ZE-Gen.

Powering Life With Zero Emissions Generators

Understanding Nigeria's Fossil Fuel Generator Challenge

Profile of generator customer segments

Summary report

January 2026

ZE-Gen.

Contents

Introduction to ZE-Gen

Zero Emissions Generators (ZE-Gen) is a collaborative, cross-sector initiative to tackle sector barriers and accelerate innovation to advance renewable energy-based alternatives to fossil-fuelled generators.

What problem ZE-Gen is looking to address

Reliance on generators has significant, negative impacts on people and planet. The unreliability and limited reach of national grids across the globe has resulted in a reliance on fossil fuel generators, but at huge financial, environmental and social cost.

Economic

- **$28-$50 billion:** spent each year on diesel and petrol for FFGs[1]
- **6X:** Electricity from FFGs can be 6 times more expensive than from the grid[2]
- **5-7%:** Grid instability can cost emerging economies 5-7% of GDP[3,4]

Environmental

- **70%**: FFGs account for up to 70% of power sector emissions in some countries[5]
- **700 – 1,000:** FFGs have an installed capacity across emerging economies of 700 to 1,000 large coal power stations[2]
- **550 MtCO2e:** in cumulative emissions projected between 2021 - 2030[6]

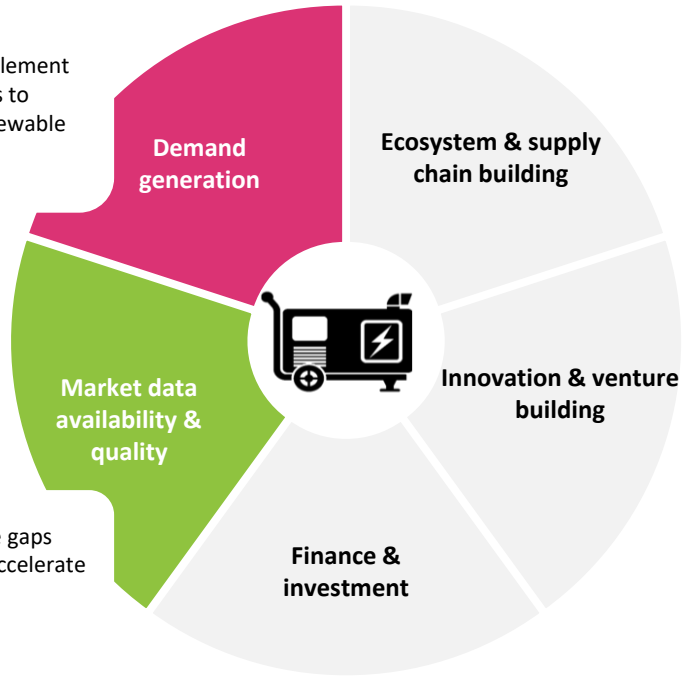
Health

- **70%:** increased risk of lung cancer[5]
- **2 in 3**: users of FFGs suffer hearing damage[7]
- **800,000:** premature deaths in 2020 across Africa linked to FFG use[8]

How ZE-Gen is addressing this problem

Scaling-up deployment of renewable alternatives to FFGs at scale requires cross-sector action – **ZE-Gen's five key focus areas aim to unite the sector and drive progress.** Of these, demand generation and market data are particularly relevant to the research summarised in this report.

Understand the target audiences and implement effective tools and promotional strategies to generate awareness of and desire for renewable energy-based alternatives.



Identify and address evidence gaps and engage stakeholders to accelerate the displacement of FFGs.

Sources: *1) World Bank (2016), link; 2) IFC (2019), link; 3) World Bank (2018), link; 4) World Bank (2023), link; 5) SEforAll (2024), link; 6) Shell Foundation & Rockefeller Foundation (2021), link; 7) Akinnubi et al. (2024), link; 8) IEA (2022), link*

Study background

ZE-Gen conducted two complementary studies to understand the Nigerian fossil fuel generator (FFG) market: this is an overview of the key insights.

Together, these studies help close data gaps, deepen customer understanding, and support the development of an evidence-based strategy for introducing renewable energy alternatives. Each report will be published individually, and we'd like to use this analysis **as a starting point for a deeper discussion and data-driven decision-making in the sector.**

	Market analysis	User data
Objective	**Understand Nigerian FFG market and identify barriers and opportunities for clean energy transition.**	**Smart meter deployments and surveys to capture real-world usage patterns.**
Key elements	• Stakeholder consultations and desk research to estimate **market size** and **growth** trends. • Supply-side analysis of **import reliance**, **pricing**, and **distribution**. • Demand-side analysis of customer **segments, willingness** to transition, and **financing** needs. • **Barrier analysis** to identify obstacles to the cleaner genset adoption.	• **Deployment of ~500 smart meters** across five priority use cases and analysis of **12 months of data.** • Real-time data on **power output, operational hours and frequency**, offering insights into consumption patterns across customer use cases. • **Complementary surveys** capturing generator specs, costs, and attitudes toward clean alternatives.
Outputs	• Market opportunity analysis • Customer segment overviews • Recommendations for enabling policies and financing mechanisms	• Customer usage profiles and behavioural insights • Open-source data via PROSPECT platform • Technical specifications for solar alternatives.

Why this matters for…

Product developers and distributors

Usage profiles and load data allow design of solar gensets that meet real-world needs, improving reliability and affordability.

Investors and lenders

Data identifies market size, customer willingness to pay, and viable financing models, enabling better risk assessment and targeted investment.

