# Mini-grid CAPEX and OPEX Benchmark Study: A Regional Approach

## in Burkina Faso, Nigeria and Sierra Leone

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# Acknowledgements

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The team and authors include Hadley Taylor, Min Hyejung, Grace Busingye and Abdul Yakubu (SEforALL); reviews were provided by Amon Mwadime (AMDA) and Samuel S. Bunnya (AFUR).

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This report has been reviewed, designed, and edited by Gregoire Jacquot, Robert Opini, Stephen Kent and Anja Barradas.

# Abbreviations

| Term | Definition |
|---|---|
| ABER | Burkinabe Rural Electrification Agency |
| AFUR | African Forum for Utility Regulators |
| AMDA | Africa Minigrid Developers Association |
| BOS | Balance of System |
| CAPEX | Capital Expenditure |
| CFA | Communauté Finanacière Africaine (West African franc) |
| CHC | Community Health Centre |
| CSEP (PCES) | Community Solar Energy Platform |
| ESMAP | Energy Sector Management Assistance Program |
| EU | European Union |
| FCDO | Foreign, Commonwealth & Development Office |
| GEAPP | Global Energy Alliance for People and Planet |
| kW | Kilowatt |
| kWc | Kilowatt crête (Kilowatt Peak) |
| kWh | Kilowatt hour |
| kWp | Kilowatt peak |
| MYTO | Multi-Year Tariff Order |
| N/A | Not Available |
| O&M | Operations and Maintenance |
| ONEA | National Office of Water and Sanitation of Burkina Faso |
| OPEX | Operating Expenditure |
| PASEL | Electricity Access Support Programme |
| PUE | Productive Use of Energy |
| RAB | Regulated Asset Base |
| RMI | Rocky Mountain Institute |
| ROI | Return on Investment |
| SEforALL | Sustainable Energy for All |
| SLEWRC | Sierra Leone Electricity & Water Regulatory Commission |
| SONABEL | National Electricity Company of Burkina Faso |
| USD | United States Dollar |
| VAT | Value-added Tax |
| WACC | Weighted Average Cost of Capital |

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CHAPTER ONE

# Introduction

# Objectives

01 Collect relevant CAPEX and OPEX data from mini-grid developers in Burkina Faso, Nigeria and Sierra Leone, in collaboration with AMDA and AFUR, enhancing benchmark credibility.

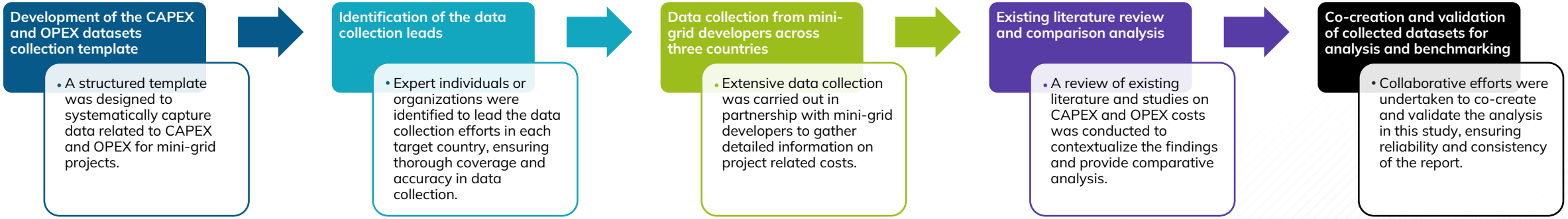
02 Analyze the data to create a comprehensive CAPEX and OPEX benchmark specific to the mini-grid industry in West Africa, enabling informed decisions and effective regulatory frameworks.

03 Compile key findings into a detailed report and conduct a training session for regulators on the final deliverable, empowering informed decision-making and facilitating strategic initiatives for sustainable mini-grid development in Sierra Leone.

04 Contextualize the findings to understand policy drivers and macroeconomic influences in Burkina Faso, Nigeria and Sierra Leone.

# Methodology

The methodology employed in this study involved a collaborative effort with key stakeholders, including SEforALL, AMDA and AFUR, to gather comprehensive data on CAPEX and OPEX in the target countries. This process was facilitated through coordinated efforts among regulatory bodies and mini-grid developers. Key steps in the methodology included:




Datasets obtained using the SEforALL template were sourced from Burkina Faso and Nigeria. For Sierra Leone, data submitted by developers for the Multi-Year Tariff Order (MYTO) tool, introduced in 2021, were analyzed and incorporated into the study. The MYTO tool and SEforALL template were meticulously compared to ensure coherence and consistency in the analysis.

Cost per connection is the metric utilized consistently throughout this analysis for evaluating the composition of CAPEX and OPEX.

The country analysis is based on costs per mini-grid, not per company.

Each source of exchange rate data is indicated in the corresponding slides for each country.

# Approach

The CAPEX and OPEX benchmark study employs a comprehensive strategy, collaborating with stakeholders and conducting structured data collection, literature review and comparison analysis. It integrates SEforALL template data from Nigeria and Burkina Faso with MYTO Tool data from Sierra Leone. By meticulously comparing these datasets, the study endeavours to offer insightful perspectives on CAPEX and OPEX landscapes, facilitating informed decision-making and strategic planning in the mini-grid market. This information is particularly valuable for regulators in Burkina Faso, Nigeria and Sierra Leone, aiding them in designing effective policies, regulations and support mechanisms to foster a conducive environment for sustainable mini-grid markets.

# Activity Leadership by Organization

| | |
|---|---|
| **SEforALL** | • Led the overall process and coordination<br>• Led the data collection template development in English and French<br>• Coordinated with SLEWRC and mini-grid developers in Sierra Leone<br>• Co-led data collection and coordination in Nigeria<br>• Conducted comprehensive data analysis and drafted the report |
| **AFUR** | • Represented the interests of African regulators<br>• Led data collection and coordination with regulators in Burkina Faso<br>• Jointly developed the data collection template and co-drafted the report |
| **AMDA** | • Represented the interests of mini-grid developers<br>• Co-led data collection and coordination with developers in Nigeria<br>• Jointly developed the data collection template and co-drafted the report |

# Limitations of the Study

1. Limited access to data: The study faced challenges due to restricted access to comprehensive data sets. This limitation hindered our ability to perform a thorough and detailed analysis across all variables.
2. Timely exchange of data: Delays and inefficiencies in the timely exchange of data further constrained the research process. The lack of prompt data sharing affected the overall timeline and the depth of the analysis. Additionally, our attempts to collect data from developers in Ghana were unsuccessful, further limiting the scope of our study.
3. Single-year data: Most of the CAPEX- and OPEX-cost data presented in this study pertain to a single year. Consequently, we were unable to track longitudinal trends, which limited our ability to analyze changes and developments over time in all three countries.
4. Data gaps: There were some gaps in the data provided by a few developers, which restricted the extent of the analytics that could be performed. These missing pieces of information have limited the study's ability to draw comprehensive and robust conclusions. The dataset and analysis conducted for Burkina Faso primarily rely on data from one company, as other companies have not submitted all the necessary components. This reliance on a single source impacted the generalizability of the findings.

CHAPTER TWO

# Analysis of Mini-Grid CAPEX and OPEX

## General Context and Literature Review

# Mini-Grid Landscape Overview

Mini-grids, while not a novel technology, have seen slow sectoral development over the past decade due to a range of challenges. These challenges include:

- Regulatory protection: A significant number of governments lack adequate protection for mini-grid owners, particularly when the main grid expands into their areas, risking asset loss or stranding. Ideal policies would ensure either compensation or the coexistence of mini-grids with the main grid.
- Customers' ability to pay: In many African countries, rural mini-grid customers are subject to unpredictable incomes from agriculture, resulting in irregular power demand and payment risks. Developers are focusing on productive-use customers to stabilize demand and enhance economic performance.
- Small project sizes: Small rural mini-grids (10–100kW) are less attractive to private financiers who prefer larger projects for better cost amortization. Due to high investment costs, developers often cannot finance these projects without external support.
- Business models and profitability: Despite being characterized as subsidizing part of the CAPEX, private ownership and cost-reflective tariffs, this widespread model is not capable of attracting private capital at the necessary levels to reach SDG7. Most of the least-cost solution mini-grids are less likely be bankable or profitable under this approach.
- De-risking strategies: Private equity can be de-risked through mechanisms such as sovereign guarantees or first-loss guarantees, enabling regulations and operations contracts, yet the perceived risk remains too high to attract private capital.
- High competition: While competition can drive costs down, it also increases risks. Market saturation reduces individual developers' market share, leading to lower revenue and financial uncertainty. Pricing pressure can cut profit margins, making it harder to cover costs. Competition for resources can raise operational costs and extend project timelines. A crowded market may deter investors due to higher risks, complicating funding efforts.

Sources: https://minigrids.org/wp-content/uploads/2020/06/Mini-grids_Market_Report-20.pdf; Mini-Grids Partnership: Bringing together partners to build a stronger clean energy mini-grids sector – Mini-grids as infrastructure

# Mini-Grid Landscape Overview

Recent advancements have addressed some issues, such as the cost of technological assets like solar panels and batteries. Despite these improvements, affordability remains a challenge. Many sector stakeholders believed that implementing cost-reflective tariffs would address most issues; however, research indicates that this approach has not significantly improved the situation.

Over the past decade, electrification in Asia, largely supported by public financing, has dramatically increased to achieve nearly full coverage. In contrast, while there has been a slight decrease in the number of people without electricity in Africa, it has not kept pace with population growth, resulting in a large sector of the population still lacking access to electricity.

Since 2019, the Sierra Leone Electricity and Water Regulatory Commission (SLEWRC) has approved cost-reflective tariffs for mini-grid operators in Sierra Leone. However, recent macroeconomic challenges, including high inflation and local currency depreciation, have impacted the business models of mini-grid operators and the affordability of tariffs for end-users.

Current discussions around mini-grids are complicated by concerns about transparency, viability and their actual value. Additionally, investment in mini-grids is often hindered by uncertainties regarding future macroeconomic conditions, such as exchange rates, interest rates on local loans and the country's economic growth rate. Addressing these challenges requires collaborative efforts among stakeholders to develop robust strategies that promote sustainable and inclusive electrification solutions.

Sources: https://minigrids.org/wp-content/uploads/2020/06/Mini-grids_Market_Report-20.pdf; Mini-Grids Partnership: Bringing together partners to build a stronger clean energy mini-grids sector – Mini-grids as infrastructure

# Literature Review

| PUBLICATION | ORGANIZATION | YEAR | KEY FINDINGS |
|---|---|---|---|
| BENCHMARKING AFRICA'S MINI-GRIDS REPORT | AMDA | 2022 | • Sample size: 400 mini-grids across Africa<br>• CAPEX (2020): slightly higher than 2019<br>  • Average total CAPEX: just over USD 8,500 per kWp (including distribution costs), a 2.5% increase from 2019 and above the three-year running average of USD 7,330 per kWp<br>• OPEX: gradually declining<br>  • OPEX (2021) per customer per month: USD 1.0–$4.0, a 30%–60% decrease from the 2019 figures (USD 2.5–USD 6.0)<br>  • Further reduction expected due to economies of scale and operational efficiencies |
| MINI-GRIDS FOR HALF A BILLION PEOPLE: MARKET OUTLOOK AND HANDBOOK FOR DECISION-MAKERS | ESMAP | 2019 | • Sample size: 53 mini-grids across Africa and Asia<br>• Capital costs: (2010) USD 8,000/kW of firm power output → (2018) USD 3,900/kWfirm<br>• Components used for generating electricity accounted for 54 percentage of total capital costs<br>  • Batteries (15%), distribution grids (14%), PV modules (11%), inverters (5–9%), powerhouse (7%), meters (4%)<br>• OPEX, across a total of 18 systems (7 in Asia and 11 in Africa), ranged from USD 8 to USD 263 per customer per year (average USD 80/customer/year)<br>  • Staff costs (salaries and expenses): 76%, fuel costs 4.3% (average USD 8.30/customer/year), other O&M (repairs and maintenance, transportation, community engagement) 20% |
| MINI-GRIDS IN THE MONEY: SIX WAYS TO REDUCE MINI-GRIDS COSTS BY 60% FOR RURAL ELECTRIFICATION | RMI | 2018 | • Sample size: simulation based on market costs<br>• Cost of service from MG: upfront costs (60%) + ongoing costs (40%)<br>  • Upfront costs: CAPEX (48%), project development and construction (12%)<br>  • Ongoing costs: fuel (20%), O&M and overhead (13%), losses and lower capacity utilization (7%)<br>• Upfront costs: battery CAPEX (34%), solar CAPEX* (18%), diesel CAPEX (16%), connection and meters (12%), duties and fees (10%), upfront soft costs** (6%), distribution CAPEX (5%), construction and installation (4%)<br>• Ongoing costs: fuel (51%), losses and capacity utilization (17%), local operations management (10%), customer relations (7%), income taxes (6%), management overhead (5%), all other overhead (2%), other staff overhead (1%) |

* Solar CAPEX: module, inverter, racking, foundation, and balance of systems
** Upfront soft costs: pre-development costs include labour for site selection and initial customer engagement; system design, construction supervision and financial modelling; captive capital and idle labour (site delays)

<table>
<tr><th>PUBLICATION</th><th>ORGANIZATION</th><th>YEAR</th><th>KEY FINDINGS</th></tr>
<tr><td>MINI-GRIDS IN THE MONEY: SIX WAYS TO REDUCE MINI-GRIDS COSTS BY 60% FOR RURAL ELECTRIFICATION</td><td>RMI</td><td>2018</td><td>• Hardware component cost assumptions in Sub-Saharan Africa<br>• PV Modules $0.58/W, Racking USD 0.15/W, PV Balance of System (BOS) USD 0.08/W, Battery Storage USD 175/kWh, Inverters $0.12/W, Battery Inverter $0.18/W, Battery BOS $0.01/W, Distribution USD 15,475/km,<br>1 Phase Connection/Meter $140, Com Connect/Meter USD 335</td></tr>
<tr><td>UNDERSTANDING MINI-GRID TARIFFS IN SIERRA LEONE</td><td>SEforALL</td><td>2023</td><td>• Sample size: 3 developers in Sierra Leone<br>• CAPEX budget lines in Sierra Leone<br>• Plant & Balance of System 66%, taxes (import duties and VAT) 10%, logistics costs 8%, development costs 17%<br>• (SL) OPEX per customer per year: $47-51 (avg. $48) / (NG) $27-54 (avg. $41)<br>• Cost build-up of a tariff: plant O&M costs 33%, salaries – management 12%, central operation costs 4%, depreciation<br>14%, ROI = WACC x RAB (Return on Capital) 37%
<table>
<tr><th></th><th>A</th><th>B</th><th>C</th><th>SL $ Avg.</th><th>NG</th></tr>
<tr><td>Plant O&M Costs</td><td>$33</td><td>$32</td><td>$33</td><td>$33</td><td></td></tr>
<tr><td>Salaries – Management</td><td>$12</td><td>$11</td><td>$12</td><td>$12</td><td></td></tr>
<tr><td>Central Operation Costs</td><td>$6</td><td>$4</td><td>$1</td><td>$4</td><td></td></tr>
<tr><td>TOTAL OPEX per connection per year</td><td>$51</td><td>$47</td><td>$47</td><td>$48</td><td>$27 to 54</td></tr>
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# Summary and Key Attributes of Examined Mini-Grid Sites

## For this Report

| Establishment, Operation and Staffing | Energy Sources | Customers and Consumption | Financing |
|---|---|---|---|
| • Most of the mini-grids were constructed in 2020 and commenced operations in 2021.<br>• 13 mini-grids utilize prepaid payment systems and have remote monitoring technology in place to oversee and manage site activities effectively.<br>• The staffing levels dedicated to each mini-grid vary significantly, with each site employing between two and 15 staff members.<br>• Notably, eight mini-grids operate with a dedicated team of three staff members, indicating differences in operational complexity and the scale of the mini-grid systems. | • Eight of the mini-grid sites studied utilize renewable energy (solar) sources, highlighting a strong inclination towards sustainable energy solutions.<br>• Only one mini-grid operates on hybrid energy (diesel and solar), while the remaining sites did not specify their energy types.<br>• This emphasis on renewable energy aligns with global trends towards reducing carbon footprints and promoting environmental sustainability. | • The number of productive use of energy (PUE) customers ranges from three to 21 per mini-grid.<br>• The total number of customers per mini-grid varies widely from 50 to 805, indicating a broad range of community sizes and energy needs being served.<br>• Monthly total demand for electricity spans from 1,257 to 1,635,281 kWh, with average monthly consumption per customer ranging between 2.9 and 610 kWh. | • The financing of these mini-grids showcases a mix of grants and equity investments.<br>• Three mini-grids reported receiving substantial grants from donors such as the World Bank, All On and the Africa Enterprise Challenge Fund (AECF).<br>• The grants ranged from 75% to 80% of capital.<br>• Additionally, most companies reported equity investments accounting for 20% to 30% of their capital structure. |

CHAPTER TWO

# Analysis of Mini-Grid CAPEX and OPEX

## Mini-Grid Developers in Three Countries

# Overview of datasets received and utilized

| COUNTRY | TOTAL SITES | CONNECTIONS | # OF DEVELOPERS | YEAR | COMPLETE DATASETS | LIMITED (NO) DATASETS |
|---|---|---|---|---|---|---|
| Sierra Leone | 50 | 2,826 | 3 | 2020 | 2 | 1 |
| Nigeria | 14 | 4,497 | 4 | 2020–2023 | 12 | 2 |
| Burkina Faso | 3 | 150 | 3 | 2018–2023 | 1 | 2 |

Note: The country analysis is based on per mini-grid costs, not per company costs.

