Case Study Report:
The Interconnected Mini-grid of Wuse Market, Abuja

Deliverable under the GEF/ECN Derisking RE project *DREI Analysis & Report for Solar PV Technology in Nigeria*, Contract No. C0408JOPDBFR04 & Addendum
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Background and objectives of this case study

Solar PV Interconnected Mini-Grids (IMG) or under grid system have been identified as having high potential in providing either support service to the main grid or direct primary electricity supply to end-users that are underserved, with the support of the main grid (IRENA Renewable Mini-Grids: Innovation Landscape Brief, 2019). As part of the efforts from the Federal Government of Nigeria to improve the poor energy situation in the country, the Rural Electrification Agency (REA) in Nigeria, which is the government organization responsible for promoting off-grid energy solutions, introduced the Energizing Economies Initiative (EEI) program to incentivize the development of IMGs. The objective of the program is to support the rapid deployment of off-grid electricity solutions to micro, small, and medium enterprises (MSMEs) in economic clusters such as markets, shopping complexes, as well as agricultural and industrial areas, through private-sector developers. The Wuse Market Interconnected Mini-Grids (IMGs) project in Abuja, Nigeria under the EEI is the first IMG project in Nigeria. Wuse Market is in Abuja, the Federal Capital Territory of Nigeria. It is an expansive market with installed booths accommodating over 5,000 traders.

In pursuit of the objective of the EEI, a Nigerian renewable energy firm, Green Village Electricity (GVE), signed a tripartite agreement with the Abuja Electricity Distribution Company (AEDC) and the Wuse Market Traders Association (WUMATA) for the development of a one-megawatt interconnected mini-grid system. The Abuja Markets Management Board (AMMB), which is responsible for all markets in Abuja gave the approval for the infrastructure to be installed in the market.

The project is designed to proceed in phases. The pilot phase (Phase 1) is completed and has successfully connected 30 traders. The installation of additional machinery, as part of the second phase (Phase 2), has been interrupted by the COVID-19 pandemic. The target is that upon completion, the project will provide 24 hours of electricity year-round to over 5,000 traders who operate in the market. It is expected that when the IMG comes on full stream, over 3,000 diesel and premium motor spirit powered generators will be rendered redundant. This will reduce the dependence on costly fossil fuel and significantly reduce greenhouse gas (GHGs) emissions. The current enumerated load requirement for the market is 969KW (REA Wuse Market Energy Audit Report, 2019)

