

Nigeria's First Commercial Undergrid Minigrid

PROJECT UPDATE

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



The Mokoloki minigrid is powered by solar panels, lead-acid batteries, and a supplementary diesel generator.



Nayo Tech worked with IBEDC to improve the distribution network delivering power to customers.

The first-of-its-kind partnership at Mokoloki community is delivering reliable power and economic progress.

In February 2020, Nigeria's **first commercial undergrid minigrid** came online in Mokoloki, Ogun State, Nigeria. The project was the first to bring reliable minigrid power to a community living under the grid—connected but receiving unreliable supply from the electricity distribution company—through a three-way partnership between a community (Mokoloki), a minigrid operator (Nayo Tropical Technology), and the Ibadan Electricity Distribution Company (IBEDC). Eighteen months later, the project continues to flourish, demonstrating the financial, technical, and political feasibility of undergrid minigrid systems in Nigeria.

Despite a tumultuous year that included the global COVID-19 pandemic, the undergrid minigrid project remained financially sound. New customers have been acquired steadily, individual demand for electricity is growing, and the minigrid is attracting new businesses to Mokoloki. The Nayo Tropical Technology team (Nayo Tech) reports that revenue already has doubled.

One of Nayo Tech's original hypotheses was that, compared with a typical isolated, off-grid minigrid, an undergrid minigrid would benefit from more robust economic activity in grid-connected peri-urban areas. In fact, the Mokoloki minigrid's average revenue per user is twice that of a comparable off-grid site in Nigeria. The undergrid minigrid is relieving pressure on IBEDC by providing customers with consistent power without taxing the distribution company's system, and Nayo Tech has met 100% of its financial obligations to IBEDC, providing revenue certainty.

Word has spread of the minigrid's reliability and customer satisfaction: minigrid staff receive regular requests from leaders who hope to replicate the project to provide reliable, sustainable, affordable power for their communities. This interest has enabled Nayo Tech and IBEDC to continue their partnership, and the two companies are now developing a pipeline of new projects expected to deploy more solar power within the IBEDC franchise area.



Technical and economic performance

The minigrid, which features 100 kWp solar PV, 194 kWh battery storage, and an 88 kW diesel backup generator, generates an average of over 5,500 kWh of solar energy per month.

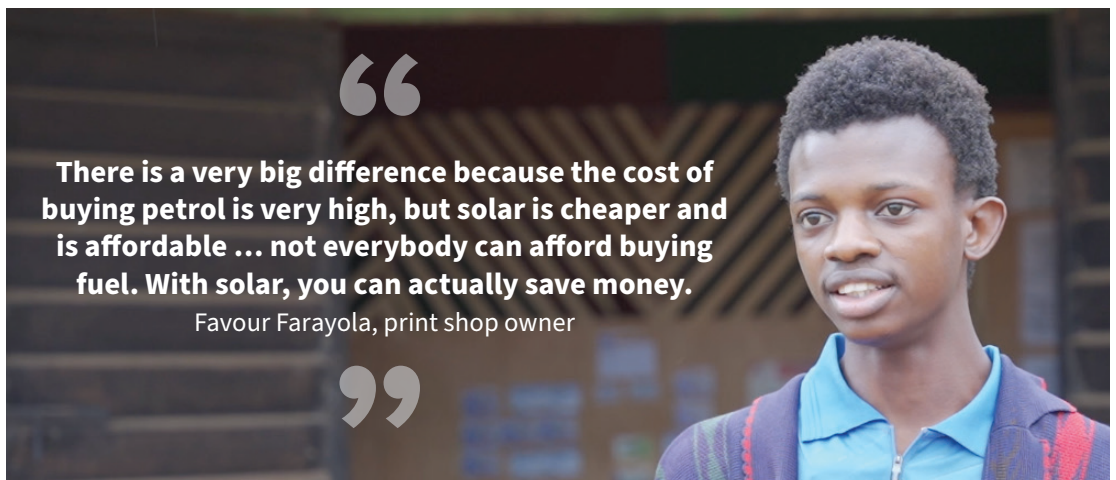
Two years ago, IBEDC was rarely able to provide more than four or five hours of electricity per day to homes and businesses in Mokoloki. Conversely, the minigrid has never experienced an outage that lasted five hours. The occasional loss of internet connection is the primary source of technical difficulty within the system, as it can interfere with payments for the otherwise reliable electricity.