# Mini-Grid Developers in Sierra Leone

| NAME | REGIONS LICENCES | LICENCED ACTIVITIES | FIRST ISSUE DATE | CURRENT ISSUE DATE | EXPIRY DATE |
|---|---|---|---|---|---|
| ENERGICITY (SL) LTD dba POWER LEONE | Moyamba, Kamibia, Portloko | Electricity generation, Distribution and supply license (photovoltaic mini-grid) | 28.05.2019 | 24.06.2021 | 30.05.2041 |
| OFF-GRID POWER (POWERGEN) | Pujehun, Kailahun, Bo, Bonthe, Kono, Kenema | Electricity generation, Distribution and supply license (photovoltaic mini-grid) | 28.05.2019 | 01.11.2020 | 31.10.2040 |
| WINCH ENERGY (SL) LTD | Koinadugu, Falaba, Bombali, Tonkolili | Electricity generation, Distribution and supply license (photovoltaic mini-grid) | 05.03.2018 | 01.11.2020 | 31.10.2030 |

Note: The CAPEX/OPEX datasets and analysis conducted for this study are sourced from mini-grid developers listed in the table.
Source: https://ewrc.gov.sl/wp-content/uploads/2021/10/Public-Register-Electricity.pdf

# Mini-Grid Developers in Nigeria

| NAME | MINI-GRID SITES | NEP QUALIFIED COMPANIES |
|---|---|---|
| RENEWVIA ENERGY AFRICA | • Oloibiri (2020): connects approx. 160 households, businesses, schools and churches<br>• Akipelai (2020): connects more than 250 households, businesses, schools and churches<br>• Ozuzu (2021): connects approx. 250 households and businesses, over 1,200 citizens<br>• Opu: connects 1,100 people (not connected to the national grid; MG sole connection to electricity)<br>• Balep: serves 800 people (not connected to the national grid; MG sole connection to electricity)<br>• Ekong Anaku<br>• Bendeghe-Afi: serves over 1,400 people (not connected to the national grid; MG sole connection to electricity)<br>• Emereoke: connects approx. 2,000 community members | √ |
| POWERGEN | Toto Community, Nasarawa State (352.24kWp)<br>• Nigeria's first interconnected solar hybrid mini-grid site<br>• Provides electricity to more than 2,000 households, 141 commercial users, 18 productive users and 45 public users | √ |
| CEESOLAR ENERGY LTD | Abaribara, Biase LGA of Cross River State (27kWp)<br>• Estimated impact: 2,000 people from 250 connections | √ |
| VENTURA LOGISTICS SERVICES | • Amaechi<br>• Mebiowa<br>• Odege | √ |

Note: The CAPEX/OPEX datasets and analysis conducted for this study are sourced from mini-grid developers listed in the table.
Sources: https://www.renewvia.com/minigridsites; https://nep.rea.gov.ng/first-interconnected-hybrid-solar-mini-grid-plant-commissioned-in-toto/; https://nep.rea.gov.ng/NEP-PHOTO-BOOK.pdf

# Mini-Grid Developers in Burkina Faso

| NAME | MINI-GRID SITES |
|---|---|
| BURKINABE AGENCY FOR RURAL ELECTRIFICATION (ABER) | Mini centrale solaire de Basgana<br>(mini-autonomous solar power plant in Basgana)<br>• 50kWp PV hybrid system<br>• Financed by the World Bank through the Energy Sector Support Project (PASEL) (approx. CFA 350 million) |
| SAHELIA SOLAR | Community Solar Energy Platform (CSEP) in Toumouni (PCES de Toumouni)<br>• CSEP aims to electrify over 100 villages to build activity centres supported<br>by solar PV, to enable sustainable development of rural communities<br>• Includes 15kWp of PV capacity, 60kWh of storage, electrical agro-processing equipment, benefitting micro-businesses and households through pay-as-you-go mobile payment options |
| SINCO | • Grid connection and solar PV systems feed-in<br>• 65 localities are to be electrified as part of the project, via 7 solar PV centres of 2,500 kWc total, and distribution of 4,000 solar kits (120 kW)<br>• Financed by the EU, SONABEL, ONEA and ABER (TDE) (amount of financing: CFA 8.1 billion) |

Note: The CAPEX/OPEX datasets and analysis conducted for this study are sourced from mini-grid developers listed in the table.

Sources: https://www.facebook.com/ABERBURKINA/posts/construction-de-mini-centrales-solaires-autonomes-en-milieu-ruralles-plateformes/782888985966023/; https://www.aber.bf/aber/projets/; https://saheliasolar.com/nos-realisations/; https://ppse-annual-report.pfan.net/sahelia-solar/; https://www.eeas.europa.eu/node/19714_en ; https://saheliasolar.com/nos-solutions/projets/

CHAPTER TWO

# Analysis of Mini-Grid CAPEX and OPEX

## Capital Expenditure (CAPEX)

# Introduction to CAPEX

## Definition

Capital expenditure (CAPEX) encompasses the upfront funds allocated by a company to acquire or enhance physical assets for projects and business operations.

## Components

The CAPEX components utilized in this study include generation cost parameters, distribution systems, customer connections, intangible assets and additional items.

## CAPEX Variations

Driven by factors such as site selection, economies of scale, regulatory efficiencies and additional costs like logistics and import duties, as well as distribution expenses.

## CAPEX in Mini-Grid Tariffs

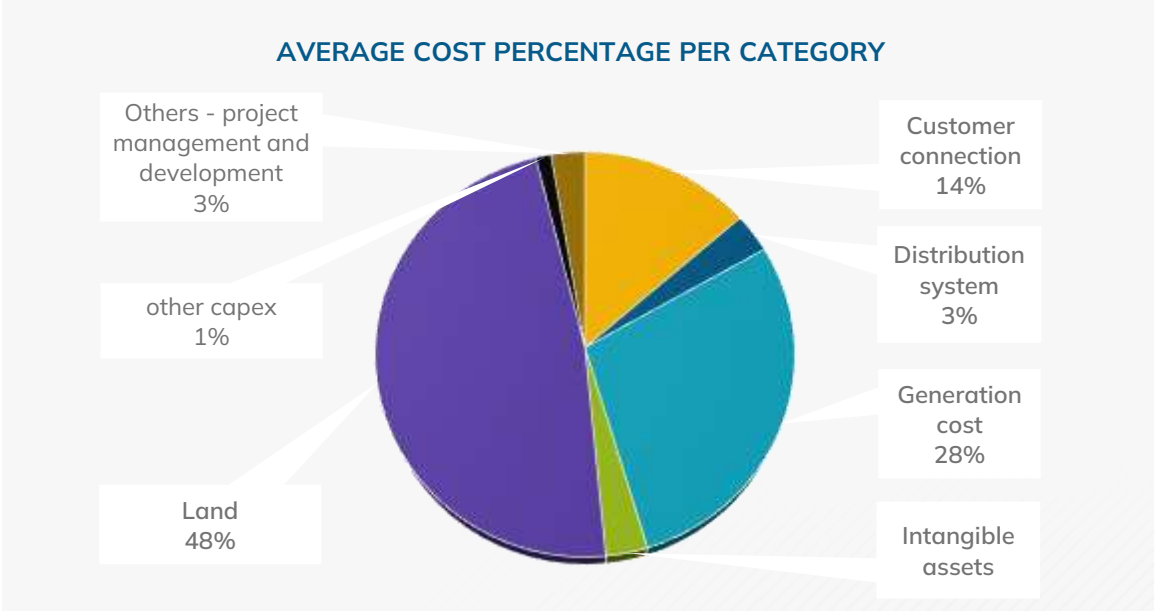
CAPEX costs primarily determine tariffs by covering the initial investment and ensuring profitability through the return on capital and earnings.

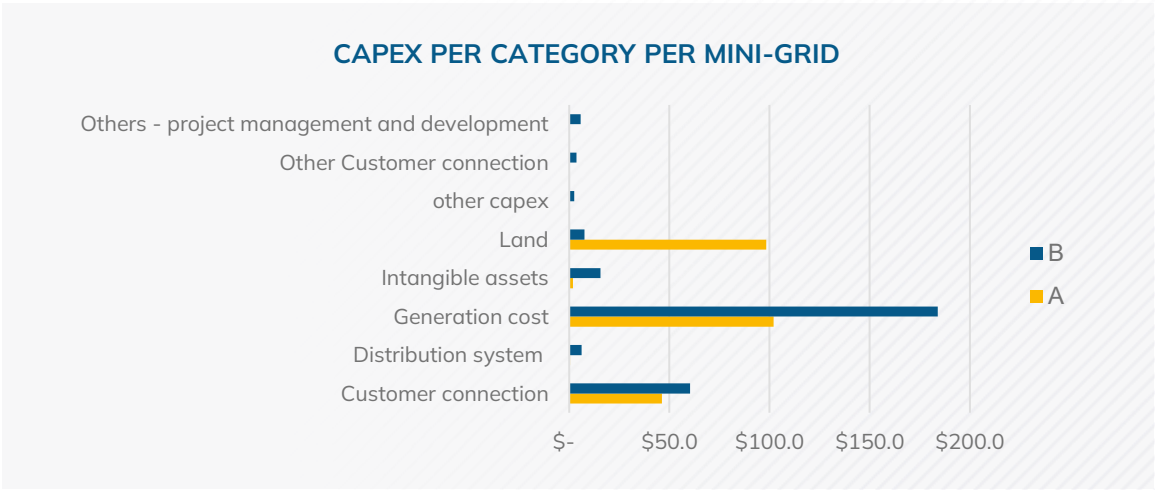
# Sierra Leone

A comparative analysis of CAPEX allocation in 2020

The allocation of CAPEX in Sierra Leone's mini-grid market in 2020 was notable for its substantial dedication to land-related expenses, including rents, administrative land and buildings, amounting to approximately USD 53 per connection and representing 48% of the total CAPEX. Generation costs follow closely, constituting 28% (USD 32) of the total CAPEX, with customer connections comprising 14% (USD 15). Other categories, such as intangible assets, make up the remaining 10% of CAPEX, with smaller allocations compared to the major physical infrastructure components.

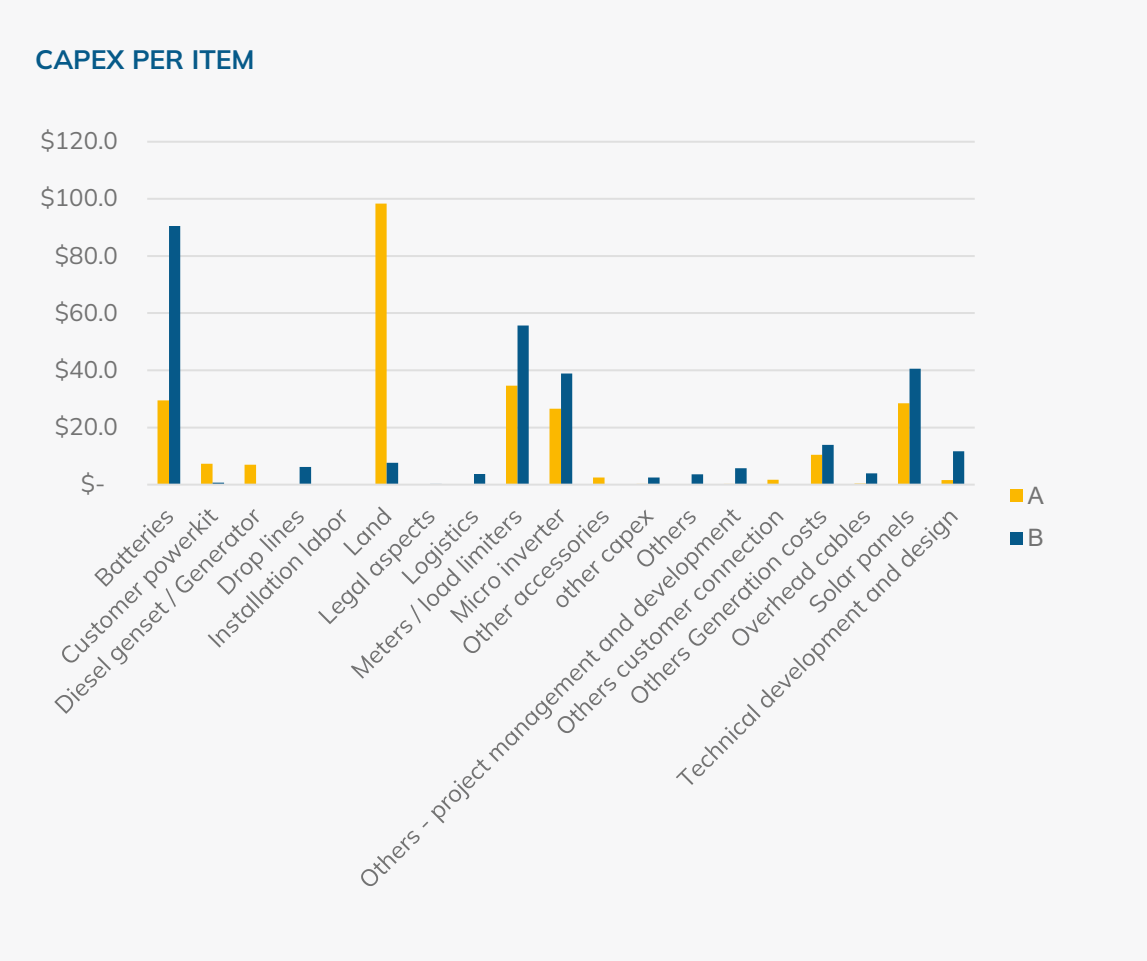
When comparing Company A and Company B, significant differences emerge in their approach to land-related expenses and generation costs. Company A allocated USD 98, nearly 40% of its total CAPEX, for land, whereas Company B spent only USD 8, equivalent to 3% of its total CAPEX on land-related expenses and generation costs. Similarly, in terms of generation costs, Company A invested USD 102, representing 41% of the total CAPEX, while Company B allocated USD 184, constituting 64%. This divergence suggests varying priorities or operational strategies between the two companies, with potential implications for their overall business performance and competitiveness within the market.




Note: The dataset and analysis conducted for Sierra Leone primarily rely on data from two companies, as the other company has not submitted all the necessary components.