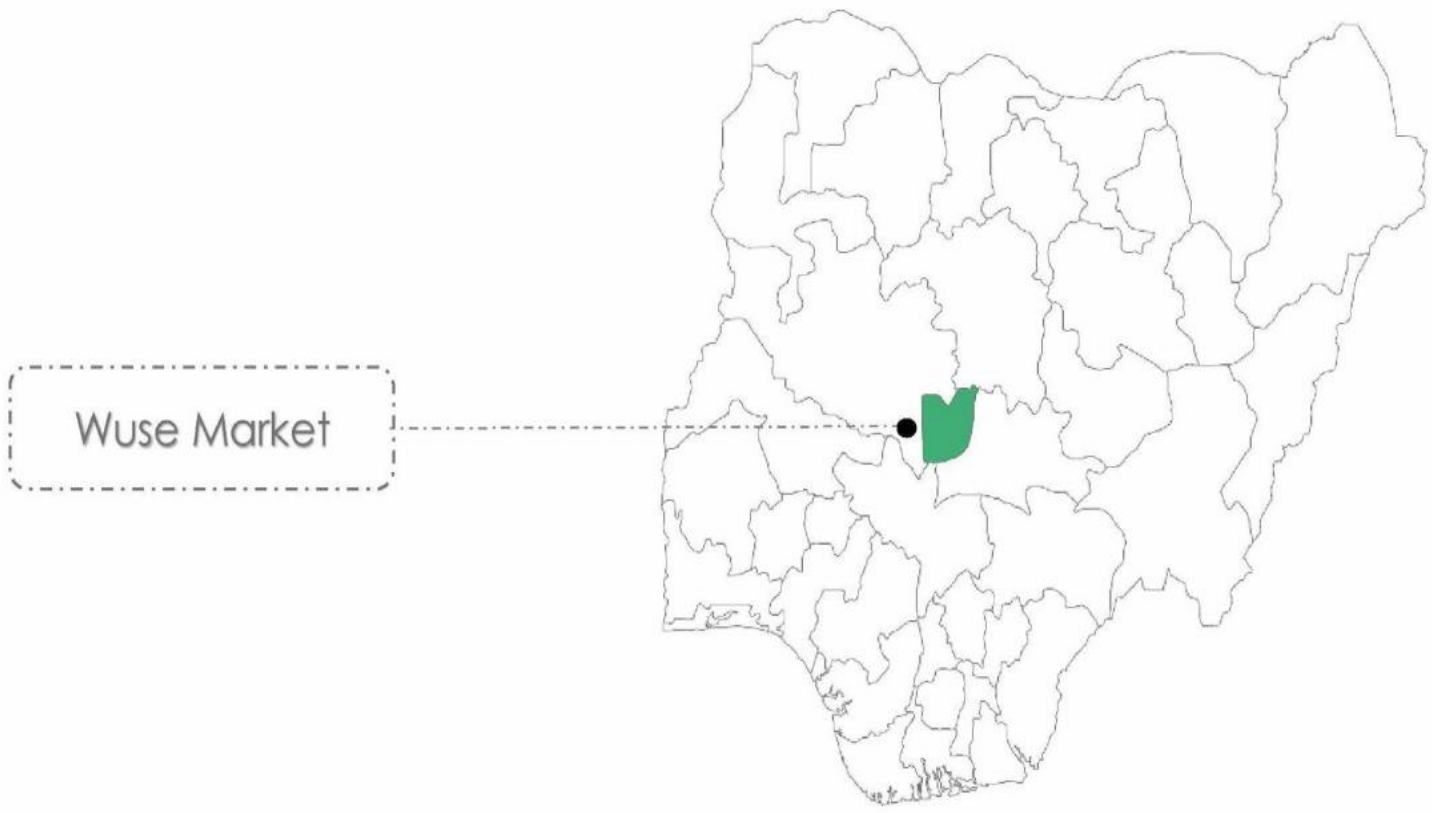
This case study has been undertaken as part of a derisking renewable energy investment analysis for an interconnected mini-grid solar PV project in Nigeria. The project is being sponsored by the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) for the Energy Commission of Nigeria (ECN). The overarching objectives aim to identify the key risks and barriers to scaling-up private investment in the development of IMGs, proffer an appropriate policy mix to substantially reduce the identified risks and barriers, and disseminate a summary report of the study to stakeholders.

Although the IMG project in Wuse Market is at an early stage of implementation, testimonies from the connected traders and skilled entrepreneurs confirm a high level of satisfaction with the electricity services made available through the new system. The Wuse Market experience has already triggered the interest of other markets and shopping complexes in the city (based on an interview with executives of the market association).

This case study report identifies and explains the stakeholders' roles, the important lessons learned, and the main challenges stakeholders have experienced so far.