Donors and development partners

Insights identify high-impact sectors like healthcare and education, helping prioritise funding and maximise social benefits.

Policymakers

Research provides evidence to reform customs tariffs, enforce quality standards, and design supportive policies that accelerate solar genset adoption.

Assumptions and methodology

Context is essential: analysis of Nigeria's energy sector is highly sensitive to fuel price volatility, grid supply assumptions, and usage patterns

Three key factors impacting energy economic modelling

Fuel price volatility and Naira depreciation make energy cost modelling highly uncertain. Fuel prices have soared by more than 80% since 2023, while the Naira has continued to depreciate against the US dollar.[1] This has made fuel significantly more expensive for Nigerians even as monthly spend in USD terms has declined. Therefore, shifts in the fuel costs and FX market result in considerable uncertainty in energy cost modelling.

Assumptions of uninterrupted grid supply misrepresent true costs. Estimating monthly grid energy costs (kWh × cost per kWh) assumes 24/7 supply, but in reality, the average Nigerian household receives less than 7 hours of grid electricity each day.[2] Electricity tariffs are structured around availability bands (e.g., 12, 16, 20 hrs/day), with the cost per kWh in the 20-hour/day band costing three times more per kWh than the 16-hour band.[3] Therefore, limited availability and tariff banding making grid electricity appear cost-effective on paper, but in fact force widespread reliance on FFGs.

Low load factors, frequent maintenance and variable user behaviour undermine efficiency and cost accuracy. FFGs in Nigeria typically operate at ~20%[4] capacity, and economic models that assume optimal load levels tend to underestimate fuel costs and overstate efficiency. Maintenance demands are heavy, with 82% of surveyed generators requiring monthly repairs, and 18% weekly.[4] Diverse usage patterns and maintenance practices further complicate modelling and planning.

How are monthly fuel costs calculated?

Variable	Value
Load factor[4]	20%
Litre per kWh[4,5]	2
Price per Litre Petrol[6]	1,200 NGN
Exchange rate (NGN–USD)[7]	0.00068

Monthly fuel costs =
Monthly energy in kWh
x Litre per kWh
x Price per Liter
x Exchange Rate

A2EI study's methodology for calculating monthly fuel costs*

- 12 months of data from the 500 smart meters used to analyse monthly energy consumption across FFG use cases.
- Supplementary insights from user surveys used to support the calculation of load factors required for estimating fuel usage.
- Findings indicate an average load factor of 20% across use cases, with approximately 2 litres of fuel required to generate 1 kWh of energy.
- For consistency, a standard load factor of 20% was applied across all clusters due to minimal variation.
- Monthly fuel costs were then estimated based on energy consumption, FFG efficiency – which declines at lower load factors – and cost per litre of petrol.
- Detailed findings per use case, including load factors, monthly consumption, monthly fuel costs are available on the PROSPECT data platform.

Sources: *1) Reuters (2024), link; 2) Premium Times – Nigeria (2024), link; 3) Ikeja Electric Plc - Nigeria's largest power distribution network (2024), link; 4) A2EI survey data; 5) Previous A2EI research in collaboration with Nile University; 6) Nigeria Data Portal, link; 7) Xe Currency Converter, link;*
***Note**: The methodology for A2EI's metering and survey study can be viewed in their report:* ZE-Gen News Archives

Summary of findings

Accelerating Nigeria's FFG-to-solar transition…

The market context

Both fossil-fuel and solar generator markets continue to grow, as energy demand grows but the national grid remains unreliable or unavailable. The number of solar genset players is also growing.

Reliance on imports is high for these products, but **solar gensets currently face punitive customs tariffs, discouraging demand.**

High upfront costs and inflexible consumer financing are the key market barriers limiting the transition of FFGs to solar gensets in Nigeria.

Households, MSMEs, Universities, Healthcare Centres and Hotels identified as five key FFG customers representing high impact opportunities for a FFG-to-solar transition.

The customer context

The majority of generators in use are small: on average, power consumption remains around 0.5kW, with peak demands seldom exceeding 2.5kW. Daytime usage dominates in markets and schools, whereas evening/night usage powers households, health centres and hotels.

A common operating pattern is "little and often": typical use is 2-4 hours on active days, for ~10-25 days/month, varying by segment (e.g., off-grid markets use gensets more days than on-grid).

Fuel costs and repairs are a persistent pain. 82% of customers report monthly repairs, 18% weekly. Fuel price spikes contributed to 20% stopping generator use; 5% already shifted to solar.

100% of respondents express interest in adopting clean energy alternatives. Over 99% agree that accessible financing options are essential to making this switch a reality.

Design insights and recommendations

A standardised solar generator with a 2.5kW maximum output, paired with 1kW of solar panels and a 2kWh battery, **could meet around 85% of the energy requirements** for the surveyed customer base**

Producers can prioritise **modular, scalable systems** that can be customised for different energy needs, with monitoring to track usage, verify sizing, and validate savings over time.

Support insights and recommendations

Tailored financing mechanisms can help cut upfront costs, secure supply chains, and boost adoption.

Increased **customer awareness and deeper customer data** can help design locally relevant products.

Supportive **policies**, skilled **workforce**, and clear **standards** are fundamental for a sustainable solar market.