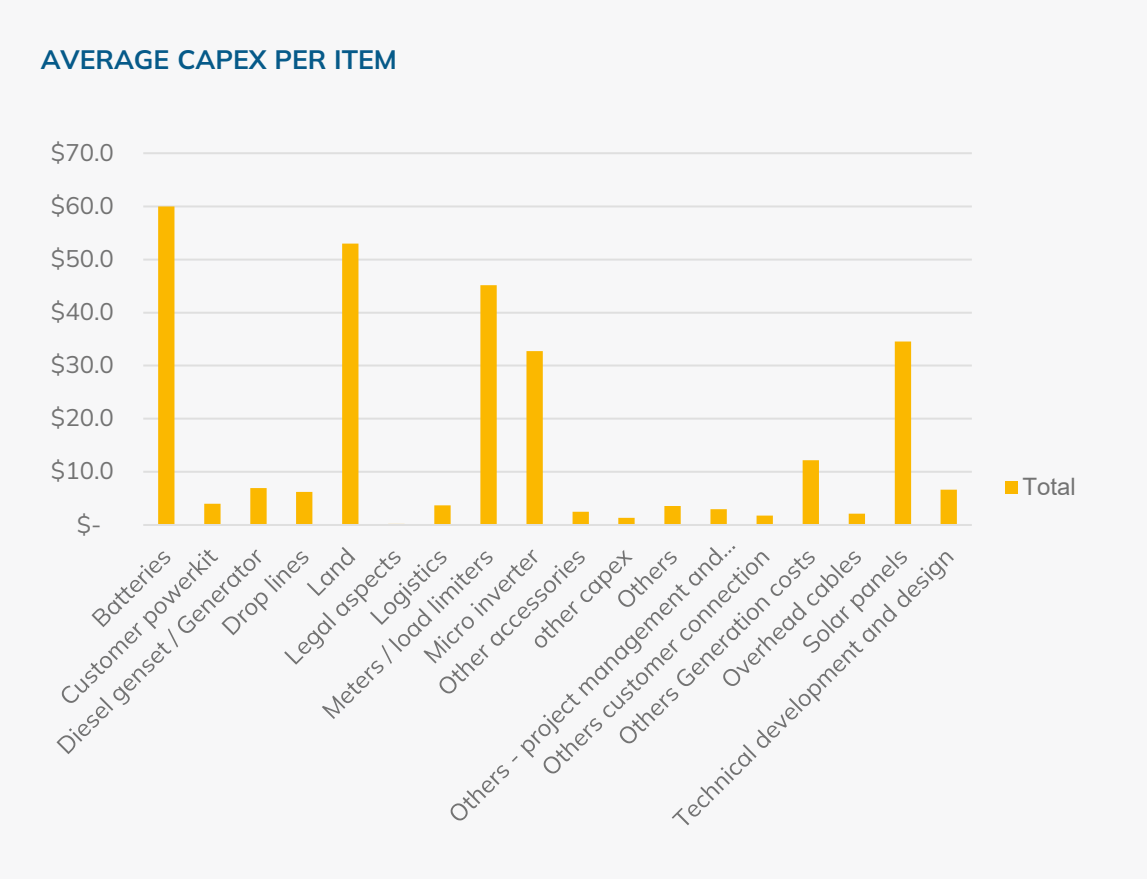
# Sierra Leone




In a more detailed comparison between Company A and Company B, the analysis reveals that while the total cost per connection for both companies falls below USD 300, ranging from USD 245 to USD 285, the cost per item unveils the unique prioritization and strategic approach for each company.

Notable differences include: batteries, with a range of USD 30 to USD 90; solar panels, ranging from USD 28 to USD 41; and diesel genset/generators, ranging from USD 0 to USD 7.

# Sierra Leone




On average, the highest expenditure is observed in batteries (USD 60), land (USD 53), solar panels (USD 35) and meters/load limiters (USD 45).

The table below provides a breakdown of cost ranges by category.

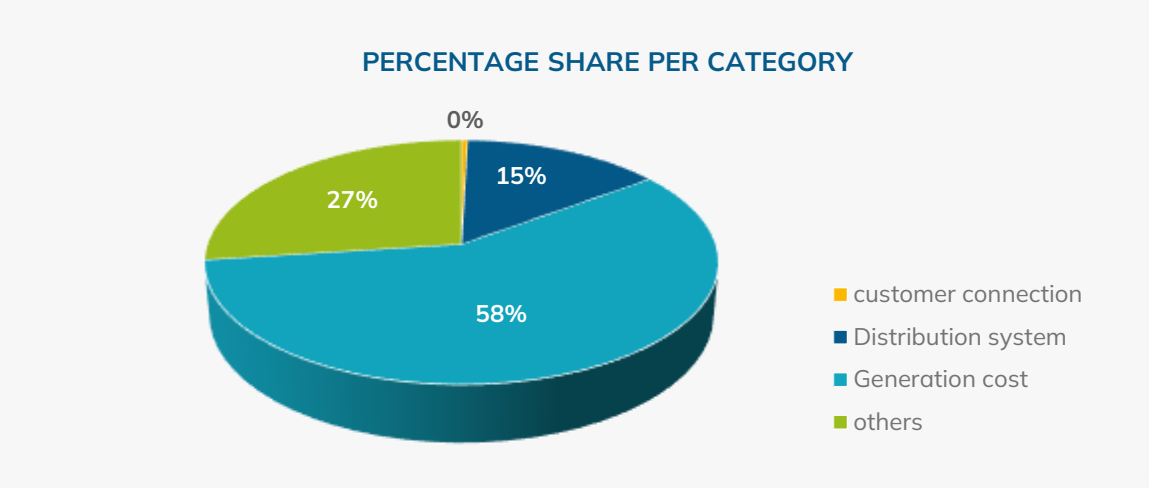
| Category | Range |
|---|---|
| Customer connections | USD 0.7–56 |
| Distribution systems | USD 0.4–6 |
| Generation costs | USD 7–91 |
| Intangible assets | USD 0.2–12 |
| Land | USD 8–98 |
| Other CAPEX | USD 0.2–3 |
| Other – project management | USD 0.3–6 |
| **Total cost per connection** | **USD 245–285** |

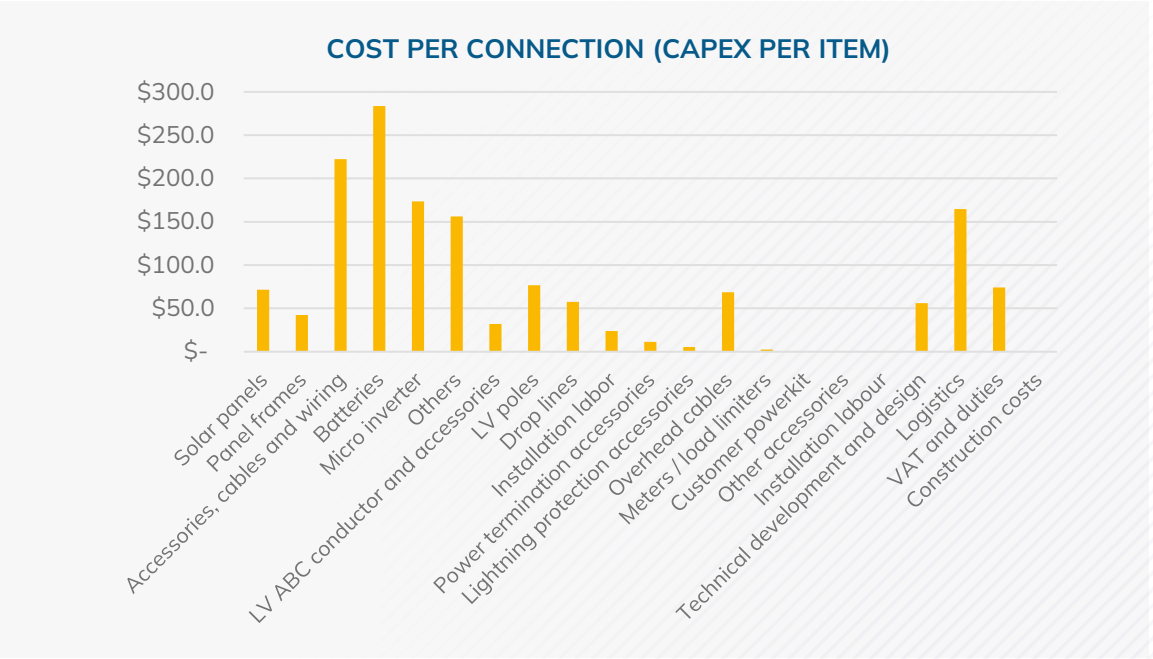
# Burkina Faso

## CAPEX allocation in 2022

The distribution of CAPEX in Burkina Faso's mini-grid sector in 2022 demonstrated significant emphasis on generation costs, accounting for 58% of the total CAPEX, amounting to approximately USD 158. Following this, the distribution system represented 15% of the total CAPEX, equivalent to USD 39, while other CAPEX costs including logistics, VAT and duties and construction costs accounted for 27%, totalling USD 74 per connection annually. Customer connections accounted for only USD 1.2 per connection annually. Compared to Sierra Leone (USD 267) and Nigeria (USD 527), the average CAPEX cost per connection in Burkina Faso (USD 1,526) was considerably higher, indicating potentially different cost structures of market conditions.

The relatively low percentage allocated to customer connection costs, despite the high overall CAPEX, suggests a potential area for optimization. Enhancing accessibility by optimizing customer connection costs could be crucial for improving the affordability and scalability of mini-grid solutions in Burkina Faso.




Note: The dataset and analysis conducted for Burkina Faso primarily rely on data from one company, as other companies have not submitted all the necessary components. Exchange rate used for local currency data submissions was sourced from: https://www.focus-economics.com/country-indicator/burkina-faso/exchange-rate/

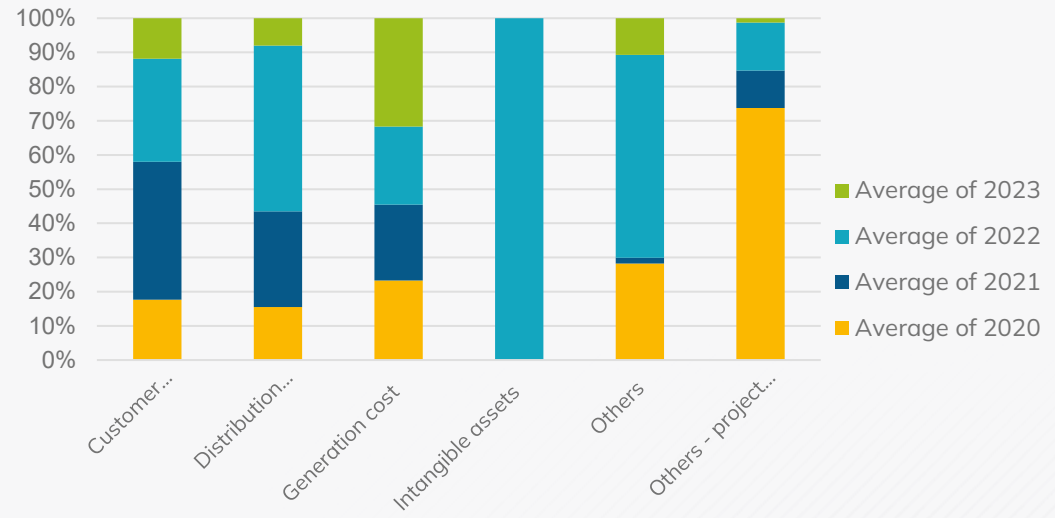
# Nigeria

## A comparative analysis of CAPEX allocation from 2020 to 2023

In this analysis, data from three developers representing 12 mini-grid sites was successfully secured and utilized, providing valuable insights into the sector's dynamics and trends.

As observed in the table, average costs per category fluctuated between 2020 and 2023. In 2020, an average total of USD 712 was spent, with the highest amount allocated to project development and management. This can be attributed to the initial investment required for project development, which typically decreases over time. This trend is consistent with our data, showing a decrease from USD 420 in 2020 to USD 7.4 in 2023. Notably, in 2023, the total average cost dropped to USD 156, indicating a significant reduction from the 2020 figure of USD 712. This substantial decrease in costs allocated for project development and management over the years is evident in the table.

**% AVERAGE CAPEX PER YEAR**




**AVERAGE COST PER CATEGORY**

| Cost category | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|
| Customer connections | $33.4 | $76.4 | $57.0 | $22.5 |
| Distribution systems | $31.3 | $56.3 | $97.8 | $16.1 |
| Generation costs | $45.6 | $43.5 | $44.9 | $62.1 |
| Intangible assets | N/A | N/A | $4.1 | N/A |
| Others | $28.9 | $1.7 | $60.6 | $11.0 |
| Others: project management and development | $419.7 | $62.4 | $79.5 | $7.4 |
| Avg. total CAPEX cost per connection | $712 | $300 | $527 | $156 |

Exchange rate used for local currency data submissions was sourced: https://www.cbn.gov.ng/

# Nigeria

| Item | Average of 2022 | Average of 2023 |
|---|---|---|
| Accessories, cables and wiring | $31.65 | $333.42 |
| Batteries | $64.94 | $58.91 |
| Construction costs | $21.37 | N/A |
| Customer power kits | $1.39 | N/A |
| Diesel gensets / Generators | $45.12 | $24.48 |
| Drop lines | $19.23 | N/A |
| Installation kits | $4.27 | $2.37 |
| Installation labour (distribution) | 1$5.50 | N/A |
| Installation labour | $66.60 | N/A |
| Internal wiring | $0.85 | N/A |
| Land | $76.42 | $10.99 |
| Legal aspects | $0.53 | N/A |
| Lightning protection accessories | $14.84 | N/A |
| Logistics | $9.88 | N/A |
| LV ABC conductor and accessories | $188.05 | $17.87 |
| LV poles | $28.94 | $14.23 |
| Meters / load limiters | $74.91 | $22.48 |
| Micro inverters | $53.02 | $44.28 |
| Office equipment and furniture | $4.95 | N/A |
| Other accessories | $1.76 | N/A |
| Other generation costs | $34.62 | N/A |
| Others – project management and development | $79.47 | $7.42 |
| Others (customer connections) | $5.13 | N/A |
| Overhead cables | $60.10 | N/A |
| Panel frames | $6.41 | $9.25 |
| Power termination accessories | $2.14 | N/A |
| Ready boards | $2.15 | N/A |
| Solar panels | $33.50 | $31.94 |
| Technical development and design | $1.94 | N/A |
| Average total CAPEX cost per connection | 527 | 156 |

The table on the left provides a comprehensive overview of the average CAPEX costs per item at the mini-grid level for 2022 and 2023. While the data for 2023 are not fully available, the insights gleaned from the 2022 figures offer valuable insights into the composition of each cost component within the total CAPEX. For example, in 2022, the highest allocation of funds was directed towards the LV ABC conductor and accessories, amounting to USD 188. Additionally, significant expenditures were incurred for project management and development (USD 79), land-related costs (USD 76), and meters (USD 75).

Of particular interest is the observed reduction in the cost of solar panels from USD 33.5 in 2022 to USD 32 in 2023, which mirrors the global trend of declining solar panel costs due to technological advancements and economies of scale.

However, it's important to note that while the average total CAPEX costs for 2022 and 2023 were USD 527 and USD 156, respectively, the reasons behind this apparent decrease require further investigation. While it's tempting to attribute this reduction to improved efficiency and cost-saving measures, the incomplete dataset for 2023 underscores the need for caution in drawing definitive conclusions.