Aerial view of Wuse Market

Location of Wuse Market

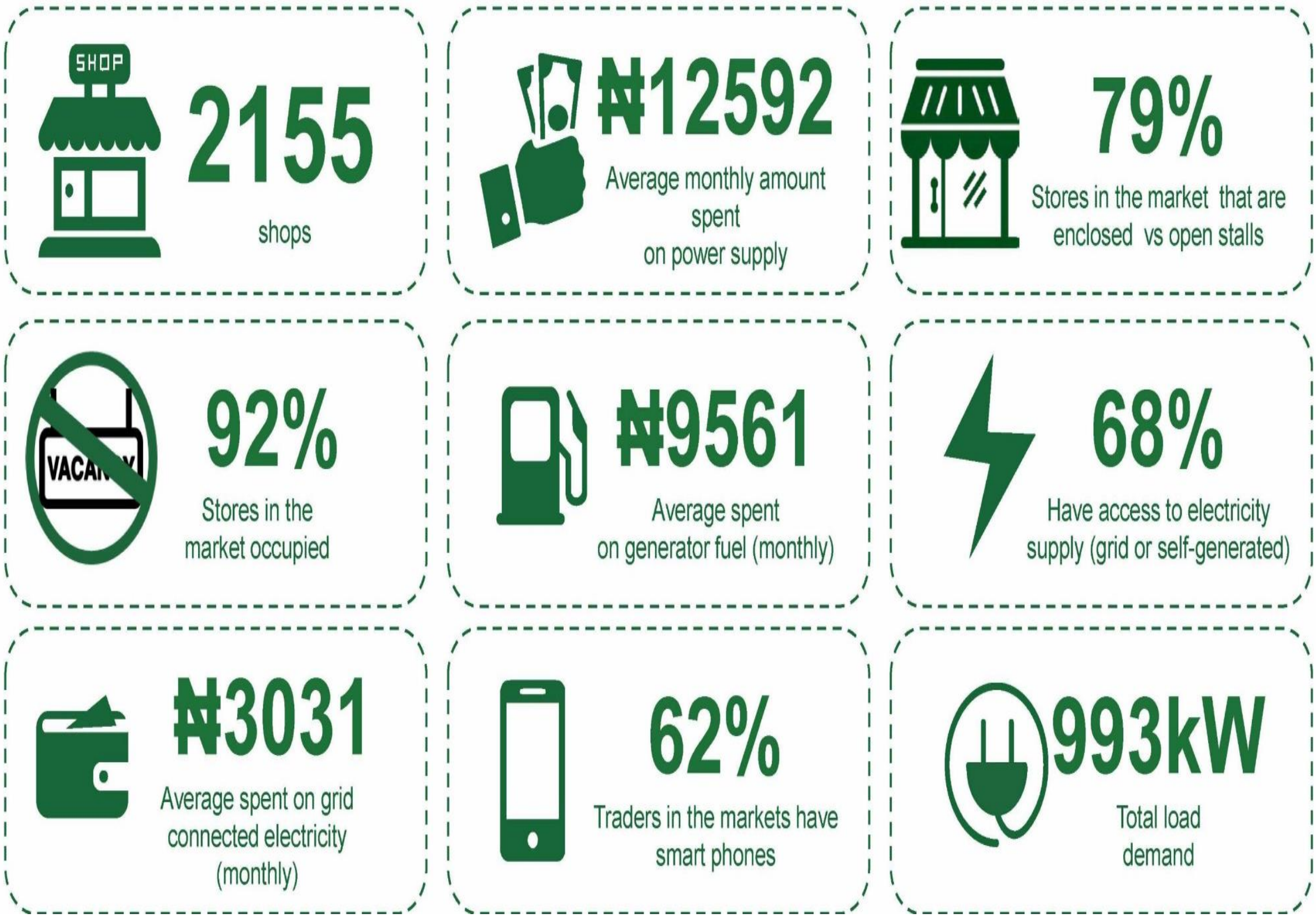


Profile of Wuse Market

- The market is located in Zone 5, Wuse district in Abuja Municipal Area Council (AMAC).
- The 5000 shop owners predominantly trade fast moving consumer goods (FMCG), as well as cloth production and crafting leather shoes, handbags and other leather products.
- Approximately 92% of shops are occupied, while 8% are locked up or unoccupied.
- The market complex is divided into four sections: two trader sections (A & B), a cold room section, and a warehouse section.

Wuse market is one of the city's leading commercial hubs that generate significant economic returns.

