



Nasarawa mini grids by Husk

Lessons from a market leader’s experience in deploying hybrid solar mini grids across central Nigeria

Headquartered in the United States, Husk Power Systems (“Husk”) is a global leader in the decentralised sustainable energy sector, serving rural and peri-urban communities in India and Nigeria. This case study looks at Husk’s experiences to date in Nigeria, specifically in the deployment of solar hybrid mini grids in 35 isolated off-grid communities since 2021. So far, these mini grids provide electricity to just over 5,000 households, businesses and public institutions. Husk’s journey in tailoring a tried-and-tested technological design and business model to the Nigerian context provides valuable lessons for other market players and new entrants.



Figure 1. Husk’s mini grid in Gidan Buba, Nasarawa state (Source: Husk Power Systems)

General information

Project name	Nasarawa solar hybrid mini grids (2021-2024)
Developer	Husk Power Systems, www.huskpowersystems.com
Location	35 communities in Nasarawa State, Nigeria
Focus dimension	Business and financing model
Type of action	Electrification intervention
Financing sources	Equity, debt, grant
Technology	Hybrid solar mini grid

Introduction

With a fleet of over 300 mini grids currently in operation, Husk Power Systems is a global leader in the sector. Husk was founded in 2008 in India, where it builds, owns and operates mini grids in the states of Bihar and Uttar Pradesh and serves 50,000 businesses, small factories and households. Following Husk's extensive experience in India, the company chose to enter the Nigerian market due to a combination of factors: some key similarities in the target customers, a favourable regulatory environment for mini grids, and a large potential for scale.

The company began operations in Nigeria in 2020 and by October 2021 its first mini grid was unveiled in Nasarawa state, in central Nigeria. In under a year, Husk had rolled out mini grids in another 11 communities in Nasarawa, and by mid-2024 had a total of 35, making Husk a pioneer in terms of speed of deployment and scaling mini grids in Nigeria. Husk's 35 mini grids have been operating continually and currently serve over 5,000 households, businesses and public institutions. The mini grids are distributed across six (6) Local Government Areas (LGAs) in the state of Nasarawa including Doma, where Husk commissioned its first mini grid in 2021.

Key figures

- 35 mini grid sites in Nasarawa (12 of which operating since 2021)
- 1MWp installed
- 5,000 households, business and public institutions
- 130 jobs created, of which 80 full time
- 103 million USD in debt and equity raised, most of which is intended to support further expansion in African markets, including Nigeria mini grids

This case study first outlines Husk's technological approach and business model as it relates to the Nasarawa mini grids. It then describes Husk's experience to date in terms of accessing finance, and how the deployment of its first mini grids unlocked further financing and will enable future expansion across Nigeria. Finally, it describes the observed social impacts and draws some conclusions on the potential for replication of the model.

Technology and operational model

Husk's Nasarawa mini grids have a very consistent design consisting of a 50kWp PV array, lead acid batteries and inverter, and diesel generator (required by Nigeria's regulator) for backup. Since the communities did not previously have any electricity distribution infrastructure, a new distribution grid was built, connecting the generation units to between 400 and 1,500 households and businesses depending on the community. With regards to the day-to-day operation and maintenance, there are 3 to 4 community members trained and employed by Husk per site, including a local electrician, a security guard and a sales agent.

A standardised, modular approach to the power generation unit is one of the pillars of Husk's business model in India. Most of the generation equipment is manufactured and assembled off-site and transported to the community for installation (Tenenbaum et al., 2024). This systematic "platform" approach has been applied in Nigeria as well and is considered key to achieving economies of scale and ensuring its electricity services are affordable (Nextier Power, 2023; Mattson et al., 2022).