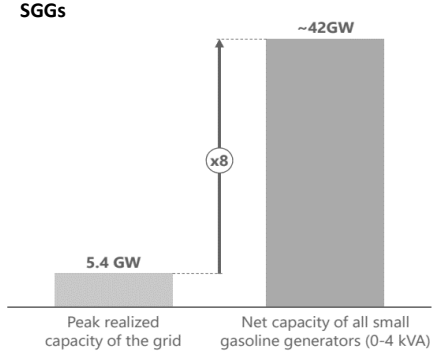
***Notes**: *meter data and survey insights can be viewed in full on PROSPECT. If you want to request access to the PROSPECT platform and this data, please reach out to the ZE-Gen team on ze-gen@carbontrust.com; **no. meters installed across surveyed customer base: MSMEs, n=213; households, n= 104; healthcare facilities, n=81; hotels, n=75,; schools = n=19; **more detailed recommendations are covered on page 16.*

Fossil fuel generators remain the backbone of Nigeria's power market

86 million Nigerians lack access to electricity , ranking Nigeria as the largest national electricity access deficit in the world.[1] With a mix of legacy grid issues, lack of widespread grid availability, and rising energy consumption, the FFG market is forecast to grow by more than $500 million in the next 5 years.[2]

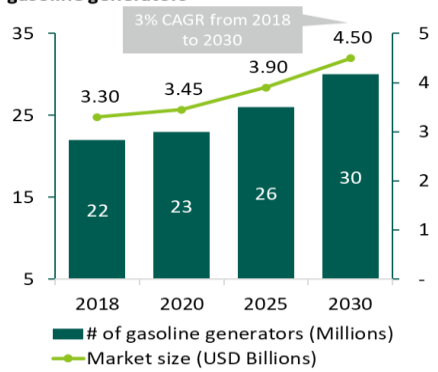
Currently 89% of Nigeria's installed capacity is provided by small gasoline generators* (SGGs).[3] Annual spend on SGGs, stands at $12bn, with fuel expenses being the main contributor.[2]

Electricity production capacity (GW) - grid vs SGGs



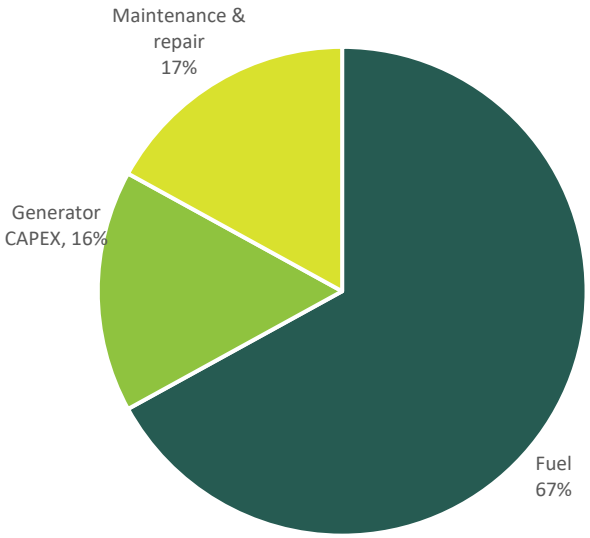
The net capacity of all small gasoline generators exceeds grid capacity by 8 times.

Projected number and market size of gasoline generators



The market for gasoline generators is steadily growing at CAGR of 3% from 2018 to 2030.

Small Gasoline Generators Expenditure breakdown



Varying product quality and storage conditions as well as patterns of intensive use result in breakdowns and costly upkeep.

Typical SGGs found in households and markets costs ~$150, but last only 5 years, just a quarter of solar genset lifespans.

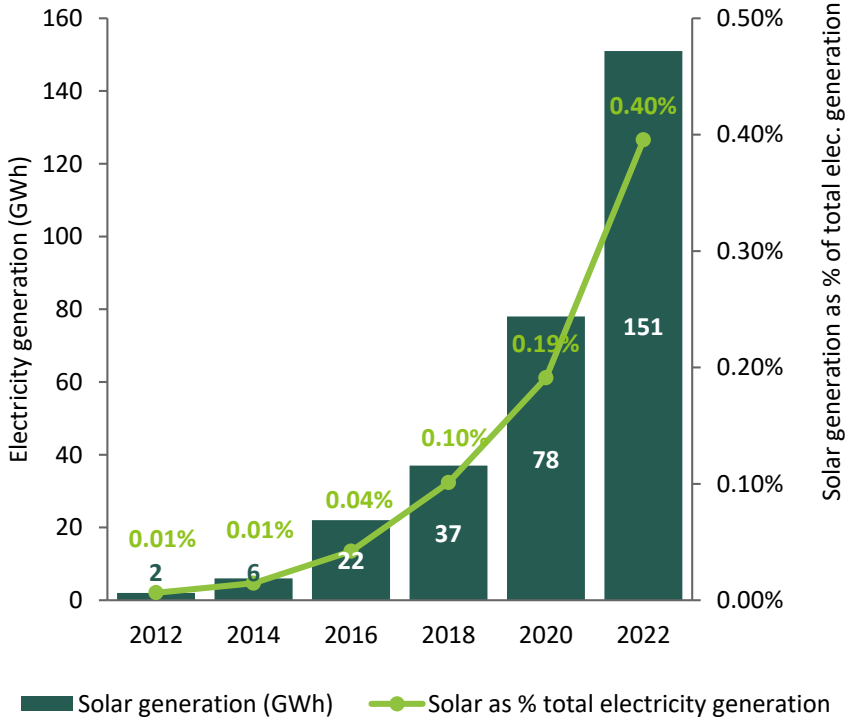
Each year, $8 billion is spent on petrol and diesel to fuel generators in Nigeria. For small businesses in particular, these fuel costs - which are roughly double the average cost of grid electricity - are a major factor contributing to business failure.

