mini-grid site identification by collecting and managing verified electrification data for project developers to access. The Federal Ministry of Power

publishes this information on the Nigeria SE4ALL[6] portal, a national electrification database developed with support from NESP, providing up-to-date data on the coverage of the grid, location of settlements, and demographic information from various sources. The initiative has so far mapped over 60,000 km of electricity grid and over 3,400 settlements, allowing for identification of unserved clusters, and tracking of the main grid. Survey templates, based on the KoBoToolbox data collection software, are also provided so as to harmonise the collection of on-site data for demand assessments. The portal also includes a mini-grid monitoring dashboard with latest data on selected operational mini-grids across the country.

The Nigerian government has also itself assigned 8,000 potential mini-grid communities and collected data on the location of schools, hospitals and other infrastructure. Market value estimates are also supported, based on selected criteria including economic activity and distance from the national grid. Verification of all the useful datasets for project preparation is not possible for the whole country, but REA has visited some sites to verify population data and conduct community demand assessments, with the intention is to scale this significantly in coming years.

2.6 Risk Mitigation

The Mini-Grid Regulations have reduced the risk of early termination due to arrival of the main grid through clear regulation and compensation instruments. The regulations provide for any permit holder to be compensated in the event of grid arrival, either by converting their operation into an interconnected mini-grid or by transferring their assets to the DisCo at the remaining depreciated value of the assets plus the past 12 months' revenue.

One risk that remains is that of electricity demand in the communities. As it is difficult to predict the amount of electricity that will be consumed in an unelectrified village, the accurate sizing and related investment in a system is not a precise science. Over-sizing a system means investing in generation capacity for a partially unsold quantity of kilowatt hours. An overestimated revenue stream equates to underperformance and difficulties repaying financiers. The Regulation for Mini-Grids allows mini-grid developers to apply for tariff revisions. However, with the pressure exerted by communities to maintain low tariffs, it is difficult to adjust the cost structure to balance out low demand. As such, stimulation of productive use and rural industrialisation needs to be embraced to keep operations running close to the intended capacity.

A further mitigation measure, employed not only in Nigeria but also in other private sector-driven markets, is to shift part of the site selection burden to the developers. It is argued that the strict allocation of mini-grid sites by government onto developers leads to less suitable site identification, as

[6] https://nigeriase4all.gov.ng/

government agencies may prioritise social and political factors above the financial viability of a village's electrification.

2.7 Rural Industrialisation

Although Nigeria has developed a focused approach to mini-grid development, rural electrification objectives could be better synchronised with rural industrialisation strategies. Few Nigerian mini-grids are well integrated with local value chains to leverage the economic opportunities that electricity access affords. Many mini-grid operators are thus struggling with financial viability. As mini-grids are capable of supporting productive uses for the agricultural sector and small and medium enterprises, Nigeria can tap into this potential to also promote rural economic development, income creation, and therefore more demand for electricity, which will also further support sustainability of mini-grid businesses and local economies. With much of Nigeria's agricultural produce coming from rural areas, the introduction of mini-grids into production zones allows for a greater portion of the profit margins to be shifted back from the point marketing and delivery to the market, towards the production end of the value chain, by reducing bulk and refining produce before it makes its way to the bigger cities.

3 Degrees of Success and Prevailing Barriers

As per the latest available data, there are currently 75 mini-grids in operation in Nigeria, with a total capacity of approximately 7 MW, serving about 160,000 people. With a focus on off-grid electrification and the establishment of clear policies, regulations and mandates, Nigeria has come a long way towards integrating mini-grids in a holistic electrification strategy.

The MST was launched in April 2019 and 47 developers submitted applications for an initial selection, of which 13 were shortlisted to proceed to the next stage. The Request for Proposal opens late-2021.

In terms of the PBG under NEP, the first mini-grid under the programme took under two months from application to commissioning, which speaks for the success of the programme in simplifying and speeding up processes. So far, three mini-grids have been commissioned under this project with a cumulative capacity of 200 kWp, and further projects with over 3000 kWp capacity and 32,000 customers are in the pipeline. With 14 developers participating, the NEP PBG has attracted over USD 40 million in financing. However, certain barriers remain. Affordable commercial lending remains a big challenge in Nigeria. Efforts to promote this are underway, as already discussed, but it may be some time before results are visible. Additionally, despite introduction of cost-reflective tariffs, developers still struggle to balance this with community's expectation of lower tariffs which affects profitability.

4 List of Key Documents, Regulations and Policies

NERC Regulations for Mini-Grids
https://nerc.gov.ng/index.php/library/documents/Regulations/NERC-Mini-Grid-Regulation/

Nigeria Electrification Plan
https://rea.gov.ng/nigeria-electrification-project-nep/

National Renewable Energy and Energy Efficiency Policy
http://admin.theiguides.org/Media/Documents/NREEE%20POLICY%202015-%20FEC%20APPROVED%20COPY.pdf

Electric Power Sector Reform Act
https://nerc.gov.ng/index.php/library/documents/Regulations/Electric-Power-Sector-Reform-Act-(EPSR)-2005/

Bank of Industry Solar Energy Fund
https://www.boi.ng/solar-energy/

Central Bank of Nigeria Framework for Implementation of Solar Connection Facility
https://www.cbn.gov.ng/Out/2020/DFD/Solar%20Connections%20Facility%20Guidelines%201.0.pdf

Nationally Determined Contributions
https://www4.unfccc.int/sites/submissions/indc/Submission%20Pages/submissions.aspx

Rockefeller Foundation, 2020
https://www.rockefellerfoundation.org/wp-content/uploads/2020/10/EE-Download-Solutions-CaseStudies-ResultsBasedFinance.pdf

Nigeria SE4ALL National Electrification Database
https://nigeriase4all.gov.ng/map

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