Site selection was guided by Husk's approach to building mini grids within geographical clusters (Tenenbaum et al., 2024). There were also a series



Figure 2. Husk's mini grid in Kiguna, Nasarawa state (Source: Husk Power Systems)

of practical considerations: the state of Nasarawa presented key opportunities such as an economy largely based around agriculture and closeness to Nigeria's capital Abuja. The latent demand is also considerable: average electricity access rate in Nasarawa is 43% (NBS, 2020), below the Nigerian average of 55%.

Husk estimated electricity demand in the Nasarawa communities prior to the technical design. For this, the Husk team in Nigeria surveyed how many fossil-fuel based generators were currently in use and had exchanges with the community leaders to get an indication of the current and latent demand in each community.

Some of Husk's larger mini grids in India also integrate a biomass gasification system (typically powered by rice husks) alongside the solar PV array. This is currently not the case in the mini grids in Nigeria. However, Husk is keen on testing this additional technology later on, in particular in areas which have high potential for availability of agricultural waste.

One key technological innovation and cost-reducing strategy in Husk's mini grids is a digital remote management and monitoring system that includes smart metering, IoT and predictive AI. These lower the cost of operations and maintenance and ensure quality and reliability of the service, optimising load management and minimising downtime. Moreover, they are key to effective revenue collection (see business model section).



Figure 3. Installation of one of the mini grids (Source: Husk Power Systems)

Business model

Two of the central pillars of Husk's business model are their full ownership and operation of the mini grids, and the focus on a blended mix of commercial and household customers, rather than relying on one anchor customer. In its Nasarawa mini grids, Husk's approach to sales, tariffs, appliance financing and other aspects of its business model are similar to the approach used in India. For example, both its household and business customers are billed on a pre-paid basis, using smart meters. Furthermore, Husk's proprietary digital tools are central in customer management: they monitor customers' power generation and consumption, distribution losses and a range of other parameters.

In the Nasarawa mini grids, households and businesses pay both a connection fee and a tariff according to energy consumption bands. For example, an entry-level monthly package meeting basic household needs costs 10,000-15,000 naira (Nigeria's local currency, currently equivalent to USD 6-9). While mini grids in India have tariffs that change depending on the time of the day, this is not the case in the Nigerian mini grids. Tariffs however do vary across different customer segments. Due to rising inflation and Nigeria's recent macroeconomic context, including currency devaluation, mini grids installed recently saw a rise in agreed tariffs as compared to the mini grids deployed in 2021.

Tenenbaum et al. (2024) reports that Husk's Nigerian mini grids reached the same levels of average revenue per user (more than USD 12 per month) after 6 months of operation, whereas it took Husk more than 3 years to reach these levels in India. Moreover, Husk reported that 80% of customers in the Nigerian mini grids are currently making payments online through a basic version of their customer-facing mobile app. The rest are collected through point-of-sale agents in the communities. Seasonality plays a key role in customer



Figure 4. Customer using rice mill (source: Husk Power Systems)

payments - the business model in Nasarawa mini grids must adapt to the seasonal changes in income from farming households.

The promotion of energy use is integral to Husk's business model. In the Nasarawa mini grids, a number of demand stimulation options are being tested and implemented. On the one hand, Husk makes financing available for individual customers who want to purchase an appliance. In this respect, Husk acknowledges that the lack of financial histories for individuals is a challenge, requiring a strong presence in the community and understanding of customer needs and payment abilities.

On the other hand, a number of shared use energy services are being piloted in the communities, including cold storage, crop processing and e-mobility (e-motorcycle leasing and battery swapping). For example, in the market of the Sabon Gida community, and with support from the [Energizing Agriculture Programme](#), a cold room with a storage capacity of 3.75 tonnes was set up. It was introduced in partnership with cold storage solutions company Ecotutu and operates on a cooling-as-a-service basis (Fresh Produce EMEA, 2023). Husk also built a rice processing facility in the village of Kiguna, with support from the [Water and Energy for Food Grand Challenge](#) (WE4F, 2024), which works with local women farmers to aggregate rice production, and increase incomes through value addition.