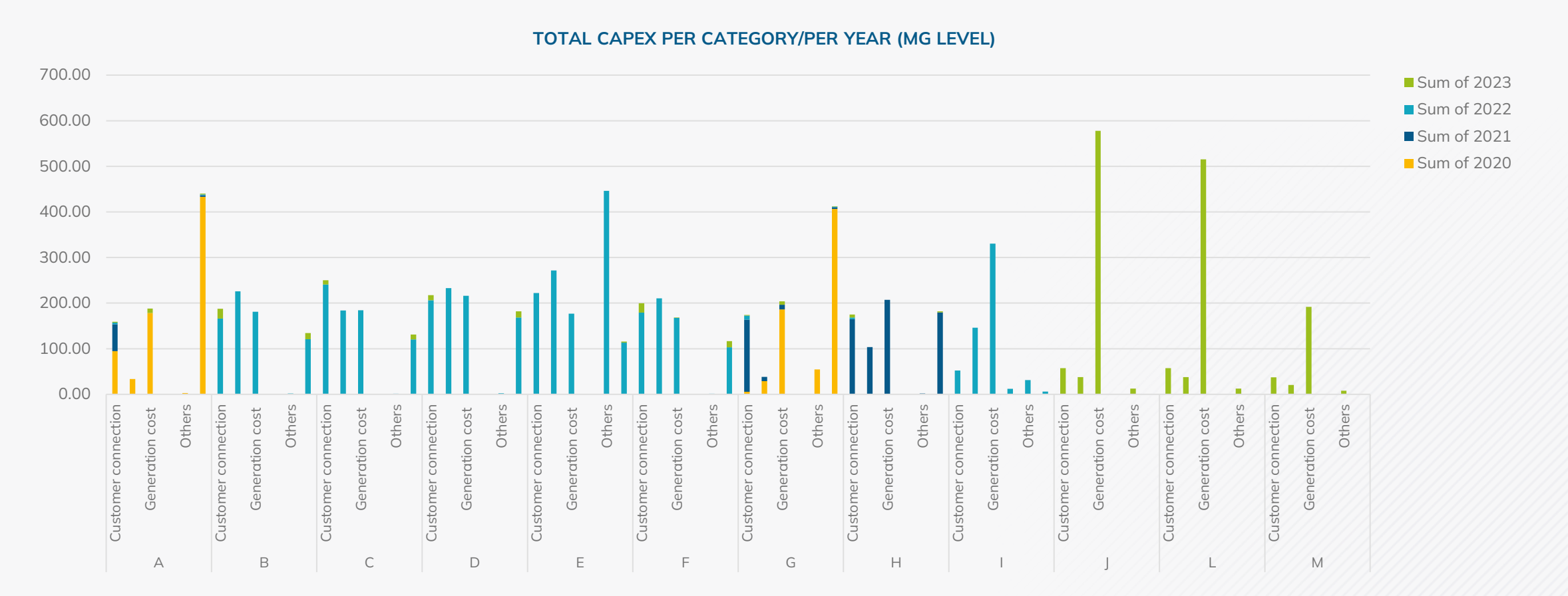
# Nigeria

The table below provides a detailed breakdown of the minimum and maximum costs per item from 2020 to 2023.

| Item | 2020 | | 2021 | | 2022 | | 2023 | |
|---|---|---|---|---|---|---|---|---|
| | Min | Max | Min | Max | Min | Max | Min | Max |
| Accessories, cables and wiring | N/A | N/A | N/A | N/A | $31.65 | $31.65 | $333.42 | $333.42 |
| Batteries | $55.40 | $61.33 | $10.27 | $54.13 | $55.84 | $82.24 | $7.41 | $99.10 |
| Construction costs | N/A | N/A | N/A | N/A | $21.37 | $21.37 | N/A | N/A |
| Customer power kits | N/A | N/A | N/A | N/A | $1.39 | $1.39 | N/A | N/A |
| Diesel gensets / Generators | $45.11 | $46.88 | $49.02 | $49.02 | $35.98 | $64.32 | $24.48 | $24.48 |
| Drop lines | N/A | N/A | N/A | N/A | $19.23 | $19.23 | N/A | N/A |
| Installation kits | N/A | N/A | N/A | N/A | $4.27 | $4.27 | $1.86 | $2.88 |
| Installation labour (distribution) | N/A | N/A | N/A | N/A | $15.50 | $15.50 | N/A | N/A |
| Installation labour | $89.19 | $89.19 | $29.98 | $89.19 | $1.30 | $95.54 | N/A | N/A |
| Internal wiring | N/A | N/A | N/A | N/A | $0.85 | $0.85 | N/A | N/A |
| Land | $2.88 | $54.80 | $1.73 | $1.73 | $1.61 | $446.40 | $8.07 | $12.45 |
| Legal aspects | N/A | N/A | N/A | N/A | $0.53 | $0.53 | N/A | N/A |
| Lightning protection accessories | N/A | N/A | N/A | N/A | $14.84 | $14.84 | N/A | N/A |
| Logistics | N/A | N/A | N/A | N/A | $9.88 | $9.88 | N/A | N/A |
| LV ABC conductor and accessories | $28.95 | $33.65 | $9.14 | $103.44 | $3.34 | $271.64 | $4.66 | $24.48 |
| LV poles | N/A | N/A | N/A | N/A | $28.94 | $28.94 | $13.41 | $15.88 |
| Meters / load limiters | $5.40 | $5.46 | $58.85 | $134.72 | $3.78 | $145.99 | $1.49 | $57.47 |
| Micro inverters | $39.06 | $39.14 | $46.88 | $46.88 | $41.73 | $66.25 | $0.12 | $80.50 |
| Office equipment and furniture | N/A | N/A | N/A | N/A | $4.95 | $4.95 | N/A | N/A |
| Other accessories | N/A | N/A | N/A | N/A | $1.76 | $1.76 | N/A | N/A |
| Other generation costs | N/A | N/A | N/A | N/A | $34.62 | $34.62 | N/A | N/A |
| Others – project management and development | $406.43 | $432.98 | $3.65 | $179.90 | $1.55 | $168.68 | $1.18 | $13.73 |
| Others (customer connections) | N/A | N/A | N/A | N/A | $5.13 | $5.13 | N/A | N/A |
| Overhead cables | N/A | N/A | N/A | N/A | $60.10 | $60.10 | N/A | N/A |
| Panel frames | N/A | N/A | N/A | N/A | $6.41 | $6.41 | $0.02 | $15.33 |
| Power termination accessories | N/A | N/A | N/A | N/A | $2.14 | $2.14 | N/A | N/A |
| Ready boards | N/A | N/A | N/A | N/A | $2.15 | $2.15 | N/A | N/A |
| Solar panels | $36.93 | $40.89 | $57.03 | $57.03 | $18.64 | $65.28 | $1.08 | $46.45 |
| Technical development and design | N/A | N/A | N/A | N/A | $1.94 | $1.94 | N/A | N/A |

# Nigeria

The comprehensive examination of mini-grid data submissions from developers in Nigeria depicted in the figure below unveils a clear trend: generation costs take precedence in the CAPEX breakdown, comprising the largest portion, followed by project management and distribution expenses.



# Nigeria

### TOTAL CAPEX ANNUALLY PER MINI-GRID SITE

| Mini-grid | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|
| A | $742.50 | $62.50 | $5.36 | $13.79 |
| B | $0.00 | $0.00 | $696.05 | $35.31 |
| C | $0.00 | $0.00 | $731.03 | $20.46 |
| D | $0.00 | $0.00 | $826.01 | $24.29 |
| E | $0.00 | $0.00 | $1230.94 | $2.34 |
| F | $0.00 | $0.00 | $661.83 | $35.34 |
| G | $681.97 | $181.69 | $10.11 | $10.08 |
| H | $0.00 | $656.84 | $3.78 | $8.74 |
| I | $0.00 | $0.00 | $578.49 | $0.00 |
| J | $0.00 | $0.00 | $0.00 | $685.43 |
| L | $0.00 | $0.00 | $0.00 | $623.24 |
| M | $0.00 | $0.00 | $0.00 | $257.82 |
| **Grand Total** | **$1424.47** | **$901.03** | **$4743.60** | **$1716.85** |

The table on the left provides a detailed breakdown of the total CAPEX for each mini-grid site in Nigeria between 2020 and 2023. A discernible pattern emerges, showcasing the highest expenditure in the initial year of mini-grid construction, followed by a significant reduction in costs over time. For instance, mini-grid site G exemplifies this trend, with the highest investment allocated in 2020 at USD 682, gradually decreasing to USD 10 by 2023. Similar patterns are observed across other sites, indicating that during the early stages of operation, mini-grids incur the highest CAPEX costs per connection. The subsequent reduction in CAPEX in later years may be attributed to an increased number of connections, necessitating the acquisition of additional assets for customer connectivity.

# Country comparison

A comparative analysis of CAPEX Trends in Burkina Faso, Nigeria and Sierra Leone

### AVERAGE CAPEX COST PER CONNECTION PER COUNTRY

| | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|
| Nigeria | $712.2 | $300.3 | $527.1 | $156.1 |
| Burkina Faso | N/A | N/A | $1,526.0 | N/A |
| Sierra Leone | $267.3 | N/A | N/A | N/A |

Examining the average CAPEX cost per connection across Burkina Faso, Nigeria and Sierra Leone offers valuable insights into the distinct mini-grid landscapes within these countries. Although limited, the data indicate that Burkina Faso has the highest average CAPEX cost per connection, totalling USD 1,526 in 2022. This significant figure is attributed to higher generation costs allocated, accounting for 58% of the total average cost per connection), compared to Sierra Leone (28% in 2020) and Nigeria (ranging from 24.1%–75.9% across 2020–2023). In contrast, Sierra Leone reported a notably lower average CAPEX cost in 2020, amounting to USD 267 per connection. On average, Sierra Leone appears to invest the least amount of CAPEX per connection compared to the other two countries. While the reasons behind these trends are not entirely clear due to limited data, they provide some insight into the financial considerations and challenges associated with implementing mini-grid projects across different regions. These insights can inform strategic decision-making and resource allocation for sustainable energy development initiatives in each country.

# Country comparison

The CAPEX datasets collected from Burkina Faso, Nigeria and Sierra Leone offer a snapshot of the diverse different mini-grid landscapes in the three countries. Various factors, including policy and regulatory frameworks, financing and investments, knowledge sharing and capacity building initiatives, business models and revenue sources, and stakeholder engagement and partnerships, all contribute to shaping the mini-grid market dynamics in each country. While each of these components plays a crucial role in influencing the mini-grid sector, our analysis will focus on comparing the datasets from the three countries and highlighting key findings, without delving into the specific factors that may have influenced the observed trends.

The range of CAPEX costs for each category from 2020 to 2023 is displayed in the table on the right. As observed in the previous sections for each country, there are significant differences in the cost ranges for CAPEX, which is also evident in the table. One of the most notable differences in the range is observed for the generation cost, which consistently exhibits the widest range compared to other category items.

**CAPEX COST RANGE PER CATEGORY (2020-2023)**

| | 2020 | | 2021 | | 2022 | | 2023 | |
|---|---|---|---|---|---|---|---|---|
| Cost category | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| Customer connections | $0.69 | $89.19 | $29.98 | $134.72 | $0.80 | $145.99 | $1.49 | $57.47 |
| Distribution systems | $0.36 | $33.65 | $9.14 | $103.44 | $2.14 | $271.64 | $4.66 | $24.48 |
| Generation costs | $6.96 | $90.48 | $10.27 | $57.03 | $4.27 | $283.61 | $0.02 | $333.42 |
| Intangible assets | $0.19 | $11.70 | N/A | N/A | $0.53 | $164.70 | N/A | N/A |
| Others | $2.88 | $98.36 | $1.73 | $1.73 | $0.09 | $446.40 | $8.07 | $12.45 |
| Others: project management & development | $0.29 | $432.98 | $3.65 | $179.90 | $1.55 | $168.68 | $1.18 | $13.73 |
| Other CAPEX | $0.25 | $2.45 | N/A | N/A | N/A | N/A | N/A | N/A |

# Country comparison (1/2)

## AVERAGE CAPEX COST PER CATEGORY PER COUNTRY

| | Burkina Faso | | | | Nigeria | | | | Sierra Leone | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cost category | 2020 | 2021 | 2022 | 2023 | 2020 | 2021 | 2022 | 2023 | 2020 | 2021 | 2022 | 2023 |
| Customer connections | N/A | N/A | $1.2 | N/A | $33.3 | $76.4 | $57.0 | $22.5 | $15.2 | N/A | N/A | N/A |
| Distribution systems | N/A | N/A | $33.2 | N/A | $31.3 | $56.3 | $97.8 | $16.1 | $3.5 | N/A | N/A | N/A |
| Generation costs | N/A | N/A | $146.7 | N/A | $45.6 | $43.5 | $44.9 | $62.1 | $31.8 | N/A | N/A | N/A |
| Intangible assets | N/A | N/A | $98.3 | N/A | N/A | N/A | $4.1 | N/A | $3.5 | N/A | N/A | N/A |
| Other CAPEX | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | $1.4 | N/A | N/A | N/A |
| Others | N/A | N/A | $0.1 | N/A | $28.8 | $1.7 | $60.6 | $11.0 | $53.0 | N/A | N/A | N/A |
| Others: project management and development | N/A | N/A | N/A | N/A | $419.7 | $62.4 | $79.5 | $7.4 | $3.0 | N/A | N/A | N/A |

The table above provides a breakdown of the average CAPEX cost per category for each country from 2020 to 2023. It is important to note that due to unavailable datasets, a direct comparison of CAPEX costs across all three countries for any single year is not feasible.

# Country comparison (2/2)

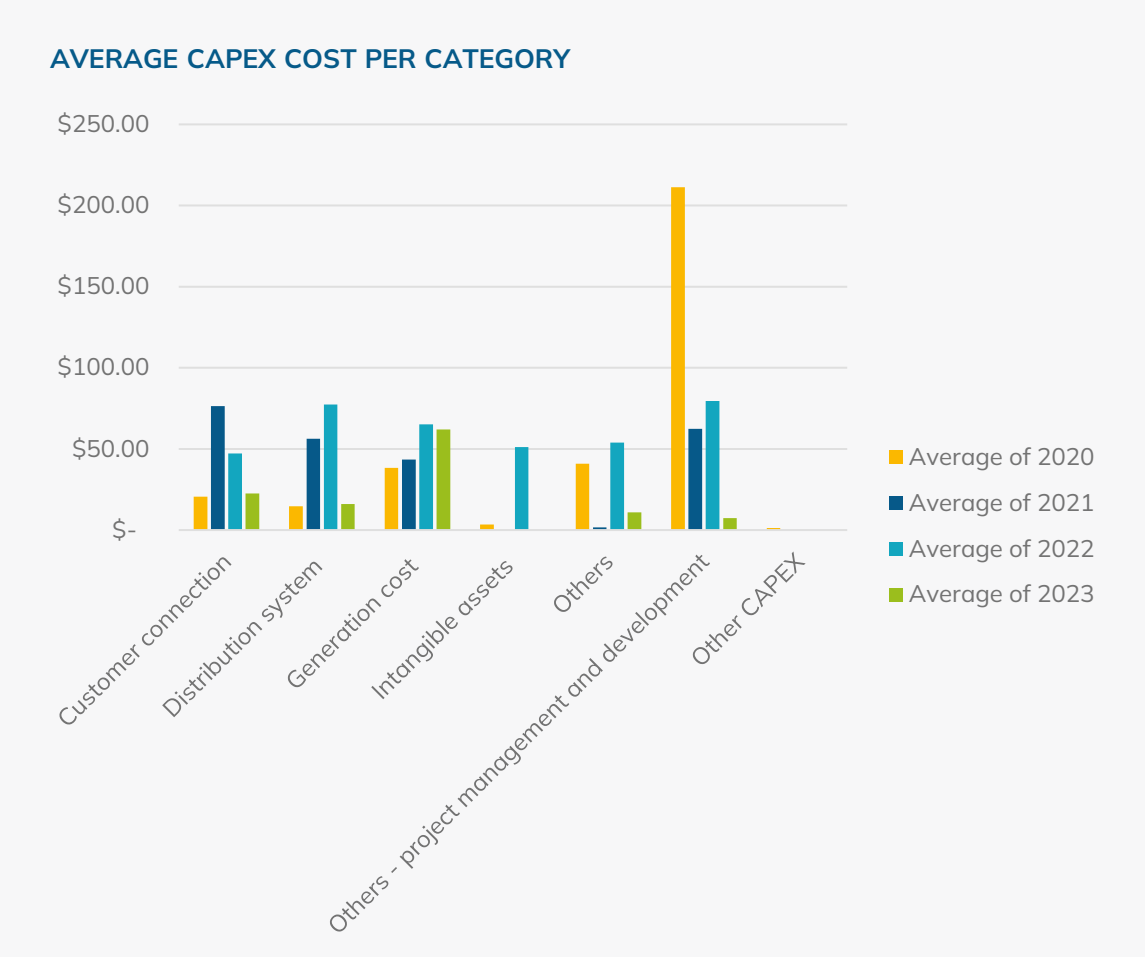
In 2020, Nigeria had varying CAPEX costs across different categories, with significant expenses in project management and development (USD 420) and generation costs (USD 46). Unfortunately, data from other countries for comparison during the same year are unavailable. Nevertheless, it is noteworthy that generation costs seem to be a prominent allocation within the total CAPEX for all three countries, albeit in different timeframes. In 2021, Nigeria continued to demonstrate high costs in project management and development (USD 62), although this was 85% less than the previous year. Additionally, expenditure for customer connections and distribution systems saw increases, USD 76 and USD 56, respectively.

In 2022, noteworthy disparities emerged between Burkina Faso and Nigeria in terms of average costs allocated to different categories. Burkina Faso's expenditure for customer connections (USD 1) and distribution systems (USD 33) were notably lower than those of Nigeria, while expenses for generation costs in Burkina Faso were more than three times those in Nigeria (USD 147 vs USD 45).

In 2020, a comparison between Nigeria and Sierra Leone revealed that Nigeria spent double to triple the amount that Sierra Leone did across all categories, with the exception of the 'others' category that included land, office equipment and furniture, and construction costs.