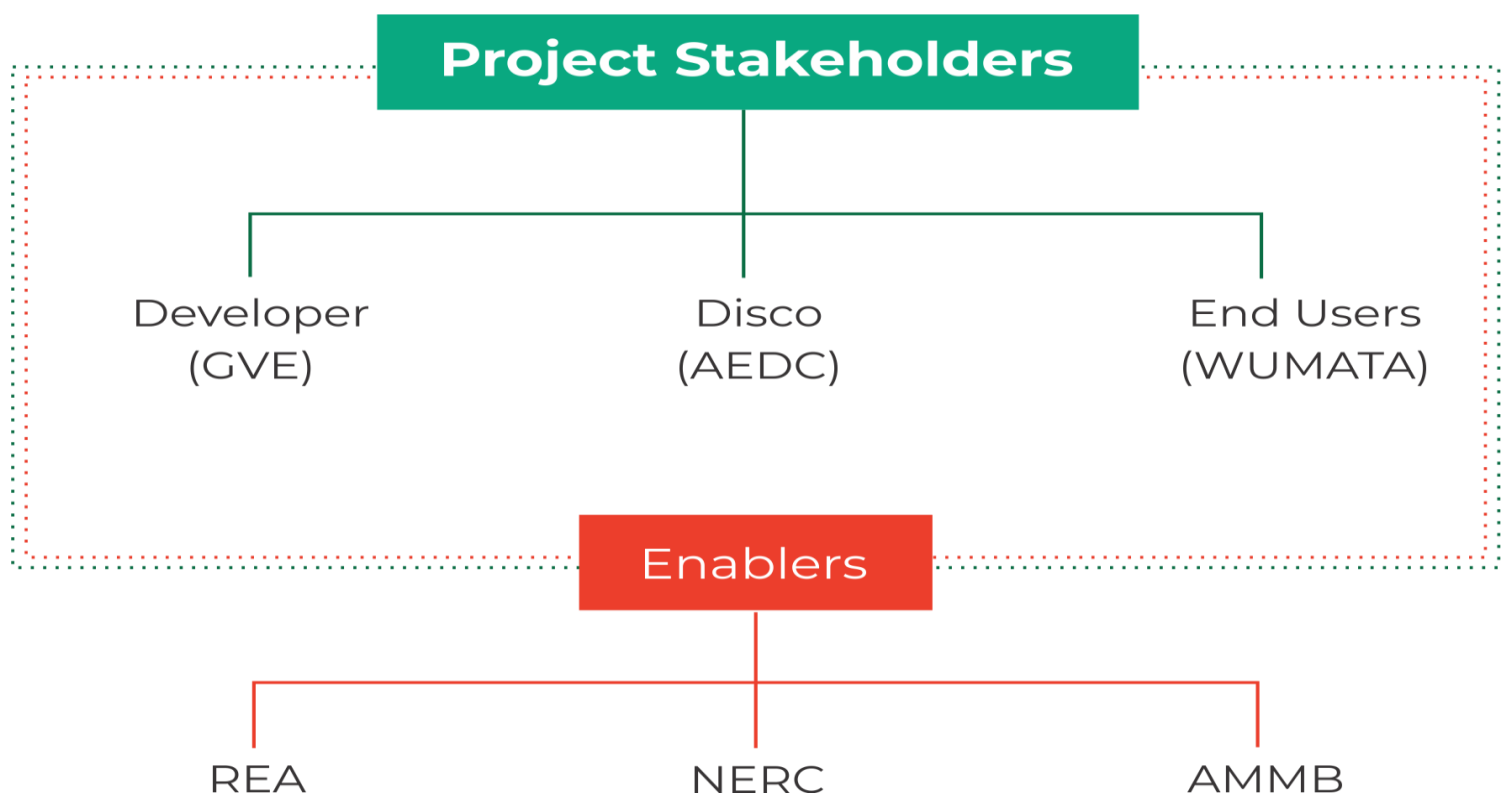
Main results from Wuse Market energy audit report



During the energy audit by REA/AEDC, it was revealed that 99% of traders interviewed prefer a commercialized solar energy system that is reliable and cost effective.