Figure 5. Husk's mini grid in Idadu

Financing

The financing journey for Husk's Nasarawa mini grids started in 2018 following an investment of USD 25 million from Shell Ventures along with other equity investors. While most of these funds sustained the expansion of Husk's mini grid fleet in India, it also initiated Husk's entry into other markets. In 2021, Husk accessed support from the Rural Electrification Agency's (REA) [Nigeria Electrification Project](#) (NEP), an initiative financed by the World Bank and the African Development Bank. These performance-based grants amounted to USD 600 per connection in 9 of the mini grids and were crucial to helping Husk achieve commercial viability in the Nasarawa mini grids sooner than expected.

In late 2022, Husk's EBITDA (earnings before interest, taxes, depreciation, and amortization) became positive, both in its Nigeria and India markets. This means that revenues from Husk's Nigeria's mini grids were sufficient to cover their variable and fixed operation costs, making Husk "the first and only mini grid company operating solely in developing countries to report operational profitability" (Tenenbaum et al., 2024).

In the wake of this announcement, and once all the first 12 Nasarawa mini grids were operational, Husk raised further funding for its operation in Nigeria. This included USD 20 million in debt financing from the European Investment Bank (EIB). The financing will support the development of new mini grids in 150 rural communities in Nigeria, but also allow Husk to expand its business in the installation of rooftop solar for commercial & industrial (C&I) customers, sale of appliances to households and small businesses, and the provision of energy use services such as agro-processing and e-mobility (EIB, 2024). The EIB financing is part of a total USD 103 million which Husk raised in 2023 (USD 43 million in equity and USD 60 million in debt financing). About two-thirds of this financing will be directed towards Husk's new mini grids in Sub-Saharan Africa (principally Nigeria) (Tenenbaum et al., 2024).

Husk has also secured a USD 750,000 5-year loan under the Up-Scaling programme of the [German Investment and Development Cooperation](#) (DEG). The latter is specifically intended to finance the construction of 8 additional plants in Nigeria and is seen as a means to unlock additional debt, including in Naira (Omofe-Sunday, 2023).

Social and environmental impacts

Over 5,000 households, business and public institutions including religious centres, healthcare centres, and communal areas have been directly impacted by Husk's Nasarawa mini grids. Given the short period of operation of most of these mini grids to date, detailed figures on observed impacts are not yet available.

The mini grids are all located in small geographically isolated rural communities that had not yet received service from the local utility, Abuja Electricity Distribution Company (AEDC). Households and businesses either relied on fossil-based generators or had no electricity whatsoever prior to the construction of the mini grids.

With regards to those previously reliant on self-generation, early reports by Husk indicated that up to 50% of diesel generators in the communities were taken offline within the first year of each

mini grid's operations, and that customers saw their monthly energy costs drop by up to 50% by switching from diesel to solar (Husk, 2022).

Data regarding the impacts on households without any prior access to electricity are not yet available. Husk reports that engaging with potential customers who are accustomed to living without electricity requires particular attention as they may be indifferent or resistant to the prospect of having reliable power.

Tenenbaum et al. (2024) report that up to date the share of Micro Small and Medium Enterprises (MSME) customers is lower in the Nasarawa mini grids than in Husk's India mini grids. In the future, it would be interesting to study further what are the impacts of Husk's mini grids on MSMEs.

In terms of Husk's approach to public services in the mini grid communities, schools and health centres in the community do not pay connection fees and pay only for the power consumed (Rowling, 2022).

Future Outlook

The future outlook for the Nasarawa mini grids (the focus of this case study) is an increase in installed capacity as demand grows. More generally, Husk's "Africa Sunshot Initiative" (Husk, 2023) has the following targets specifically for Nigeria:

- Build 100 mini grids by the end of 2024, 500 by 2026 and 1,000 by 2028
- Provide 400,000 connections
(5% of the connections needed to achieve Nigeria's electricity access goals)
- Impact 2 million Nigerians (1% of the total Nigerian population).
- Displace at least 25,000 diesel and gasoline generators.
- Deliver affordable energy to 5,000 MSMEs
- Electrify 700 public health clinics and 200 schools

A number of local staff are hired in each community (see Technology and operation section) Moreover, a village power committee was formed for each mini grid, as required by national mini grid regulation. Each committee is composed of 12-15 community members, including at least one woman and one youth representative. Husk also has a seat in the committee, and this serves as one of various channels to engage with the users and resolve demands and queries.