This analysis highlights the diverse trends in CAPEX expenditure among these countries over the specified years, reflecting different priorities and investments in their respective mini-grid markets.

# Country comparison




Transitioning to the average CAPEX per category from 2020 to 2023, there is a notable pattern, particularly evident in the spike observed for project development and management in 2020. This spike indicates that the initial phase of project development demands a significant upfront investment, likely due to the need for extensive planning, research and resource allocation at the outset of a project. It is worth noting that these specific mini-grid projects commenced operations in 2020, hence the reason for this hike in expenditure during that year. This observation aligns with the data presented in the previous table, where the range of minimum and maximum costs per category indicated that the project development and management cost was the highest in 2020.

Furthermore, it is worth noting that while there may be fluctuations in the average costs per category over the years, with the exception of the project development and management cost for 2020, all other categories exhibit average costs of less than USD 100 annually. This suggests a trend towards relatively stable and moderate expenditure across various aspects of project implementation and operation, indicating a degree of consistency in cost management practices over time.

CHAPTER TWO

# Analysis of Mini-Grid CAPEX and OPEX

## Operating Expenditure (OPEX)

# Introduction to OPEX

## Definition

Operating expenditure (OPEX) represents ongoing costs incurred by a company or a project to maintain regular operations and support its activities.

## Components

The OPEX components utilized in this study include personnel, diesel fuel costs, maintenance, insurance, communication and promotions and additional items.

## OPEX Variations

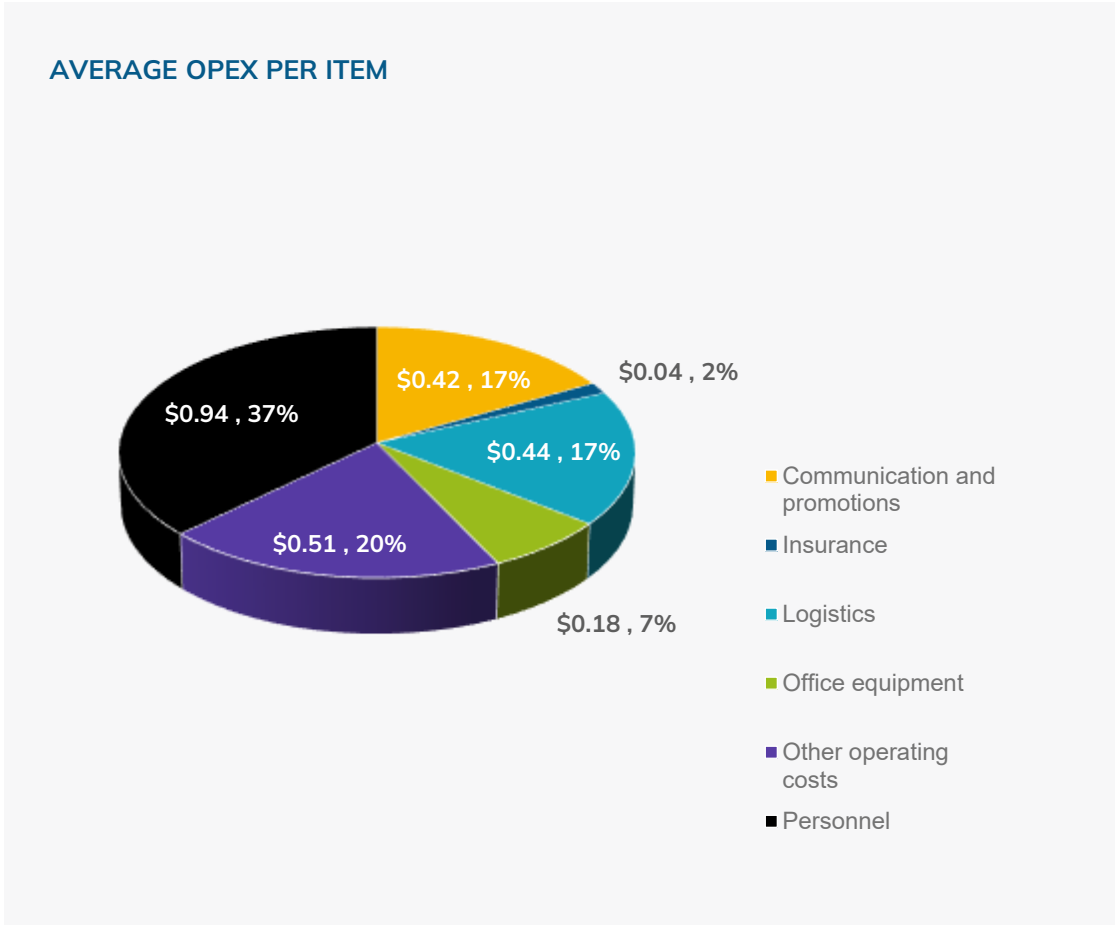
Influenced by factors such as geographical location, scale of operations, regulatory requirements, technological advancements and changes in market conditions.

## OPEX in Mini-Grid Tariffs

OPEX plays a significant role in the cost drivers of mini-grid tariffs by influencing ongoing operational and maintenance expenses, directly affecting the overall pricing and financial sustainability of the project.

# Sierra Leone

A comparative analysis of OPEX allocation




The average OPEX cost per connection in Sierra Leone is derived from data provided by two developers, encompassing approximately 2,830 connections. According to the pie chart on the left, personnel costs represent the largest portion, accounting for 37% of the total average OPEX allocation, amounting to USD 0.94. Other operating costs, including items such as customer billing expenses, technical operation expenses and operation materials make up 20% of the total, amounting to USD 0.5. Additionally, logistics and communication and promotions each constitute 17% of the total OPEX, with USD 0.42 allocated to each category.

For a more detailed breakdown of the minimum and maximum cost range per item, please refer to the table below.

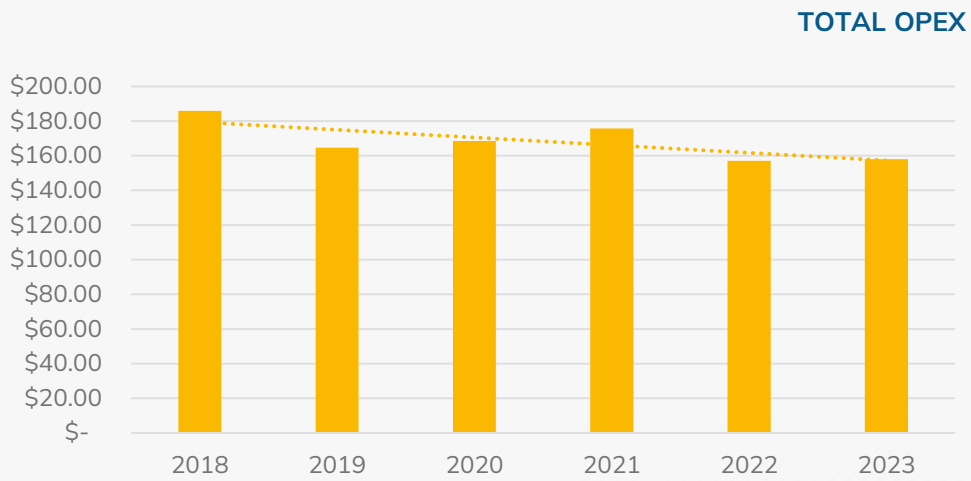
| Item | Min Cost | Max Cost |
|---|---|---|
| Communication and promotions | $ 0,42 | $ 0,57 |
| Insurance | $ 0,04 | $ 0,04 |
| Logistics | $ 0,44 | $ 0,96 |
| Office equipment | $ 0,09 | $ 0,18 |
| Other operating costs | $ 0,17 | $ 0,51 |
| Personnel | $ 0,94 | $ 3,19 |

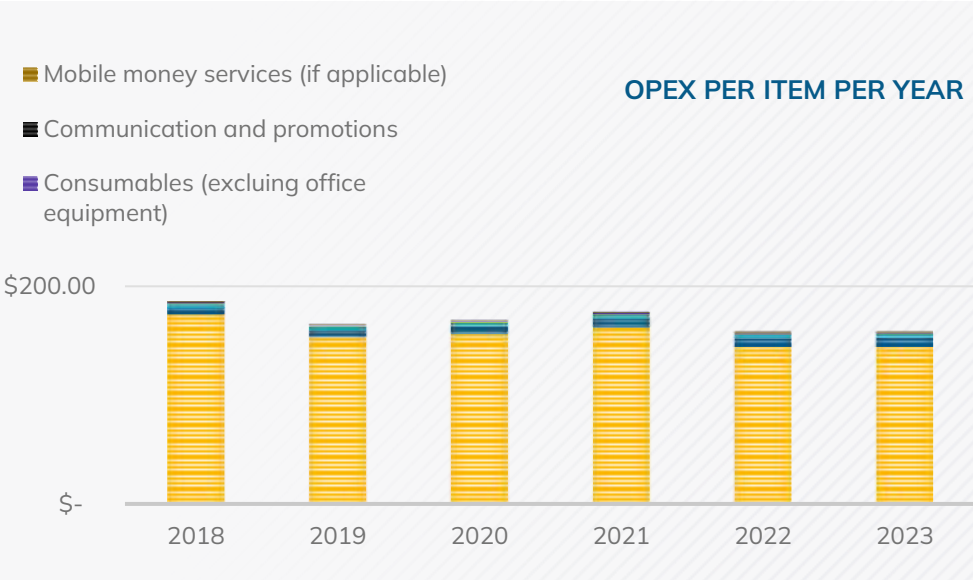
# Burkina Faso

## OPEX allocation from 2018 to 2023

The data from Burkina Faso are particularly important as they allow for the analysis of annual variations and trends spanning from 2018 to 2023 from a single company. The graph illustrates a gradual increase in total OPEX from 2019 to 2021, followed by a slight reduction in 2022 and 2023. Given that the majority of total OPEX is attributed to diesel fuel costs for this case (see the OPEX per item per year graph), this gradual increase can be attributed to the global rise in diesel fuel prices during the COVID-19 pandemic, as evidenced by the main increase in the diesel fuel cost. The forthcoming country comparison chapter will include a comparative analysis of the spike in diesel fuel prices with Nigeria. However, due to the availability of only the 2020 datasets for Sierra Leone, a comparative assessment is not possible.

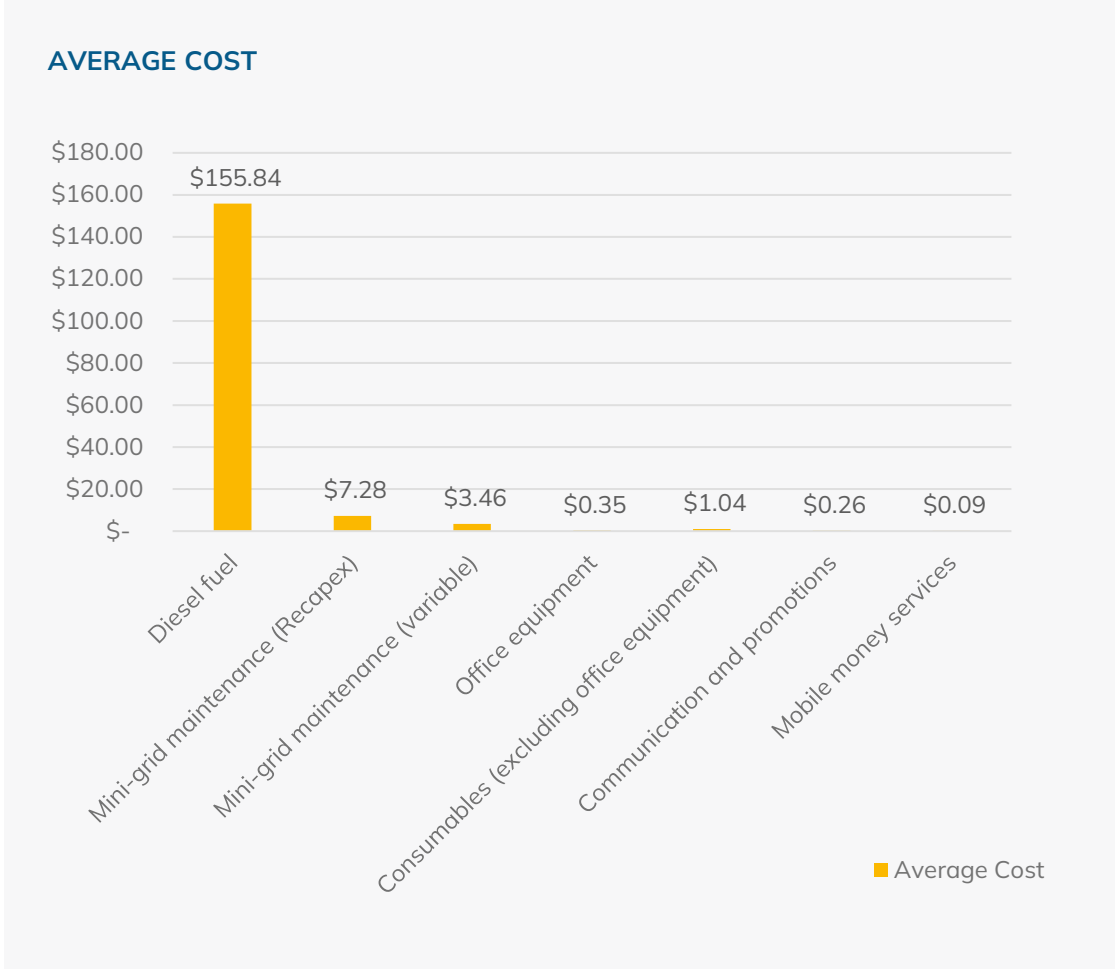
A detailed breakdown reveals that the overarching trends observed between 2018 and 2023 remain almost constant. On average, diesel fuel accounts for 91.4% to 93.8% of the total OPEX annually, amounting to USD 144 to USD 179 per connection. Following diesel fuel, maintenance (recapex) encompasses replacement parts for electrical components, and test equipment for trouble shooting, contributing 3.1% to 5.6%, or USD 6 to USD 8.5 per connection of the total OPEX. The remaining components comprise office equipment, mobile money services, communication and promotions, and other expenses.




Note: The dataset and analysis conducted for Burkina Faso primarily rely on data from one company, as other companies have not submitted all the necessary components.

# Burkina Faso




The graph on the left offers a comprehensive portrayal of the average OPEX incurred over a six-year period, as outlined in the preceding slide.

It illustrates that diesel fuel comprises the most substantial portion of the operational expenses for this particular company, constituting a significant proportion of the total budget. This underscores the critical role of fuel expenses in supporting the power generation activities of the hybrid mini-grid. Given that diesel fuel represents a considerable share of the operational costs, any fluctuations or variations in fuel prices can have a notable impact on the overall operational budget and subsequently influence tariff rates.

# Burkina Faso

The table below provides a breakdown of the proportion of OPEX allocated to specific items annually.