REA Energy Audit Report, 2019.

Wuse Market IMG stakeholders



Stakeholder's Roles	GVE	AEDC	WUMATA /AMMB	REA	NERC
Grant permit for power generation					
Policy to guide project operation and delivery mechanism					
Investment of capital					
Identification of project site					
Engagement of market traders					
Obtain regulatory approval					
Fore-runners of the Energizing economics initiatives					
Provision of non-financial assistance such as research and energy audit					
Own generation					
Manage relationship with traders					
Owner of distribution					
Operate and maintain distribution					
Operate and maintain generation					
Provision of meters, billing, and collection					
Monitoring and evaluation					

Leading Role Supporting Role Minimal Role

Project description

The IMG project in Wuse market is operated by GVE in consultation with AEDC, the market traders association, and other stakeholders such as REA, NERC and AMMB. It maximizes the developer's autonomy while limiting the risks and responsibilities of DisCo-AEDC and the traders throughout the project lifetime. At the same time, financial risk from ownership of the system is borne primarily by GVE. In addition, interaction with traders revealed that the introduction of the mini-grids has thus far increased productivity, income, and profitability from goods and services because of the provision of reliable and accessible power supply.

Source: extracts from the stakeholder interviews.

Roles and contributions of main actors

Developer - GVE

Role: Generation and storage, asset ownership and investment, mini-grid operation, and customer engagement.

Challenges: The COVID-19 pandemic has posed a major challenge to scaling up the connection of shops in the market beyond the pilot phase. However, efforts are being made to address the situation and get more blocks and shops connected to the grid.

Outcomes so far:

- About 30 shops have been connected to the grid.
- Provision of 24-hour reliable power supply without disruption from technical operations or weather conditions.
- Connection is done at no cost to the customer. This strategy has helped to build trust and confidence amongst traders to support project objectives.
- A cost-reflective tariff system: cheaper and accessible to traders.
- Improved relationship and communication with market traders through an effective feedback mechanism.
- Efficient metering, billing, and collection process improves revenue collection.

DisCo - AEDC

Role: Distribution of asset ownership, service provision (partial supply of energy to the grid in order to power the PV batteries).

Challenges: Slow implementation of phase two due to COVID-19, engineering operations, bottlenecks causing delay in permit, and commercial issues including complicated billing and the use of the distribution network.

Outcomes so far:

- AEDC gets payment for the energy used by GVE and some payments for the use of the network.
- Projected increase in revenue collection and minimal interface with customers will provide the opportunity for the DisCo to recuperate funds faster.
- Increased confidence in the DisCo by customers to support reliable and accessible power supply.

Customers- Wuse Market traders

Role: WUMATA is responsible for organizing traders to mobilize support for the project. The association participates in monitoring, evaluating, and assessing the impact of the mini-grids.

Challenges: There are some resentment and distrust from certain customers who are yet to embrace the project. Such customers may become targets of AEDC staff who could use them to sabotage the process because they are unable to ‘’cut-corners’’ with defaulting customers during compliance (metering and billing payment) monitoring activities.

Outcomes so far:

- Significant increase in the productivity, income and profitability of traders connected to the mini-grid.
- There is preference for the use of mini-grids as opposed to public power service (power provided by AEDC) because the mini-grid has been more efficient and reliable.
- Customers were able to negotiate a lower tariff payment (₦55/hr) in comparison to what is spent on fuel/diesel generators and the grid-connected electricity supply (monthly average ₦ 12592 or $32.7).
- The negotiated tariff system afforded customers with the opportunity to weigh their options between the mini-grid system, the main grid and fuel/diesel generating sets.
- Customers are saving money by using the mini-grid instead of fuel or diesel generating sets.