Over the first 15 months, operating costs were about one-third of total revenue.ⁱ This is on par with similar off-grid minigrid projects, which see operating costs ranging from 27%–37% of revenue. Collection rates have soared from around 20% before the minigrid to 100% today, with every Mokoloki customer now using a prepaid meter.ⁱⁱ

Customer demand and load growth

Customer demand and minigrid revenues have grown consistently since the Mokoloki project launched. Originally, only 90 Mokoloki customers were connected to the IBEDC grid. Over 200 customers initially signed up to receive power from the minigrid, and now that number has increased by more than 20% to nearly 300 connections. Minigrid revenue doubled within the first 18 months of operation; and to keep up with demand growth, Nayo Tech already has begun a planned expansion that will approximately double the battery, inverter, and PV capacity.

Major commercial customers like welders, bakers, and mills are important for minigrid viability. From the outset, Mokoloki community was an attractive location for a minigrid project because of the economic activity and the potential for productive uses of electricity. Today, commercial customers comprise only about 9% of the total customer base in Mokoloki but contribute 45% of total revenue. After 18 months, it is clear that the minigrid also is driving local economic growth by helping local businesses thrive and attracting new ones.



ⁱ We have chosen to treat sensitive financial figures like project revenue as confidential and instead attempt to contextualize them through ratios or other metrics. A more detailed financial representation will be forthcoming in the World Bank's *Undergrid Mini Grids in Nigeria and India: Interconnected and Non-Interconnected*.

ⁱⁱ One challenge presented by the smart meters used in Mokoloki has been the inability to track time interval data, which has prevented Nayo Tech from learning more about the demand profile and load curve associated with peri-urban customers.

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Mr. Daniel Adeoti, chairman of the Welders Association in Mokoloki, was one of the earliest adopters of the minigrid. He notes that the reliable electricity connection has been up to the task of powering all his welding equipment, which has helped his business prosper. Similarly, Mrs. Olayemi Okesola uses minigrid power to operate a dough mixer, bread slicer, and oven for her bakery business—and she is planning to expand due to the availability of reliable electricity.



The minigrid creates tangible opportunities for new economic development. Existing electricity users like Adeoti and Okesola are growing their businesses, and other productive users have retrofitted their petrol-powered engines to new electric drives. New businesses, like one that will process soybeans into milk, are in the process of moving to Mokoloki due to favorable conditions and targeted demand stimulation efforts provided by Nayo Tech. Local communications entrepreneur Ogunmade Olamilekan Emmanuel says of the minigrid, “It changed the community totally based on the stable electricity... More people are coming [into Mokoloki] because of the light. It improved business.”

Tripartite agreement performance

The Mokoloki undergrid minigrid modeled the implementation of a tripartite agreement—a contract between the distribution utility formerly serving the community, the new minigrid provider, and the community itself. All three parties believe the risk was worth it.

Anayo Okenwa Nas, CEO of Nayo Tropical Technology, says, “One year on, we are happy to say it was a good economic and social decision to be involved in this project.”

Saheed Busari, embedded generation and renewable energy lead for IBEDC, adds that “IBEDC has recorded a number of benefits by permitting the minigrid to run within her franchise. IBEDC receives fixed annual payments from the minigrid operator for the right to provide electricity in Mokoloki. [IBEDC is] also benefitting from the elimination of financial and technical losses incurred while serving the community before the minigrid arrived.”

The leader of Mokoloki, HRM Oba Ademola Joseph Edun Ogunbona Ojiko 1, Onomoko of Mokoloki Land, noticed that since the minigrid came online, “Many businesses have been growing—like those that have been using it for grinding, pepper grinding, the flour mill, and others.” He hopes that the minigrid and the constant electricity availability will continue to attract new investment in homes and businesses across Mokoloki.

Project Partners



Ibadan Electricity Distribution Company (IBEDC) 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 (Nayo Tech) 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.



RMI is an independent nonprofit founded in 1982 that transforms global energy systems through market-driven solutions to align with a 1.5°C future and secure a clean, prosperous, zero-carbon future for all. RMI conceptualized the project, providing advisory support to IBEDC and Nayo Tech and guiding negotiations around the first-ever tripartite contract.

Further Reading

- [Mokoloki Project Updates at rmi.org](#)
- [Under the Grid](#)
- [Electrifying the Underserved](#)
- [Agricultural Productive Use Stimulation in Nigeria](#)
- [Minigrids in the Money](#)

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