### PERCENTAGE OPEX PER ITEM PER YEAR

| Year | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Diesel fuel | 93.8% | 93,3% | 92,8% | 92,3% | 91,8% | 91,4% |
| Mini-grid maintenance (Recapex) | 3.1% | 3.6% | 4.1% | 4.6% | 5,1% | 5,6% |
| Mini-grid maintenance (variable) | 2.1% | 2.1% | 2.1% | 2.1% | 2,0% | 2,0% |
| Office equipment | 0.2% | 0.2% | 0.2% | 0.2% | 0,2% | 0,2% |
| Consumables (excluding office equipment) | 0.6% | 0.6% | 0.6% | 0.6% | 0,6% | 0,6% |
| Communication and promotions | 0.2% | 0.2% | 0.2% | 0.2% | 0,2% | 0,2% |
| Mobile money services | 0.1% | 0.1% | 0.1% | 0.1% | 0,1% | 0,1% |

# Nigeria

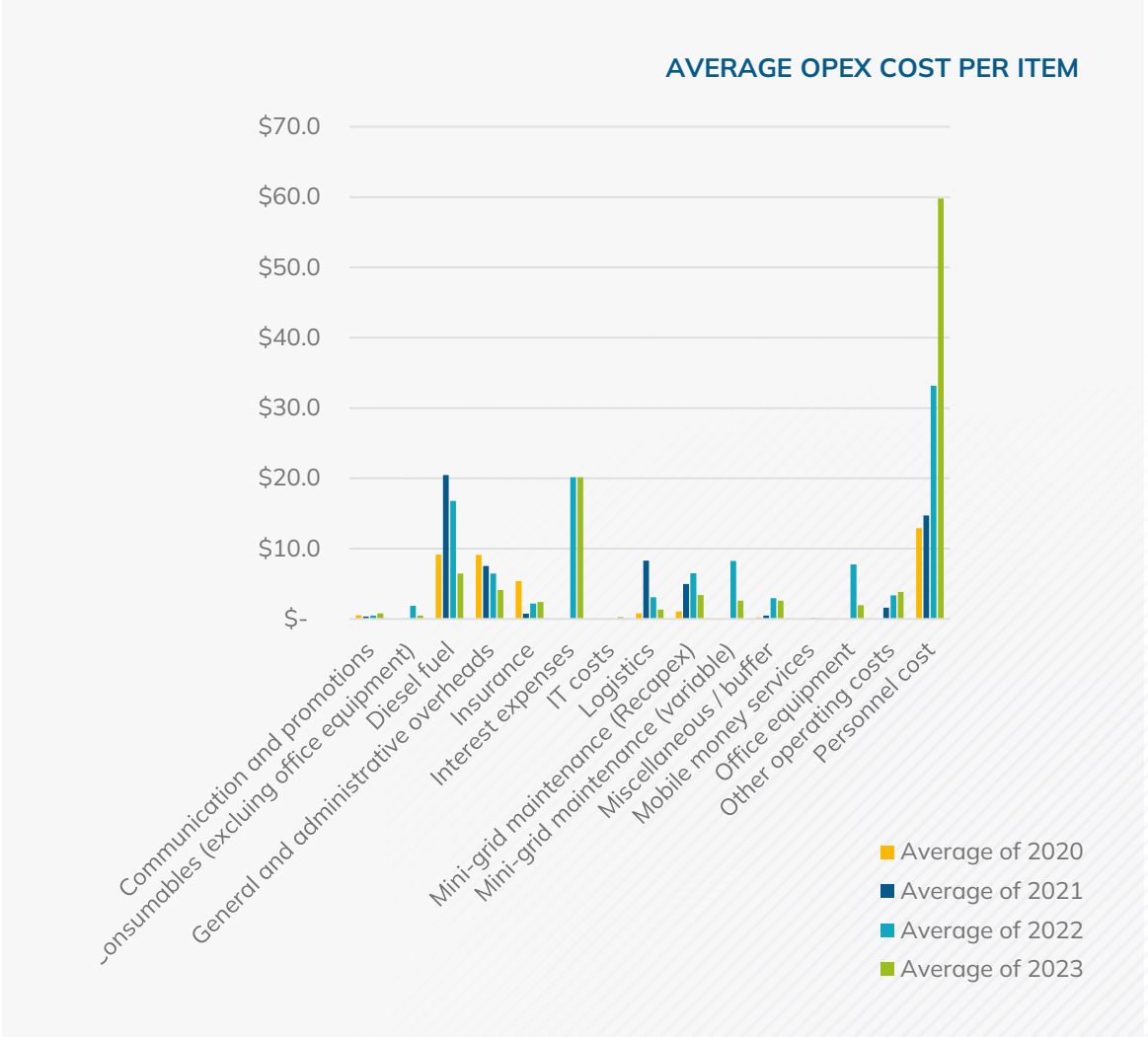
## A comparative analysis of OPEX allocation

The data from Nigeria provide insights into annual variations and trends between 2020 and 2023, sourced from a total of three developers across 12 mini-grid sties.

The average cost of diesel fuel per connection required to meet electricity demand annually exhibited fluctuations over these years, starting at USD 9 in 2020, peaking at USD 21 in 2021, and subsequently decreasing to USD 6 in 2023. This pattern closely mirrors the trend observed in Burkina Faso, confirming our hypothesis that the global rise in diesel fuel prices during the COVID-19 pandemic was the primary driver of this fluctuation.

In terms of percentage allocation within the total OPEX, diesel fuel accounted for 23% in 2020, 31% in 2021, 18% in 2022 and 8% in 2023.

One of the highest allocations for the average OPEX item is personnel, a pattern that closely resembles the trend observed in Sierra Leone and underlines the significance of labour costs in operating mini-grid systems across different regions.



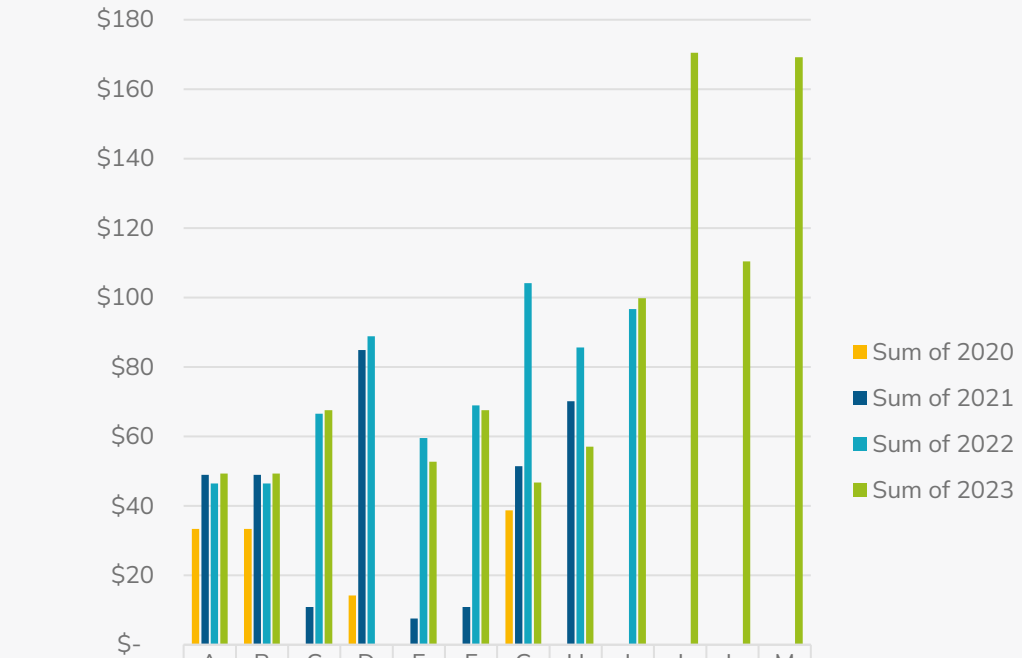
# Nigeria

The table below provides a breakdown of the minimum and maximum cost range per OPEX item annually.

| Item | Min of 2020 | Max of 2020 | Min of 2021 | Max of 2021 | Min of 2022 | Max of 2022 | Min of 2023 | Max of 2023 |
|---|---|---|---|---|---|---|---|---|
| Communication and promotions | $ 0.49 | $ 0.58 | $ 0.28 | $ 0.51 | $ 0.07 | $ 1.65 | $ 0.01 | $ 1.37 |
| Consumables (excluding office equipment) | $ N/A | $ N/A | $ N/A | $ N/A | $ 1.89 | $ 1.89 | $ 0.02 | $ 1.87 |
| Diesel fuel | $ 8.60 | $ 10.21 | $ 8.53 | $ 30.77 | $ 9.00 | $ 33.56 | $ 1.30 | $ 12.64 |
| General and administrative overheads | $ 8.17 | $ 9.59 | $ 6.96 | $ 8.92 | $ 4.37 | $ 9.11 | $ 0.03 | $ 6.65 |
| Insurance | $ 5.37 | $ 5.37 | $ 0.74 | $ 0.74 | $ 1.49 | $ 4.36 | $ 0.47 | $ 5.38 |
| Interest expenses | $ N/A | $ N/A | $ N/A | $ N/A | $ 20.13 | $ 20.13 | $ 20.13 | $ 20.13 |
| IT costs | $ N/A | $ N/A | $ N/A | $ N/A | $ N/A | $ N/A | $ 0.02 | $ 0.72 |
| Logistics | $ 0.24 | $ 1.09 | $ 4.85 | $ 12.82 | $ 1.47 | $ 6.70 | $ 0.22 | $ 2.68 |
| Mini-grid maintenance (recapex) | $ 0.97 | $ 1.27 | $ 3.09 | $ 7.35 | $ 2.07 | $ 18.71 | $ 0.28 | $ 6.50 |
| Mini-grid maintenance (variable) | $ N/A | $ N/A | $ N/A | $ N/A | $ 8.25 | $ 8.25 | $ 0.19 | $ 9.53 |
| Miscellaneous / buffer | $ 0.11 | $ 0.35 | $ 0.45 | $ 0.51 | $ 0.28 | $ 22.53 | $ 0.14 | $ 22.53 |
| Mobile money services | $ N/A | $ N/A | $ 0,01 | $ 0,12 | $ 0,06 | $ 0.18 | $ 0.09 | $ 0.11 |
| Office equipment | $ N/A | $ N/A | $ N/A | $ N/A | $ 7.76 | $ 7.76 | $ 0.02 | $ 7.72 |
| Other operating costs | $ N/A | $ N/A | $ 0.45 | $ 2.74 | $ 1.76 | $ 7.16 | $ 2.99 | $ 7.26 |
| Personnel costs | $ 12.48 | $ 14.22 | $ 7.54 | $ 52.71 | $ 10.70 | $ 47.34 | $ 10.70 | $ 162.84 |

# Nigeria

## TOTAL OPEX COST PER MINI-GRID, PER YEAR




| | A | B | C | D | E | F | G | H | I | J | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sum of 2020 | $33 | $33 | $- | $14 | $- | $- | $39 | $- | $- | $- | $- | $- |
| Sum of 2021 | $49 | $49 | $11 | $85 | $8 | $11 | $51 | $70 | $- | $- | $- | $- |
| Sum of 2022 | $46 | $46 | $67 | $89 | $59 | $69 | $10 | $86 | $97 | $- | $- | $- |
| Sum of 2023 | $49 | $49 | $68 | $- | $53 | $68 | $47 | $57 | $10 | $17 | $11 | $16 |

Note: The names of the mini-grid sites have been anonymized and are referred to as A, B, C, D, E, F, G, H, I, J, L, and M.

The analysis uncovers a broad spectrum of total OPEX per connection per year, varying from USD 8 to USD 169 across all mini-grids in Nigeria. Notably, personnel costs consistently emerge as the highest expenditure, followed by diesel expenses where applicable, and general administrative overheads.

The total for 2023 surpasses that of all other years due to comprehensive reporting of all examined parameters specifically in that year. In contrast, in previous years, not all parameters were consistently reported. Additionally, the substantial inclusion of personnel costs, which constitute the largest percentage of OPEX across almost all mini-grids, contributed significantly to the higher total in 2023.

# Country comparison

A comparative analysis of CAPEX trends in Burkina Faso, Nigeria and Sierra Leone

### AVERAGE OPEX COST PER CONNECTION PER COUNTRY

| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Nigeria | N/A | N/A | $29.9 | $41.7 | $73.7 | $85.5 |
| Burkina Faso | $616.0 | $564.7 | $568.5 | $575.8 | $557.1 | $557.9 |
| Sierra Leone | N/A | N/A | $3.8 | N/A | N/A | N/A |

The table on the left displays the average OPEX costs per country per year. Burkina Faso has by far the highest costs, which can be attributed to the data being sourced from a single company. This limitation in data diversity hinders a comparative analysis and a deeper understanding of the underlying causes.

In contrast, Sierra Leone has the lowest costs, while Nigeria falls in the middle with a moderate number of submissions, reflecting a potentially more representative overview of on-the-ground realities. A more diverse dataset from multiple companies would enhance the comprehensiveness and accuracy of the analysis, enabling better insights into the factors driving OPEX costs in each country.

# Country comparison

The table below presents the average OPEX item costs per connection across Burkina Faso, Nigeria and Sierra Leone. Personnel costs consistently emerge as the highest expenditure for all years, closely followed by diesel costs. The trend is consistent in all three countries.

### AVERAGE OPEX PER ITEM PER YEAR ACROSS THE 3 COUNTRIES

| Item | Average of 2018 | Average of 2019 | Average of 2020 | Average of 2021 | Average of 2022 | Average of 2023 |
|---|---|---|---|---|---|---|
| Communication and promotions | $ 0.3 | $ 0.3 | $ 0.5 | $ 0.4 | $ 0.4 | $ 0.8 |
| Consumables (excluding office equipment) | $ 1.2 | $ 1.0 | $ 1.0 | $ 1.1 | $ 1.4 | $ 0.6 |
| Diesel fuel | $ 174.2 | $ 153.6 | $ 45.9 | $ 44.1 | $ 32.7 | $ 17.9 |
| General and administrative overheads | N/A | N/A | $ 9.1 | $ 7.5 | $ 6.5 | $ 4.1 |
| Insurance | N/A | N/A | $ 2.7 | $ 0.7 | $ 2.2 | $ 2.4 |
| Interest expenses | N/A | N/A | N/A | N/A | $ 20.1 | $ 20.1 |
| IT costs | N/A | N/A | N/A | N/A | N/A | $ 0.3 |
| Logistics | N/A | N/A | $ 0.8 | $ 8.3 | $ 3.1 | $ 1.3 |
| Mini-grid maintenance (Recapex) | $ 5.8 | $ 6.0 | $ 2.0 | $ 5.5 | $ 6.7 | $ 3.9 |
| Mini-grid maintenance (variable) | $ 3.9 | $ 3.4 | $ 3.5 | $ 3.6 | $ 5.7 | $ 2.7 |
| Miscellaneous / buffer | N/A | N/A | $ 0.2 | $ 0.5 | $ 3.0 | $ 2.6 |
| Mobile money services | $ 0.1 | $ 0.1 | $ 0.1 | $ 0.0 | $ 0.1 | $ 0.1 |
| Office equipment | $ 0.4 | $ 0.3 | $ 0.2 | $ 0.4 | $ 4.0 | $ 1.6 |
| Other operating costs | N/A | N/A | $ 0.3 | $ 1.6 | $ 3.4 | $ 3.8 |
| Personnel costs | $ 430.1 | $ 400.0 | $ 65.1 | $ 57.5 | $ 69.8 | $ 88.2 |

# Country comparison

The table below provides the minimum and maximum cost ranges per OPEX items annually in all three countries.