Sources: *1) ESMAP (2023), link; 2) A2EI & Dalberg (2019), link;*
Notes: **SGGs, defined as having a capacity of 0-4kVA, are the most prevalent generator type in Nigeria*

Nigeria's solar genset market is growing on the back of innovation and falling costs, but widespread adoption faces significant market barriers

The share of solar generation in Nigeria's energy mix is rising steadily…

Nigeria solar PV electricity generation in TWh & percentage of total electricity generation 2012-2022[1,2]



…and there have been some positive trends in the Nigeria solar sector

- Government support: (NEAP, NERC guidelines)
- 85% price drop in module price between 2011-2020[2]
- Fuel price volatility driving interest in clean alternatives
- $227M invested in Solar PV, with $1.3B in secured funding awaiting[2]

However, despite progress, key market barriers exist which hinder solar adoption

Market intelligence	
Limited customer awareness	Lack of consumer insights and market data

Finance and investment	
High upfront costs and financing challenges	Inflexible customer financing model

Ecosystem building		
Ineffective regulation, policies, and initiatives	Non-existence and poor enforcement of quality standards	Lack of local specialised skills and competencies

Product innovation
Technical limitations: space constraints for installation, lack of portability, safety concerns, battery performance uncertainty

Sources: *1) IEA (2019), link; 3) All-On (2021), link*
Note: **For this research, "solar gensets" refer to any AC-powered solar technology capable of directly displacing FFGs, they typically consist of solar panels, batteries, inverters and/or controllers.*

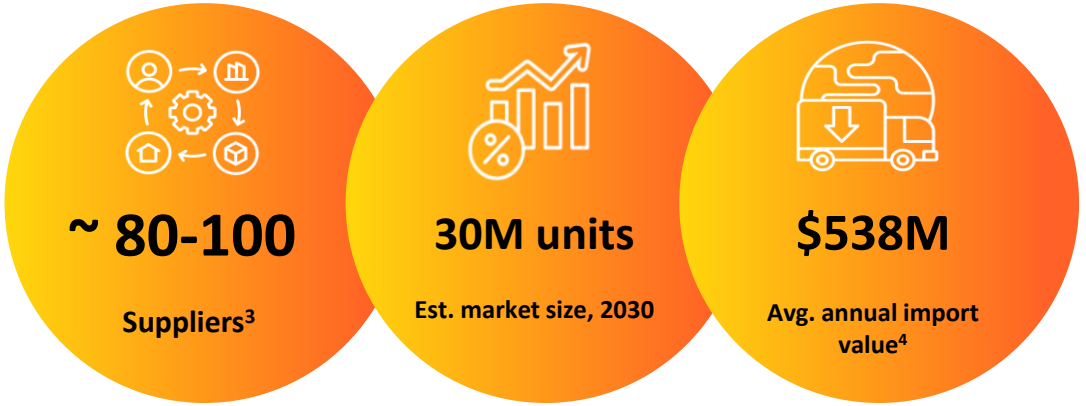
Supply side analysis

A supply side assessment revealed that both the FFG and solar genset markets are reliant on importation; however, solar gensets currently face punitive customs tariffs, discouraging demand

Fossil-fuel generators

FFGs are typically imported from China and India, while the supply landscape is characterized by a variety of players serving the continuous growth in demand

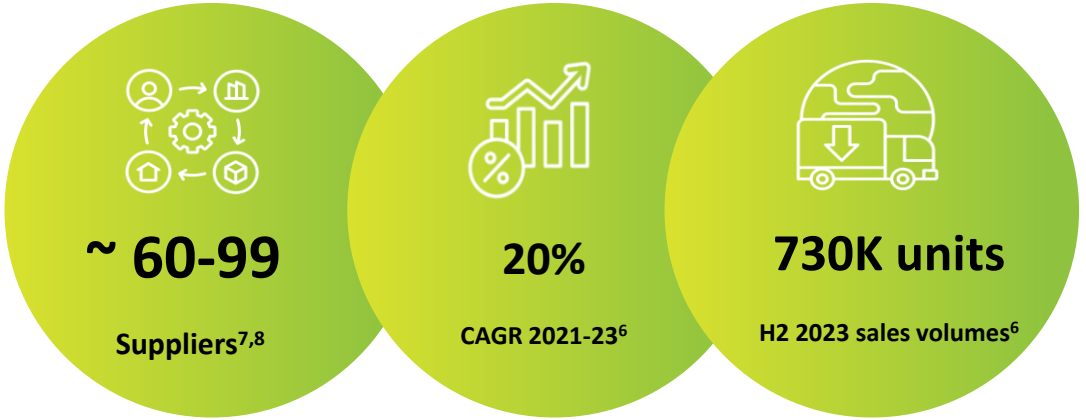
- Nigeria is the largest user of FFGs in Africa, accounting for almost half of sub-Saharan Africa's back-up generating capacity[1]
- Most generators are manufactured outside of Nigeria and imported from China and India[2]
- In May 2023, Nigeria announced the end of its fuel subsidy, increasing the running costs of FFGs



Solar Gensets

Solar technology sales rose by 200% between 2021 and 2023, but PAYGo sales have since levelled off, partially due to the end of the Nigerian Electrification Project's results-based financing subsidies.