Replicability

The Nigerian market presents an immense opportunity for mini grids. The REA aims to roll out 10,000 mini grids, each with a capacity of 100 kW, by 2030. This would mean close to 2,000 mini grids are deployed annually in the coming years.

While still far from that pace of deployment, Husk's experience in Nasarawa has demonstrated the possibility of deploying mini grids simultaneously within geographical clusters, at a rate that is significantly higher than previously seen in Nigeria. As of 2024, Husk was adding an average of 5 mini grids per month.

The fast and effective deployment of the Nasarawa mini grids hinges on Husk's transfer of the company's robust knowhow from India into a new context (coupled with Husk's success in raising debt, equity and grant financing). Nonetheless, Husk's experience provides valuable lessons for other market players and new entrants in terms of replicating elements of its model. These include the modular approach to infrastructure design, the choice of clustering multiple mini grid locations within a particular area, the strong emphasis on demand stimulation, and the active engagement with the customers.

In terms of leveraging its own experience to date, Husk has ambitious plans for scaling up its operations in Nigeria, including the target of building 1,000 mini grids in the next 4 years (see further



Figure 6. Mini grid distribution network at the Igbabor community (Source: Husk Power Systems)

details in Future outlook section). The firm recently partnered with REA with the goal of deploying up to 250MW of decentralised renewable energy projects, including mini grids, rooftop C&I solar, productive use of energy (PUE) and appliance sales and financing. Another of Husk's key targets is the building and operation of interconnected mini grids in collaboration with distribution companies (Discos). To this end, Husk is looking at selecting suitable states and locations in Nigeria where a large number of mini grids would be viable. For a particular location to be suitable for tens or hundreds of mini grids, there must be sufficient existing economic activity as well as potential for new markets. In this context, Husk reports that Nigeria's recently approved Electricity Act opens an opportunity for engaging directly with state governments in the identification of areas of high potential for mini grids.

In its Industry Roadmap, Husk has shared its position regarding the needs of the Nigerian and African mini grid sector as a whole (Mattson et al., 2023). This includes the need for a new unified approach to measuring costs, moving away from the prevailing "cost per connection" approach, and centred around a more future-looking Levelized Cost of Energy (LCOE) metric. Moreover, there is a need to accelerate public-private partnership arrangements with governments (Kene-Okafor, 2023).

Lessons learnt

Husk has tailored a well proven model to a different environment, testing its approach across its initial 12 mini grids before expanding across Nigeria. Some of the lessons from the Nasarawa mini grids to date include:

- The standardised modular approach used for the design and installation of the generation and distribution infrastructure was key to achieving economies of scale.
- Considerable effort went and still goes into promoting energy use, either via financing of energy use appliances to individuals and businesses or the deployment of community-scale energy services.
- Maintaining very active customer relations and fostering trust is essential to ensuring operations and long-term sustainability.
- Attitudes towards power vary among different customer segments. Implementing tailored approaches for customer engagement and service delivery is essential to maintaining positive customer relations.

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Figure 7. Husk's mini grid in Akura, Nasarawa state (Source: Husk Power Systems)

Further resources

For more insights into the key needs for scaling the mini grid market across Africa, as seen from a mini grid developer's perspective, see Husk's "Scaling Solar Hybrid mini grids: and Industry Roadmap" (Mattson et al., 2023).

Husk's Youtube channel: <https://www.youtube.com/channel/UCnczhw6ETBu3xGUYfg8XmYQ>

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