### ANNUAL MINIMUM AND MAXIMUM COST RANGES FOR OPEX ITEMS ACROSS THE 3 COUNTRIES

| | 2018 | | 2019 | | 2020 | | 2021 | | 2022 | | 2023 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OPEX Item | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| Communication and promotions | $0.3 | $0.3 | $0.3 | $0.3 | $0.3 | $0.6 | $0.3 | $0.5 | $0.1 | $1.6 | $0.0 | $1.4 |
| Consumables (excluding office equipment) | $1.2 | $1.2 | $1.0 | $1.0 | $1.0 | $1.0 | $1.1 | $1.1 | $1.0 | $1.9 | $0.0 | $1.9 |
| Diesel fuel | $174.2 | $174.2 | $153.6 | $153.6 | $8.6 | $156.4 | $8.5 | $162.3 | $9.0 | $144.3 | $1.3 | $144.3 |
| General and administrative overheads | N/A | N/A | N/A | N/A | $8.2 | $9.6 | $7.0 | $8.9 | $4.4 | $9.1 | $0.0 | $6.7 |
| Insurance | N/A | N/A | N/A | N/A | $0.0 | $5.4 | $0.7 | $0.7 | $1.5 | $4.4 | $0.5 | $5.4 |
| Interest expenses | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | $20.1 | $20.1 | $20.1 | $20.1 |
| IT costs | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | | | $0.0 | $0.7 |
| Logistics | N/A | N/A | N/A | N/A | $0.2 | $1.1 | $4.9 | $12.8 | $1.5 | $6.7 | $0.2 | $2.7 |
| Mini-grid maintenance (Recapex) | $5.8 | $5.8 | $6.0 | $6.0 | $0.0 | $6.9 | $3.1 | $8.1 | $2.1 | $18.7 | $0.3 | $8.8 |
| Mini-grid maintenance (variable) | $3.9 | $3.9 | $3.4 | $3.4 | $3.5 | $3.5 | $3.6 | $3.6 | $3.2 | $8.2 | $0.2 | $9.5 |
| Miscellaneous / buffer | N/A | N/A | N/A | N/A | $0.1 | $0.3 | $0.4 | $0.5 | $0.3 | $22.5 | $0.1 | $22.5 |
| Mobile money services | $0.1 | $0.1 | $0.1 | $0.1 | $0.1 | $0.1 | $0.0 | $0.1 | $0.1 | $0.2 | $0.1 | $0.1 |
| Office equipment | $0.4 | $0.4 | $0.3 | $0.3 | $0.1 | $0.3 | $0.4 | $0.4 | $0.3 | $7.8 | $0.0 | $7.7 |
| Other operating costs | N/A | N/A | N/A | N/A | $0.2 | $0.5 | $0.4 | $2.7 | $1.8 | $7.2 | $3.0 | $7.3 |
| Personnel costs | $430.1 | $430.1 | $400.0 | $400.0 | $0.9 | $400.0 | $7.5 | $400.0 | $10.7 | $400.0 | $10.7 | $400.0 |

# Country comparison

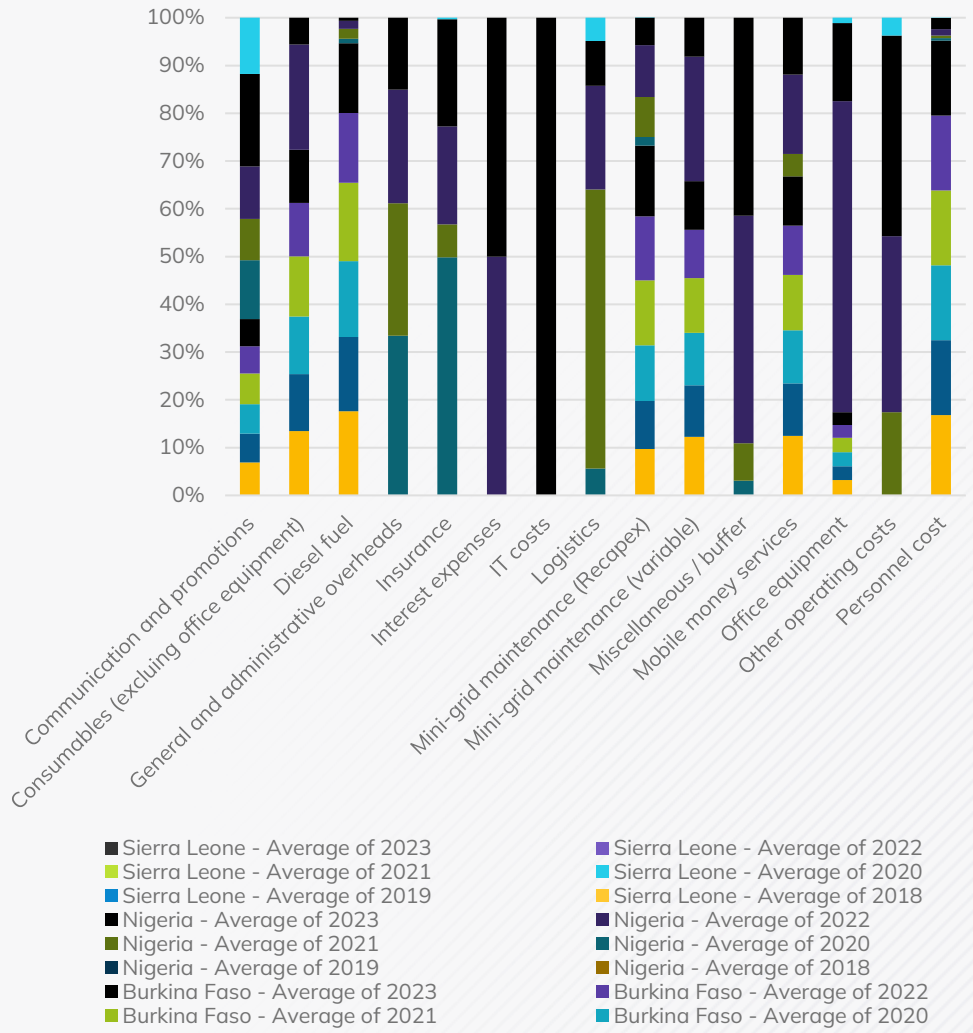
The data across Burkina Faso, Nigeria and Sierra Leone provide valuable insights into the trends in average OPEX costs per item over the specified years. Communication and promotions remain relatively consistent across all years and countries, indicating a stable approach to communication strategies. However, notable differences emerge in the costs associated with diesel fuel, with Burkina Faso consistently reporting significantly higher costs than Nigeria and Sierra Leone. This variation could stem from differences in energy generation strategies or pricing variations within each country.

Nigeria's OPEX costs have remained relatively stable, indicating consistent expenditure patterns. On the other hand, while data regarding general and administrative costs only exist for Nigeria and Sierra Leone, both countries show a decreasing trend over the years, suggesting potential efficiency improvements in administrative operations.

Logistics costs demonstrate a generally stable trend across all three countries but there are fluctuations over the years, possibly the result of factors such as transportation costs or supply chain disruptions.

Personnel costs consistently emerge as the highest expenditure across all countries and years, underscoring the critical role of human resources in mini-grid operations. However, Burkina Faso reports notably higher personnel costs than Nigeria and Sierra Leone, warranting further analysis to understand the underlying reasons for this disparity and identify potential areas for cost optimization.

## COMPARATIVE ANALYSIS OF AVG. OPEX COSTS IN THREE COUNTRIES




For detailed numbers, please check the table in the next slide.

# Country comparison

### AVERAGE OPEX COSTS IN BURKINA FASO, NIGERIA AND SIERRA LEONE

| | Burkina Faso | | | | | | Nigeria | | | | Sierra Leone |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Item | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2020 | 2021 | 2022 | 2023 | 2020 |
| Communication and promotions | $0.29 | $0.26 | $0.26 | $0.27 | $0.24 | $0.24 | $0.52 | $0.37 | $0.46 | $0.82 | $0,50 |
| Consumables (excluding office equipment) | $1.16 | $1.02 | $1.04 | $1.08 | $0.96 | $0.96 | N/A | N/A | $1.89 | $0.49 | N/A |
| Diesel fuel | $174.23 | $153.61 | $156.36 | $162.30 | $144.29 | $144.29 | $9.14 | $20.47 | $16.79 | $6.43 | N/A |
| General and administrative overheads | N/A | N/A | N/A | N/A | N/A | N/A | $9.11 | $7.55 | $6.47 | $4.11 | N/A |
| Insurance | N/A | N/A | N/A | N/A | N/A | N/A | $5.37 | $0.74 | $2.21 | $2.41 | $0.04 |
| Interest expenses | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | $20.13 | $20.13 | N/A |
| IT costs | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | $0.26 | N/A |
| Logistics | N/A | N/A | N/A | N/A | N/A | N/A | $0.81 | $8.31 | $3.10 | $1.33 | $0.70 |
| Mini-grid maintenance (Recapex) | $5.81 | $5.97 | $6.95 | $8.11 | $8.02 | $8.82 | $1.07 | $4.99 | $6.50 | $3.40 | $0.00 |
| Mini-grid maintenance (variable) | $3.87 | $3.41 | $3.47 | $3.61 | $3.21 | $3.21 | N/A | N/A | $8.25 | $2.57 | N/A |
| Miscellaneous / buffer | N/A | N/A | N/A | N/A | N/A | N/A | $0.19 | $0.49 | $2.96 | $2.58 | N/A |
| Mobile money services | $0.10 | $0.09 | $0.09 | $0.09 | $0.08 | $0.08 | N/A | $0.04 | $0.13 | $0.09 | N/A |
| Office equipment | $0.39 | $0.34 | $0.35 | $0.36 | $0.32 | $0.32 | N/A | N/A | $7.76 | $1.95 | $0.14 |
| Other operating costs | N/A | N/A | N/A | N/A | N/A | N/A | N/A | $1.59 | $3.37 | $3.84 | $0.34 |
| Personnel costs | $430.11 | $400.00 | $400.00 | $400.00 | $400.00 | $400.00 | $12.92 | $14.69 | $33.15 | $59.80 | $2.06 |

CHAPTER THREE

# Conclusion

# Conclusion

## Comparative examination of CAPEX and OPEX Trends in Burkina Faso, Nigeria and Sierra Leone

Understanding the dynamics of mini-grid development across Burkina Faso, Nigeria and Sierra Leone entails examining their CAPEX and OPEX trends. In 2022, Burkina Faso had the highest average CAPEX per connection at USD 1,526, mainly due to high generation costs. Conversely, Sierra Leone had a significantly lower CAPEX per connection, at USD 267 in 2020, while Nigeria fell in between these figures. A notable spike in CAPEX in 2020 across all three countries likely reflects intensive initial investments for mini-grid project implementation. Subsequent years show more stable expenditure.

OPEX analysis reveals that Burkina Faso had the highest costs, possibly due to data limitations, while Sierra Leone had the lowest. Nigeria's OPEX costs fell between those of Burkina Faso and Sierra Leone. Personnel costs are consistently the largest expense across all three countries, with Burkina Faso reporting substantially higher personnel costs than Nigeria and Sierra Leone. This suggests a need for efficiency improvements.

In essence, this comprehensive examination of CAPEX and OPEX trends across the three countries in the study unveils a mosaic of challenges and opportunities inherent in the development of mini-grid infrastructure. Beyond the numerical figures, these insights serve as invaluable compasses guiding strategic decision-making and resource allocation efforts towards fostering sustainable energy ecosystems within each respective nation.

Main takeaways of the study include:

- Burkina Faso's high CAPEX: highest average CAPEX per connection in 2022 at USD 1,526 due to high generation costs.
- Sierra Leone's low CAPEX: significantly lower average CAPEX per connection in 2020 at USD 267.
- Nigeria's moderate CAPEX: intermediate average CAPEX per connection, falling between Burkina Faso and Sierra Leone.
- CAPEX surge in 2020: notable increase in project development and management costs across all three countries.
- Stable subsequent expenditure: post-2020 shows more stable and moderate expenditure patterns.
- High OPEX in Burkina Faso: highest OPEX costs, with personnel costs as the primary expense, indicating areas for potential efficiency improvements.

# Recommendations

Recommendations for Future Data Collection:

- Standardized template for data collection and analysis
    - Ensuring that standardization of data collection processes is crucial across organizations is paramount for facilitating consistent and comprehensive data analysis. It is imperative that sector stakeholders adopt uniform data collection templates to streamline reporting and minimize discrepancies.
    - The establishment of a dedicated focal point for mini-grid data collection represents a crucial step toward improving coordination and accessibility. Having a designated individual responsible for reaching out to developers ensures a more efficient data collection process.
    - AMDA is currently developing a standardized template for mini-grid data collection. SEforALL and AFUR will promote its adoption across organizations, easing the burden on developers who often have to fill in different template requests, thereby enhancing overall efficiency.

Recommendations based on findings:

- Stakeholder coordination
    - Fostering collaboration among developers, regulators and donors is crucial to addressing data gaps and enhancing data quality. By promoting a unified approach to project planning and data sharing, all stakeholders can ensure alignment and optimize the development and operation of mini-grids.
    - Establishing clear roles and responsibilities for each stakeholder group is essential for effective coordination. Regulators should set the policy framework, developers should provide technical expertise and community engagement, and donors should align funding with national priorities.
- Capacity building and knowledge sharing
    - Organizing regular workshops and webinars to share best practices, lessons learned and emerging trends in the mini-grid sector can help developers and operators optimize their CAPEX and OPEX by learning from the experiences of others.
    - Providing training on the technical aspects of mini-grid development and operation, such as site assessment, feasibility studies, construction, operations and maintenance, can help reduce CAPEX and OPEX by ensuring projects are designed and implemented efficiently.

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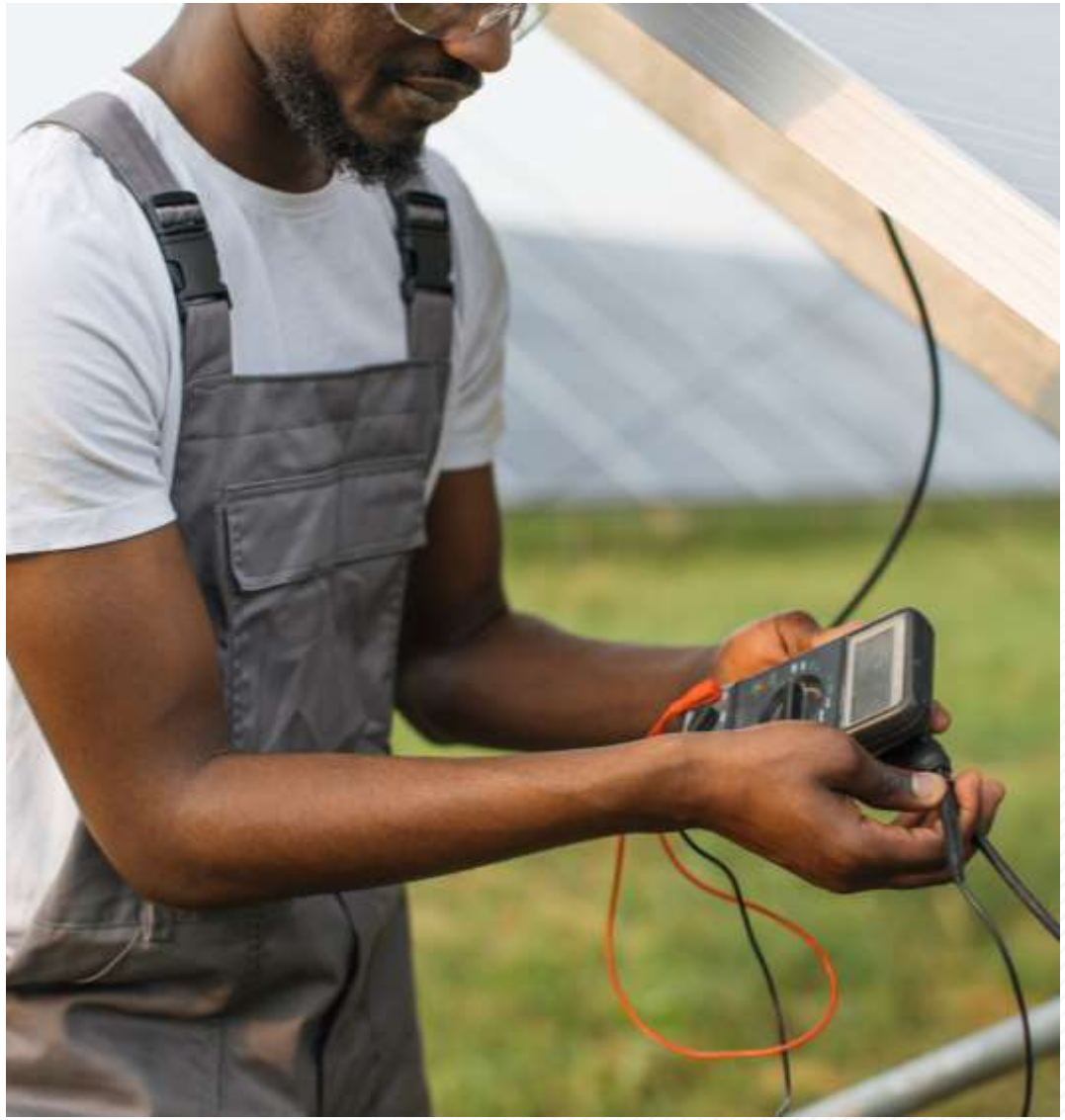
# Annex

1. SEforALL Data Collection Template

2. MYTO Data Collection Template in Sierra Leone

3. Comparison of SEforALL and MYTO Templates

4. Categorization for CAPEX and OPEX and Subcomponents



# SEforALL Dataset Collection Template

## Overview

| 1. Mini-grid name | Timeline |
|---|---|
| Your name (full name and designation) | |
| Email address | |
| **2. Country** | |
| HQ | |
| Operating regions | |
| **3. Year** | |
| Mini-grid built in | |
| Mini-grid operating since | |
| Number of staff working for mini-grid | |
| Number of staff dedicated to this specific mini-grid | |
| **4. Mini-grid generation capacity (per mini-grid)** | |
| Total | |
| Inverter capacity | |
| Battery size | |
| Generator size | |
| Capacity utilization | |
| **5. Mini-grid type** | |
| Renewable energy (please specify) | |

# SEforALL Dataset Collection Template

## Overview

| |
|---|
| Non-renewable (please specify) |
| Hybrid |
| **6. Number of customers** |
| Total for this mini-grid |
| Number of productive use (PUE) customers |
| **7. Connections** |
| Total number of connections |
| **8. Demand (kWh)** |
| Total demand (per month) |
| Total demand (per annum) |
| **9. Consumption (kWh)** |
| Total consumption (per month) |
| Total consumption (per annum) |
| **10. Financing – type of capital investment (% of capital)** |
| Grants (specify donor) |
| Equity |
| Debt |
| Other (please specify) |