- In 2022, renewables accounted for 24.5% of Nigerian power generation, with solar PV at just 0.4%[5]
- Less than 5% of traders receive formal financing, and 17% receive supplier credit.
- Most households and MSMEs pay upfront in cash[6], although financing models such as energy-as-a-service and energy-as-an-asset exist



Sources: *1) Africa Energy Outlook 2019, Link; 2) Trade Map, Link; 3) Volza Grw Global, Link; 4) Analysis of ITC data, Link; 5) IEA (202), link; 6) GOGLA (2023), link; 7) ACE-TAF (2021), link; 8) Consultation with REA*

Customer data analysis summary

Generator customer use cases were selected based on two criteria: (i) current FFG usage and (ii) interest in transitioning to solar. Five use cases were identified for further examination.

	Use Case	Impact summary of FFG usage	Opportunity
	**Households**	Many households rely on FFGs to power essential appliances, but rising fuel costs are straining already tight budgets. Inefficient, older models are commonplace, increasing household expenses, pollution, and health risks during power outages.	Largest user segment with high potential for scaling clean alternatives. Installation of smart meters for monitoring energy consumption.
	**MSME Markets**	High cost of fuel and maintenance eats into already slim profit margins for many small businesses using FFGs. Grid outages or generator failures disrupt services, spoil goods, reduce profits and damage customer trust.	MSMEs also represent a significant segment of the FFG market. Clear demand for reliable, cost-effective energy solutions, making them a viable target for clean energy pilots and scale.
	**Education**	Lack of clean reliable power limits access to lighting, ICT tools, directly impacting educational quality, student performance, and welfare. Facilities struggle with limited public and institutional budgets.	Educational institutions have a strong sustainability mandate Can serve as influential adopters and influence wider community behaviours and attitudes.
	**Healthcare Centres**	Generator failure can put lives at risk, particularly in rural hospitals where grid reliability is lower. Rising fuel prices and high maintenance costs put additional strain on already limited healthcare budgets, forcing facilities to divert funds from patient care toward energy expenses.	Recent electrification efforts and established proof-of-concepts using clean energy alternatives make this an attractive initial focus option with scale potential.
	**Hotels**	High fuel and maintenance costs hurt profit margins. Outages harm guest experience and business reputation.	Constant need for, and high consumption of, electricity and ability to sometimes leverage from mixed energy sources show strong scale potential for clean alternatives.

Customer data analysis: Residential

17M households spend on average $12. 1 per month on fuel, equivalent to a total annual spend of $2.5bn, making it one of the largest fuel expenditure market

Key numbers

40%
of Nigerian households own FFGs[2]

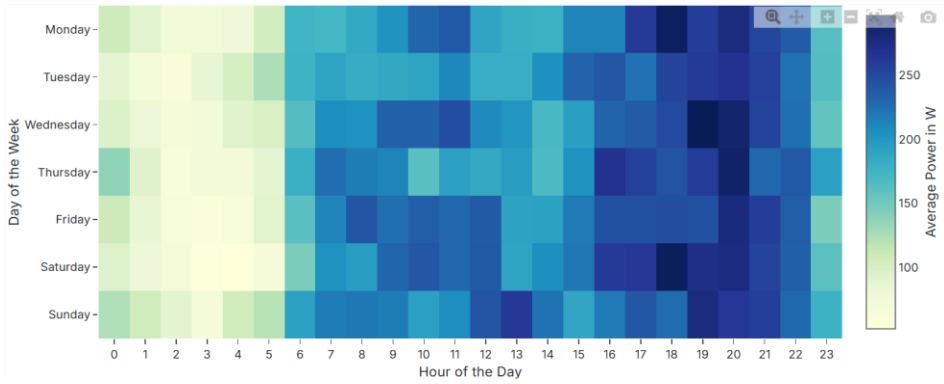
$12.1
Avg. monthly household fuel spend[4]

0-4kVA
Avg. generator size range[3]

Description

- Unreliable electricity supply (**~8 hours per day**) means households rely heavily on FFGs to meet their daily energy needs, which typically total around **15 hours**.[2,5]
- FFGs are **most commonly used in urban & and peri-urban areas**, where **84% of the population** depend on them. Higher purchasing power in these regions supports the affordability of both generators and fuel.
- In contrast, **only 20% of rural households use FFGs**, largely due to lower income levels.[3]
- FFGs are used to power essential appliances such as **refrigerators, cooking equipment, and various electronic devices.**

FFG load profile of on- and off-grid household users



Usage profile

Peak usage: evening/nighttime[4] when residents are at home for ~7hours.[2]
Type of generators: mostly small petrol generators, which are more prevalent because of the cheaper (although less efficient) fuel
Typical generator lifetime: around 5 years[1]
Average fuel consumption: 14.8 litres per month[4]
Average energy consumption: 7.40 kWh per month[4]

Survey insights

Total respondents: 104
Brand: Firman (33%), Tiger (21%)
Avg. life: 5+ years (59%), 2-5yrs (36%)
Capacity: 3kVA (33%), 1kVA (24%)
Maintenance: ~$3.4 monthly (75%)
Avg. monthly fuel cost: ~$12.1

Considerations for transitioning to cleaner gensets

- Solar gensets offer long-term savings but face adoption barriers due **to high upfront costs** (2.6x that of FFGs).[5] All survey respondents were open to switching, with easy financing as the main incentive.
- **Fuel prices have more than quadrupled since 2020**, making solar more appealing, especially as petrol accounts for 67% of annual FFG costs. With suitable financing, **solar becomes cheaper after 4–5 years**.[1,*]
- Nigerian households tend to focus on total cost, not daily rates, making **flexible models like PAYGo, lease-to-own, and Energy-as-a-Service** essential. However, low margins on small solar units mean suppliers must scale to stay profitable.