Source: extracts from the stakeholder interviews.

Current set up

The complete installation of phase 1, the on-going installation of phase 2, and a customer metering device.

Installed and connected equipment, phase 1.

New installation as part of phase 2, currently interrupted.

Metering device

Traders' feedback

"I trust the operations of GVE, they have done well in managing traders' expectations. It was very difficult to get all parties to the table – but once we were able to agree on the terms, everyone became happy."

"Beaurocracy and bottlenecks associated with project implementation could have been avoided if consultation was undertaken early on."

"Some market associations all over the city have heard of this project and would like to be part of it and enjoy the same benefits as us."

"It is cheaper for us to be connected to the mini-grid and ''pay as you go'' compared to the public service provided by AEDC."

"In my opinion the AEDC should be commended for supporting traders desire to get reliable and available power. This goes a long way to show they are open to innovations to support clean energy and generator-free economic clusters such as Wuse Market."

"We have not experienced any disruption in power supply due to technical issues or weather condition.

"As a tailor, I can testify that my income and productivity has significantly increased since my shop was connected to the mini-grid system."

Source: Extracts from the stakeholder interviews.

Summary of lessons learned from the IMG project in Nigeria

The experience gathered so far in developing the interconnected mini-grid project in Wuse Market offers a few lessons for stakeholders in the industry. Overall, the pilot project has proven successful at providing higher quality and more reliable energy supply than the main grid (provided by AEDC) while at a relatively affordable tariff rate, as agreed in the tripartite contract. The main takeaways from the study are as follows:

- **Stakeholder engagement and communication:** Transparent project objectives allowed for cross-sector engagement to cultivate the trust required for implementing the project. It also made it possible for parties to the tripartite contract to collaborate in the coordinating the progress of the project. This helped expedite the project's development by avoiding misunderstandings related to a novel market segment, such as interconnected mini-grids.

- **Sustainable partnerships:** To promote mutual benefits rather than competition, project stakeholders were approached to put ''all their cards on the table'', in terms of what they can offer to ensure that standardization and due process are followed. This served as a strategy to shorten project delivery time and reduce expenditures. For example, involvement of the Rural Electrification Agency (key enabler for the project) provided technical support to undertake an energy audit of the market. The findings from the report provided a good starting point with regards to the preparedness and enthusiasm of the traders towards the IMG project.

- **Reinforced customer trust:** Engagement with the Wuse Market Trader's Association(WUMATA) and Abuja Market Management Board (AMMB) ensured a strong buy-in of the project. Particularly, traders became confident of the project's benefits when the developer (GVE) connected them to the infrastructure at no cost. This approach undertaken by the developers helped boost the customers' (market traders) perception of DisCo and demonstrated their commitment to giving higher quality of service.

- **Contract terms and period:** The long-term contract period of 20 years agreed by the stakeholders allows the developer (GVE) and DisCo to maintain commercial viability. The feedback from end-users and stakeholders' reveals that the long-term contract of five-year review intervals offers them the opportunity to monitor and evaluate performance to determine project continuity or termination. However, there is no clarity as to what will happen to the contract in the event of expropriation of the DisCo by the Federal Government.

- **Project phase segregation**: Implementing the project in phases allows for effective monitoring of the implementation by project partners. Their participatory experience will improve project development, operation, maintenance, and customers' engagement in later phases when the installations are ramped up. A phased roll out of a project can help build customers' trust and appreciation of success while stimulating greater collaboration.

- **Early permit approvals and negotiation**: Beaurocracy and bottlenecks delayed the permit approvals from NERC and affected the outcome of the commercial terms between AEDC and GVE, especially with regards to the pricing mechanisms and tariff system. There are ongoing discussions to address these issues. It is important to note that fast-tracked permit approval processes and comprehensive negotiation amongst parties would reduce time inefficiencies and propel momentum towards project implementation.

Source: Extracts from the stakeholder interviews.