# SEforALL Dataset Collection Template

## Overview

| 11. Financing – tariff structure | Timeline |
|---|---|
| Time of use | |
| Block rate | |
| Flat rate | |
| Other (please specify) | |
| **12. Financing – payment** | |
| Prepaid: Y/N | |
| Post: Y/N | |
| Both (please specify) | |
| **13. Remote monitoring system** | |
| Y/N | |

# SEforALL Dataset Collection Template

## CAPEX

| 1. Generation cost parameters | | Timeline |
|---|---|---|
| 1.1 Solar panels | This include all upfront costs associated with solar PV | |
| 1.2 Panel frames | This includes all upfront costs associated with panel frames | |
| 1.3 Installation kits | Total upfront cost for all installation kits on the site | |
| 1.4 Accessories, cables and wiring | This includes total cost of accessories, cables and external wiring | |
| 1.5 Batteries | This includes all upfront costs associated with batteries. (e.g. battery management system components, battery enclosure or racks) | |
| 1.6 Micro inverters | This includes all upfront costs associated with inverters | |
| 1.7 Diesel gensets/generators | This includes all upfront costs associated with generator | |
| 1.8 Others | Please specify | |
| **2. Distribution system / connection to the grid** | | |
| 2.1 LV ABC conductor and accessories | Total cost of all LV conductors and accessories on site | |
| 2.2 LV poles | Total cost of all distribution poles on site | |
| 2.3 Drop lines | Total cost of all customer drop lines on site | |
| 2.4 Ready boards | Total cost of all ready boards on site | |
| 2.5 Installation labour | Total cost of labour for the distribution system | |
| 2.6 Power termination accessories | Total cost of all power terminal accessories on site | |
| 2.7 Lightning protection accessories | Total cost of all lightning protection accessories | |
| 2.8 Overhead cables | | |

# SEforALL Dataset Collection Template

## CAPEX

| 3. Customer connections | | Timeline |
|---|---|---|
| 3.1 Meters/load limiters | Total cost of all customer meters on site | |
| 3.2 Customer power kit | Total cost of all customer power kits on site | |
| 3.3 Other accessories | Total cost of all other customer connection accessories (e.g. breakers, outlets) | |
| 3.4 Installation labour | Total cost of installation labour | |
| 3.5 Internal wiring | Total cost of all internal wiring on site | |
| 3.6 Others | Please specify | |
| **4. Intangible assets/other non-material costs** | | |
| 4.1 Technical development and design | Technical design, technical assistance | |
| 4.2 Logistics | This include transport, warehousing, etc. | |
| 4.3 VAT and duties | VAT and duty costs that were incurred to build the site | |
| 4.4 Legal aspects | Contract and legal related | |
| 4.5 Others: project mgt and development | Please specify | |
| **5. Others** | | |
| 5.1 Office equipment and furniture | Total cost of computers, tables, chairs and other office equipment on site | |
| 5.2 Land | Upfront cost of land, permitting, land lease, etc. | |
| 5.3 Construction costs | | |

# SEforALL Dataset Collection Template

## OPEX

| 1. Personnel | | Timeline |
|---|---|---|
| Total salary of the people working exclusively on this mini-grid. Please choose a range from these (USD). | 24–30K/30–50K/50–70K/70–100K/Others | |
| Number of people working exclusively on this mini-grid. Please choose a range that fits your mini-grid. | 1–5/5–10/10–15/15–20/20–25/30–50/Others | |
| 2. Diesel fuel (if applicable) | Total cost of fuel required to meet electricity demand | |
| 3. Mini-grid maintenance (Recapex) | Total cost of mini-grid replacement parts for electrical components, test equipment for troubleshooting | |
| 4. Mini-grid maintenance (variable) | Total cost of mini-grid maintenance supplies (e.g. lubricants, cleaning materials, etc.) | |
| 5. Insurance | Total cost of insurance | |
| 6. Office equipment | Includes stationery costs | |
| 7. Consumables (excl. office equipment) | Total cost of consumables excluding office equipment | |
| 8. Communication and promotions | Total cost of customer engagement and education, internet and other marketing equipment, airtime, etc. | |
| 9. Mobile money services (if applicable) | Total cost of mobile money services (e.g. SMS) | |
| 10. Interest expenses | Total interest on loan if applicable | |
| 11. General and administrative overheads | | |
| This includes the overhead costs charged from this mini-grid. Please choose a range. | 1–5%/5–10%/10–15% | |
| 12. IT costs | Software licenses, hardware components of the IT infrastructure, IT maintenance expenses. IT infrastructure depreciation. | |
| 13. Logistics | Includes total costs incurred during transport, storage exclusively for this mini-grid | |
| 14. Miscellaneous/buffer | Total buffer (include what this buffer is intended to cover) | |
| 15. Other operating costs | Any other operating cost not defined above and please specify. | |

# MYTO Dataset Collection Template

## Cost

| Name of account | Base cost in Y1 | Unit | Number of units |
|---|---|---|---|
| Executive salaries and expenses | | Number of executive staff | |
| Management salaries and expenses | | Number of management staff | |
| General administrative salaries and expenses | | Number of administrative staff | |
| Other staff expenses | | Number of staff | |
| Office rent expenses | | Number of offices | |
| Office supplies and expenses | | Number of offices | |
| International travel expenses | | Number of international trips | |
| Local travel expenses | | Number of local trips | |
| Insurance | | Number of sites insured | |
| Non-capitalized licence, permit, concession, fee expenses | | Number of payments | |
| Advertising expenses | | Number of customers | |
| Training and workshop expenses | | Number of trained people | |
| Outside services employed | | Number of outside services employed | |
| Community relations staff expenses | | Number of community relations staff | |
| Community safety training | | Number of trained people | |
| Community relations sundry | | Number of community relations staff | |
| Outside services employed for community relations | | Number of outside services employed for community relations | |
| Miscellaneous customer service and information expenses | | Number of mini-grid sites | |

# MYTO Dataset Collection Template

## Cost

| Name of account | Base cost in Y1 | Unit | Number of units |
|---|---|---|---|
| Sales staff expenses | | Number of sales staff | |
| Sales, billing and collecting material expenses | | Number of electricity customers | |
| Meter expenses | | Number of electricity meters | |
| Customer contract expenses | | Number of electricity customers | |
| Customer billing expenses | | Number of electricity customers | |
| Collecting cash shortages | | Number of electricity customers | |
| Bad debt expenses | | Number of electricity customers | |
| Outside services employed | | Number of outside services employed for electricity sales | |
| Other technical operation expenses | | Number of mini-grid sites | |
| Technical maintenance staff expenses | | Number of technical maintenance staff | |
| Maintenance materials for power generation | | kW installed generation capacity | |
| Maintenance materials for power distribution | | kW installed distribution lines | |
| Maintenance materials for customer connections | | Number of customer connections | |
| Other maintenance materials | | Number of mini-grid sites | |
| Maintenance travel expenses | | Number of maintenance travels | |
| Other technical operation expenses | | Number of mini-grid sites | |
| Usage rights fees | | Percentage of assets with usage rights | |
| ESCROW reserve account | | Percentage of assets with usage rights | |

# MYTO Dataset Collection Template

## Cost

| Name of account | Base cost in Y1 | Unit | Number of units |
|---|---|---|---|
| Other operating expenses | | Number of mini-grid sites | |
| Interest on long term debt | | Interest percentage | |
| Amortization of debt discount and expense | | Interest percentage | |
| Finance premium paid/payable on debt-credit | | Premium percentage | |
| Interest on debt to associated companies | | Interest percentage | |
| Other interest expenses | | Interest percentage | |
| Other finance costs | | Interest percentage | |
| Income taxes for regulated activity | | Income tax percentage | |
| Provision for deferred taxes – income statement | | Effective tax percentage | |
| Taxes other than income taxes | | Effective tax percentage | |
| Tax deductibles | | Income tax percentage | |
| Return on outstanding balance of GST | | GST tax percentage | |

# MYTO Dataset Collection Template

## Asset

| Asset category | Name of asset | # of units | Unit | Total investment cost |
|---|---|---|---|---|
| Buildings for electricity generation or distribution | Power houses | | | |
| PV modules and PV module mounting | PV modules and racking | | | |
| PV inverters and converters | Inverters | | | |
| Batteries | Battery investment | | | |
| Battery inverters | Charge controller investment | | | |
| Diesel generators | Initial investment | | | |
| MV transformers | Includes all material to connect solar/batteries & generators | | | |
| Power generation equipment other | Includes all material to connect solar/batteries & generators | | | |
| Project development costs | - | | | |
| LV overhead power line accessories | - | | | |
| Customer connection drop line accessories | Includes materials for drop to customer | | | |
| Customer connection single phase electricity sales meter | Meters + materials for mounting and connecting meters | | | |
| Distribution boxes or multicluster boxes | This includes combiner boxes for combining PV strings along with DC&AC distribution | | | |
| Measurement and control equipment | This includes the measurement and control systems for the OPS systems for WP2 sites | | | |
| Computer and communication equipment for power generation | This includes the modems etc. needed to communicate externally for the OPS system | | | |

# MYTO Dataset Collection Template

## Asset

| Asset category | Name of asset | # of units | Unit | Total investment cost |
|---|---|---|---|---|
| Other equipment or facilities for power generation | This includes all of the wiring and miscellaneous materials to connect modules and batteries to the system | | | |
| Vehicles | Trucks | | | |
| Tools for civil works | This includes all tools needed for the site to complete the installation work and other items such as ladders | | | |
| Tools for electric measurement and installation | This includes the volt meters & other miscellaneous tools for each site | | | |
| Permits, licences, concessions | This includes the permits and licences for the land at the WP2 sites and for a new site at Gbangatoke for expansion | | | |

# SEforALL and MYTO Template Comparison

## CAPEX

| SEforALL Template | MYTO Template |
|---|---|
| 1. Generation cost parameter | |
| 1.1 Solar panels | PV modules and PV module mounting |
| 1.2 Panel frames | - |
| 1.3 Installation kits | - |
| 1.4 Accessories, cables and wiring | - |
| 1.5 Batteries | Batteries |
| 1.6 Micro inverters | PV inverters and converters / battery inverters |
| 1.7 Diesel gensets/generators | Diesel generators |
| 1.8 Others | Power generation equipment other / other equipment or facilities for power generation |
| 2. Distribution system / connection to the grid | |
| 2.1 LV ABC conductor and accessories | LV overhead power line accessories |
| 2.2 LV poles | MV power poles |
| 2.3 Drop lines | Customer connection drop line accessories |
| 2.4 Ready boards | - |
| 2.5 Installation labour | Included in buildings for electricity generation or distribution |
| 2.6 Power termination accessories | - |
| 2.7 Lightning protection accessories | - |
| 2.8 Overhead cables | Distribution boxes or multicluster boxes |

# SEforALL and MYTO Template Comparison

## CAPEX

| SEforALL Template | MYTO Template |
|---|---|
| **3. Customer connection** | |
| 3.1 Meters / load limiters | Meter expenses / customer connection single phase electricity sales meter |
| 3.2 Customer power kits | Customer connection central meter measurement, control and communication equipment |
| 3.3 Other accessories | Customer connection other customer connection fixtures, fittings and equipment |
| 3.4 Installation labour | Included in buildings for electricity generation or distribution |
| 3.5 Internal wiring | Included in other equipment or facilities for power generation |
| 3.6 Others | Computer and communication equipment for power generation / tools for civil works / tools for electric measurement and installation |
| **4. Intangible assets / other non-material costs** | |
| 4.1 Technical development and design | Project development cost |
| 4.2 Logistics | Vehicles |
| 4.3 VAT and duties | Income taxes for regulated activity / provision for deferred taxes – income statement / taxes other than income taxes / tax deductibles / return on outstanding balance of GST |
| 4.4 Legal aspects | Permits, licenses, concessions / non-capitalized license, permit, concession, fee expenses / customer contract expense / usage rights fee |
| 4.5 Others – project management and development | ESCROW reserve account / other finance costs / amortization of debt discount and expenses / interest on debt to associated companies / finance premium paid/payable on debt-credit |

# SEforALL and MYTO Template Comparison

## CAPEX

| SEforALL Template | MYTO Template |
|---|---|
| 5. Others | |
| 5.1 Office equipment and furniture | Office equipment furniture |
| 5.2 Land | Buildings for electricity generation or distribution / rents / office rent expenses / land for administration and management / land for electricity generation or distribution |
| 5.3 Construction costs | Included in buildings for electricity generation and distribution |
| 5.4 Other CAPEX costs | Measurement and control equipment |

# SEforALL and MYTO Template Comparison

## OPEX

| SEforALL Template | MYTO Template |
|---|---|
| 1. Personnel | Executive salaries and expenses / management salaries and expenses / general administrative salaries and expenses / other staff expenses / technical operation staff expenses / security staff expenses / sales staff expenses |
| 2. Diesel fuel | Generation fuel and consumables |
| 3. Mini-grid maintenance (Recapex) | Included in maintenance material for: power generation; distribution; customer connections |
| 4. Mini-grid maintenance (variable) | Maintenance material for: power generation; power distribution; customer connections; other |
| 5. Insurance | Insurance |
| 6. Office equipment | Office supplies and expenses |
| 7. Consumables (excl. office equipment) | Included in generation fuel and consumables |
| 8. Communication and promotions | Advertising expenses / training and workshop expenses / community relations staff expenses / community safety training / community relations sundry / outside services employed for community relations / miscellaneous customer service and information expenses |
| 9. Mobile money services | Business administration – mobile money fees |
| 10. Interest expenses | Interest on long-term debt |
| 11. General and administrative overheads | - |
| 12. IT costs | - |
| 13. Logistics | Local travel expenses / maintenance travel expenses / international travel expenses |
| 14. Miscellaneous / buffer | Included in miscellaneous customer service and information expenses |
| 15. Other operating costs | Customer billing expenses / collecting cash shortages / bad debt expenses / other technical operation expenses / other operations materials / sales, billing and collecting material expenses / other sales, billing and collecting expenses / outside services employed |

# Categorization for CAPEX and OPEX and included subcomponents

| Customer connections | Distribution systems | Generation costs | Intangible assets | Others |
|---|---|---|---|---|
| Customer power kits | Drop lines | Accessories, cables and wiring | Legal aspects | Construction costs |
| Installation labour (customer connections) | Installation labour (distribution) | Batteries | Logistics | Land |
| Internal wiring | Lightning protection accessories | Diesel gensets / Generators | Technical development and design | Office equipment and furniture |
| Meters / load limiters | LV ABC conductor and accessories | Installation kits | VAT and duties | VAT and duties |
| Other accessories | LV poles | Micro inverters | | |
| Others (customer connections) | Overhead cables | Other generation costs | | |
| | Power termination accessories | Others | | |
| | Ready boards | Panel frames | | |
| | | Solar panels | | |

## About SEforALL

Sustainable Energy for All (SEforALL) is an independent international organization that works in partnership with the United Nations and leaders in government, the private sector, financial institutions, civil society and philanthropies to drive faster action on Sustainable Development Goal 7 (SDG7) – access to affordable, reliable, sustainable and modern energy for all by 2030 – in line with the Paris Agreement on climate change.

SEforALL works to ensure a clean energy transition that leaves no one behind and brings new opportunities for everyone to fulfil their potential. Learn more about our work at www.SEforALL.org.

## About AMDA

The Africa Minigrid Developers Association (AMDA) is an industry association created by private sector mini-grid developers and operators, development partners and investors interested in improving political and financial environments for mini-grid companies in Africa. AMDA's work involves accelerating mini-grid companies' pathways to scale and profitability.

Today, AMDA represents over forty-four companies that are operating mini-grids across 22 countries in five regions on the continent.

## About AFUR

The African Forum for Utility Regulators (AFUR) addresses regulatory matters spanning energy, telecommunications, transport, and water & sanitation industries, emphasizing cross-sectoral issues. Its goal is to cultivate cooperation among utility regulators across Africa, bolstering the continent's growth and socio-economic progress. AFUR's mission is to promote the evolution of efficient utility regulation, advancing Africa's infrastructure development. AFUR operates as a formal association of African regulators, with its own constitution stipulating its objectives, functions and other operational requirements.