***Sources**: 1) A2EI & Dalberg (2019); link; 2) Sterling x Stears (2022), link; 3) Federal College of Forestry, Forestry Research Institute of Nigeria (2022), link; 4) A2EI Smart meter data 5) OCA calculation or consultation. **Notes**: * Price of a new solar home system is assumed to be $1,500;*

Customer data analysis: MSMEs

86% of Micro, Small and Medium Enterprises (MSMEs) depend on backup generators for reliable energy supply, having a massive impact on enterprises across the country

Key numbers

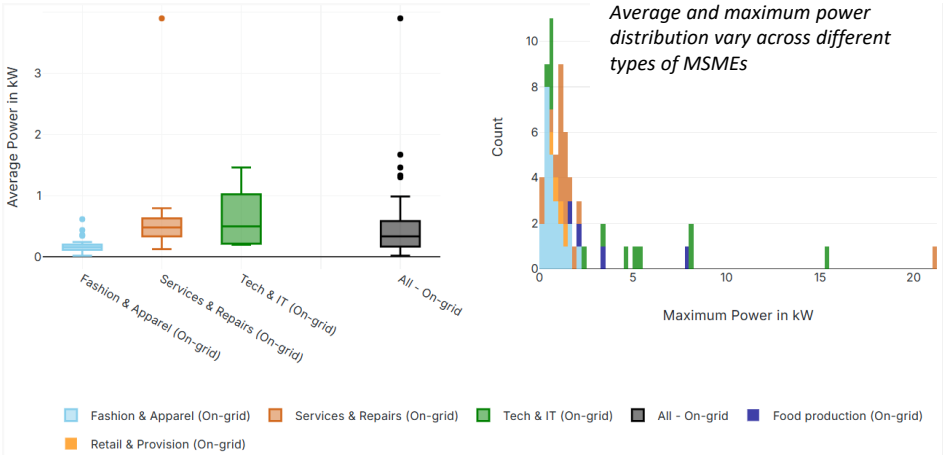
86%
of Nigerian MSMEs own FFGs[2]

$12.2
Avg. monthly MSME fuel spend[4]

1-5kVA
Avg. generator size range[1,4]

Description

- **Micro, Small and Medium Enterprise (MSME) markets refer to clusters of businesses that have a small number of employees (<50)**, typically including clothing stores, mobile phone outlets, food markets, and bet shops, amongst others
- Nigeria has **over 41 million MSMEs and more than 1,200 market clusters.[3,5]** Lagos state has the highest number of markets and Anambra state hosting the largest single market (Onitsha Main Market)
- **FFG usage varies by business type**, helping maintain operations during power outages.
- Generators power essential equipment such as **computers** in betting shops, **fridges** in food stalls, and devices like **lights, radios, TVs, and ACs.[5]**



Average and maximum power distribution vary across different types of MSMEs

Usage profile

Peak usage: during the day[4] when most shops are open. Businesses typically receive 1-5 hours of grid electricity and rely on FFGs for the remaining business hours (1- 4 hours). Night-time demand is lower.[1]
Type of generators: Most shops use petrol generators to reduce fuel costs, while those with higher energy needs opt for more efficient diesel generators.[4,5]
Typical generator lifetime: 5 years[1]
Average fuel consumption: 15 litres per month[4]
Average energy consumption: 7.50 kWh per month[4]

Survey insights

Total respondents: 204
Brand: Firman (27%), Tiger (18%
Avg. life: 5+ years (60%), 2-5yrs (19%)
Capacity: 2-3kVA (56%), 1kVA (18%)
Maintenance: ~$3.4 monthly (72%)
Avg. monthly fuel cost: ~$12.2

Considerations for transitioning to cleaner gensets

- To reduce upfront costs, MSMEs require **flexible financing models such as Energy-as-a-Service, Lease-to-Buy, or PAYGo**, which have shown early success (e.g. d.light and ChromeVolt).[6]
- While MSMEs in the same market cluster can **share solar systems** to lower costs, **most prefer to own their backup energy systems**.[1]
- Businesses are open to switching due to the **noise, air pollution, and the high maintenance costs and labour required for** FFGs.[1]

***Sources**: 1) A2EI (2019); 2) GIZ (2015), link; 3) National Survey of Micro Small & Medium Enterprises (MSMEs) (2017), link; 4) A2EI smart meter data; 5) OCA consultation.*

Customer data analysis: Education

Educational institutes: We analysed both universities and schools in this research, but with metering data and survey insights only available for schools.

