

NIGERIA'S FIRST COMMERCIAL UNDERGRID MINIGRID

Project Summary

Ogun State, Nigeria – July 2020

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For additional project information and lessons learned, visit:
rmi.org/mokoloki



The solar hybrid project in Mokoloki community is Nigeria's first rural commercial undergrid minigrid, coming online in February 2020. Through an innovative partnership between Ibadan Electricity Distribution Company (IBEDC), Nayo Tropical Technology (Nayo Tech), and Mokoloki community—with advisory support from Rocky Mountain Institute (RMI)—this project demonstrates a path to collaboration. Early evidence suggests the project improves electricity service, support community development, and reduce utility losses.

While the Mokoloki minigrid is an important proof-of-concept that the undergrid model can be achieved, it represents more than that. It also proves that the undergrid model is technically and economically feasible. Before the project the tripartite contract enabled by Nigeria's Mini Grid Regulation had never been executed. This project builds on the Rural Electrification Agency's expansion of the minigrid and off-grid sectors in Nigeria to exemplify a good-faith negotiation between three parties that saw the benefit of an undergrid minigrid. And it proved their faith was justified.

By replacing a weak grid connection, Mokoloki's minigrid:

- Created cost savings for the utility, which previously registered aggregate technical and commercial losses of up to 70 percent in Mokoloki;
- Opened a new revenue stream and minigrid market segment for the developer;
- Avoided about 15,000 kg of CO₂ emissions in its first three months of operation; and
- Reduced customer electricity costs by ₦20/kWh (\$0.06/kWh)

The undergrid minigrid approach is scalable to thousands of other communities in Nigeria. Both IBEDC and Nayo Tech are eager to replicate this project's success elsewhere but have noted the need to avoid some of its challenges. After enduring complex contract negotiations, all acknowledge the need for a standard template and streamlined process.



ABOUT MOKOLOKI

Mokoloki community, in Obafemi Owode Local Government Area in Ogun State, Nigeria, is home to approximately 1,000 residents who previously struggled with intermittent electricity access. Poor voltage quality and an average of four hours of electricity service per day limited health service, commercial development, and other aspects of daily life. The business opportunity in Mokoloki, with its bustling market, provided ample offtake capacity for a well-run electricity system.

BUSINESS MODEL AND TRIPARTITE CONTRACT

The Nigerian Electricity Regulatory Commission's tripartite contract blueprint enables a broad range of projects, but leaves many details open to negotiation based on project specifics. Although these answers may differ depending on the undergrid minigrid business model, the operator-led model (represented here, with a few minor variations) is the most straightforward. After months of negotiation, IBEDC, Nayo Tech, and Mokoloki community agreed on the following decisions:

- **Interconnection:** The system is islanded from the main grid, with an option to reconnect and share power in the future.
- **Distribution Usage Fee:** The developer pays the utility a fixed fee on a monthly basis, which provides the utility with a predictable revenue and encourages the developer to maximize electricity sales to ensure system profitability.
- **Contract Term:** Initial duration of 10 years allows for minigrid operation to align with other licensing practices and enables the developer to achieve system payback, with provision for contract renewal.
- **Investment:** The developer invested in generation assets and distribution upgrades.
- **Customer Engagement:** Shared by the utility and the developer to maintain goodwill between the utility and the community while introducing the developer as a trusted partner.
- **Regulatory Approval:** Developer-led with participation from the utility.
- **Asset Ownership:** The developer owns generation; the utility owns pre-existing distribution and will own new distribution assets at project termination.
- **Customer Relationships:** The developer manages metering, billing, and collection; any customer complaints are filed to the developer and, if unresolved, escalated to the utility before being channeled to regulator.
- **Operation and Maintenance:** The developer is responsible for all generation and distribution maintenance.
- **Monitoring and Evaluation:** The developer is responsible for monitoring and sharing monthly reports with the utility.

TECHNICAL DETAILS

Customer interest has outpaced expectations with 230 residential, 48 commercial, 11 public, and 1 anchor customer connected within three months of operation. At least four additional major productive use loads are anticipated to come online within the first year. The generation system was designed to handle load growth, with 100 kW solar PV, 192 kWh battery, and 88 kW diesel backup installed and an expansion plan in place. This scalable system design, while unusual due to the additional planning required, is considered best practice in the minigrid sector due to the difficulty of load prediction. Reliability is reported at 99.9 percent.

The tariff structure is customized to connection type. Residential customers pay a flat rate per kWh, but commercial and agricultural customers pay time-of-use rates to incentivize consumption during peak daytime hours (9 a.m. to 4 p.m.) when the sun is shining.

NEXT STEPS

Both **IBEDC** and **Nayo Tech** are closely monitoring operation of the Mokoloki project to expand lessons learned and are actively exploring additional undergrid minigrid projects, creating opportunities for interested investors. Meanwhile, Nigeria's power sector policymakers, development partners, and other distribution companies are exploring expanded use of distributed energy resources to improve electricity service.

PROJECT PARTNERS



Ibadan Electricity Distribution Company is the largest electricity distribution company in Nigeria, serving Oyo, Ogun, Osun, Kwara, and parts of Niger, Ekiti, and Kogi states since 2013. IBEDC began the undergrid minigrid project after identifying the high losses associated with serving Mokoloki community, selected Nayo Tech as a project partner, and led the contract negotiation process. Visit ibedc.com for more information.



Nayo Tropical Technology has specialized in solar minigrid utilities, EPC contracting, and warehouse and sourcing in the Nigerian renewable energy sector since 2004. Nayo Tech developed the minigrid in Mokoloki community, including technical design, construction, and customer acquisition, and is currently operating the minigrid. Nayo Tech is in a growth stage partnership with Shell Foundation to scale its operations across Africa. Visit nayotechnology.com for more information.



Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. RMI conceptualized the project, providing advisory support to IBEDC and Nayo Tech and guiding negotiations around the first-ever tripartite contract.

FURTHER READING

Under the Grid: Improving the Economics and Reliability of Rural Electricity Service with Undergrid Minigrids

>> rmi.org/insight/under-the-grid

Electrifying the Underserved: Collaborative Business Models for Developing Minigrids Under the Grid

>> rmi.org/insight/undergrid-business-models