UNIVERSITIES

Key numbers

~265

Universities use FFGs[1]

400-1000kVA

Avg. generator size range[2,*]

Description

- **Universities are the main users of FFGs among educational institutions,** particularly when located in rural regions, which have highly unstable power infrastructure
- **Schools and education and technology colleges****, both public and private, also use generators to maintain essential services during electricity shortages
- For this use case, we analysed universities and schools, with the latter having metering data
- Most schools and univerisities depend on public grid electricity as the primary source of energy, with **FFGs as their backup, while few use solar gensets**
- Generators power **ACs, lighting, computers, lab machines, refrigeration and cooking electronics**.[2,3]

SCHOOLS

Key numbers

$7

Avg. monthly school spend on fuel[3,*]

1.5-3 kVA

Avg. generator size range[3,]**

Usage profile *(for schools only)*

Peak usage: Schools experience peak electricity demand during daytime hours[4] and the months when classes are in session (Sept-May), however, back-up energy system use is relatively low, averaging only 1.5 hours per day[3] for per generator
Type of generators: mostly diesel generators[3,4]
Typical generator lifetime: 20 years[4]
Average fuel consumption: 8.6 litres per month during term time[3]
Average energy consumption: 4.3kWh per month[3]

Survey insights *(for schools only)*

Total respondents: 19
Brand: Firman (37%), Parsun (21%)
***Avg. life*:** 5+ years (100%)
Capacity: 3kVA (68%), 1.5kVA (32%)
Maintenance: $10.20 monthly
Median monthly fuel cost: $7.00

Considerations for transitioning to cleaner gensets

- Educational institutes, especially universities, need to evaluate **between opting for the replacement of fossil fuel generators on a per-building basis or the installation of solar mini-grids** to support the entire campus
- **Private (for-profit) institutes** may be able to afford the upfront capital requirements, while **public schools** could try to leverage government/NGO subsidies

***Sources**: 1) Nigeria University Commission, link; 2) Nile University of Nigeria (2023), link; 3) A2EI Smart meter data; 4) OCA consultations;*
***Notes**: *This data is indicative and not based on a representative sample. It comes from a single study conducted at Nile University in Nigeria. At this university, four generators are used, ranging in size from 400 kVA to 100 kVA, providing a combined system capacity of 2,600 kVA; **Colleges of education and technology are typically less populous, offering differing qualifications when compared to universities; **Metering data is only for schools.*

Customer data analysis: Healthcare

Primary Healthcare Centres could transition to clean energy generators by leveraging their potential to attract donor grants and subsidies

Key numbers

34K

Primary health centres use FFGs[1]

$10.3

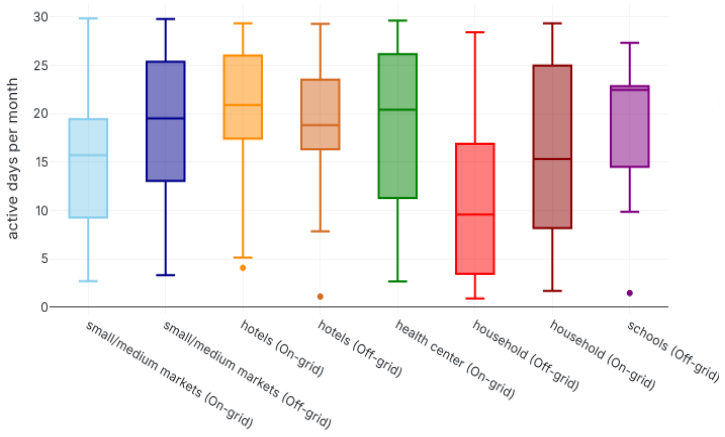
Avg. monthly fuel spend per primary health care centre[6]

2.8-4.8 kVA

Avg. generator size range[2]

Description

- Nigeria has ~**40k Health Centres, of which 40% are not connected to the grid.**[1]
- Due to unreliable or unavailable electricity access, **nearly all Health centres in Nigeria use FFGs** either as a primary or backup power source.
- Primary Health centres (PHCs), 85% of all health facilities, are **the first point of contact** for medical services and **each serve 10k-20k people.**[1] PHCs are the main focus of this use case
- **57% of PHCs are grid-connected;**[2] the rest depend entirely on FFGs.
- Electricity needs vary by **size, occupancy, and equipment**. Larger centres, typically in urban areas, have higher demand.
- Generators power **critical appliances** such as medical equipment, medicine and vaccine refrigeration, computers, and telecommunications systems.



On-grid health centres show a wide range of generator usage days per month, with operational patterns similar to those of MSMEs and schools, indicating comparable energy use behaviours.

Usage profile

Peak usage: among PHCs in rural areas, averaging 2.2 hours daily within an 8-hour operational window.[4] PHCs typically receive only 4 hours of grid power, below the national average of 6.8 hours[5], due to weaker infrastructure.[2] Larger PHCs in urban areas require continuous power to meet higher patient demand.
Type of generators: mostly diesel generators
Typical generator lifetime: ranges from 5 - 20 years[2]
Average fuel consumption: 13.8 litres per month[6]
Average energy consumption: 6.9 kWh per month[6]

Survey insights

Total respondents: *79*
Brand: Firman (88%)
Avg. life**:** 5+ years (100%)
Capacity: *1.5kVA (92%)*
Maintenance: $3.40 monthly
Median monthly fuel cost: $10.30

Considerations for transitioning to cleaner gensets

- **Lease-to-own model** could be suitable for PHCs as the majority (82%) are government-owned and may have a limited budget to afford the upfront cost of cleaner energy alternatives
- However, healthcare centres are also more likely to receive **donor grants or government subsidies,** which would help support the upfront capital requirements when transitioning to cleaner gensets

Sources*: 1) SEforALL (2022), link; 2) The Heinrich Boell Stiftung Nigeria (2018), link; 3) LinkedIn article EM-ONE (2023), link; 4) HEFAMAA, link; 5) Business Daily Nigeria (2020), link; 6) A2EI smart meter data*

Customer data analysis: Hospitality

Hotels are one of the highest electricity consumers, and their for-profit model enables them to be early adopters of clean energy generators

Key numbers

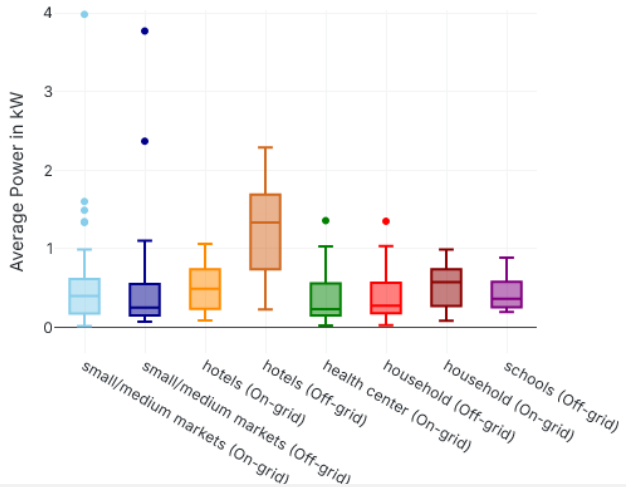
13.4k
Hotels own FFGs[1]

$71.3
Avg. monthly fuel spend per hotel[4,5]

1-3 kVA
Avg. generator size range[4,*]

Description

- Hotels receive only **6 hours grid electricity daily[3] and rely on FFGs to maintain 24/7 power.**
- Electricity use varies by **hotel capacity, occupancy, and amenities**; the **largest electricity consumers are luxury and business hotels** located in major cities such as Lagos and Abuja
- **Luxury and business hotels** have additional uses of FFGs for functional and leisure appliances such as **meeting/conference room equipment, gym equipment, swimming pool heating systems, kitchen food refrigeration, etc.**
- **Smaller economy and informal hotels** mainly use FFGs to power room appliances such as **TVs, mini-fridges, ACs and shower heaters.**



Average power distribution across use cases. Hotels found to have largest power requirements amongst all surveyed groups.

Usage profile

Peak usage: in December, January, and April[2] when hotels have higher occupancy in the periods around the Christmas and Easter holidays. On average, hotels use their FFG systems for 3.2 hours daily within an 18-hour operation window.
Type of generators: mostly diesel generators[4,5]
Typical generator lifetime: around 20 years[5]
Average fuel consumption: 87.4 litres per month[4]
Average energy consumption: 43.70 kWh per month[4]

Survey insights

Total respondents: 74
Brand: Firman (55%)
Avg. life: 5+yrs (97%)
Capacity: 1.5-3kVA (67%), 7kVA (20%)
Maintenance: ~$5 monthly (97%)
Avg. monthly fuel cost: $71.3

Considerations for transitioning to cleaner gensets

- Hotels could be **early adopters of clean energy gensets** given their **purchasing power** and incentives such as **long-term fuel savings, reduced noise pollution, and eco-friendly marketing opportunities**
- Hotels require clean gensets with **technical specifications suited to high, continuous electricity needs.**
- However, current research indicates a **lack of local supply of clean gensets** that can meet larger hotel demands, which must be addressed

***Sources**: 1) Rentech Digital, link; 2) C. Okpala, H. Njoki, and P. Ako, link; 3) Premium Times, link 4) A2EI smart meter data; 5) OCA calculation.*
*Notes: *Off-grid hotels included in the study showed significantly higher energy capacity (many with 7kVA and above) compared to their on-grid counterparts, reflecting the need to provide consistent power supply for guest comfort. Larger hotels were not included as part of this study, but have energy needs up to 15MW (Lambert, link)[6]*

Conclusion

A coordinated, systems approach is needed, bringing together key stakeholders to support the FFG-solar transition

Key recommendations

Product developers & distributors

Collaborate to design solar gensets based on real-world usage data. Distributors should partner with smart meter installers to gather customer consumption profiles and share insights with suppliers to drive product innovation, such as grid-compatible, portable battery solutions tailored to the Nigerian market.

Investors & lenders

Increase market availability of flexible customer financing models and use of carbon credits to reduce up-front costs. Expand inventory procurement services to reduce capital pressures.

Donors & development partners

Enhance customer awareness of solar gensets through marketing and awareness programs. Improve customer data analysis to tailor product design to local markets.

Policy makers

Advocate for the enforcement and expansion of supportive government policies, practices and initiatives. Consider mechanisms to expand the local installation and maintenance labour force. Guide regulators to setup national solar genset standards and support promotion of certified solar gensets.

What's next

Prospect data platform

ZE Gen empowers stakeholders to use the publicly available metering data and survey insights on the Prospect platform to develop informed, tailored energy solutions for high-impact customer use cases.

Let's continue the conversation

We encourage stakeholders to share feedback on the types of performance metrics, analyses, and features they would find valuable from a product design or project development perspective.

We intend to use this report and underlying data as a springboard for in-depth discussions, contributing to wider knowledge exchange and the development of a robust local ecosystem for market transformation. Don't hesitate to reach out to the ZE-Gen team on ze-gen@carbontrust.com if you want to get in touch or request access to the PROSPECT platform.

Future research

Future research could expand data collection across and beyond Nigeria, where energy use varies by local policy, environment, and economy, helping tailor solutions to diverse contexts.

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