

OCTOBER 2019

Off-Grid Solar Market Assessment Cameroon

Power Africa Off-grid Project

ABOUT POWER AFRICA

The Power Africa Off-grid Project is a four-year program that launched in November 2018 to accelerate off-grid electrification across sub-Saharan Africa. RTI International implements the project in collaboration with Fraym, Norton Rose Fulbright, Practical Action Consulting, and Tetra Tech. Power Africa is comprised of 12 U.S. Government agencies, over 145 private companies, and 18 bilateral and multilateral development partners that work together, supporting sub-Saharan governments to increase the number of people with access to power.

Power Africa aims to achieve 30,000 megawatts of new generated power, create 60 million new connections, and reach 300 million Africans by 2030.

What's Inside

INTRODUCTION	ES-1
ABOUT THE POWER AFRICA OFF-GRID PROJECT (PAOP)	ES-1
1 EXECUTIVE SUMMARY	ES-3
2 CAMEROON ENERGY SECTOR OVERVIEW	1
2.1 Country Introduction	1
2.1.1 Physical Framework	1
2.1.2 Socio-Economic Indicators	1
2.1.3 Overall Political Landscape	3
2.2 Energy Sector	4
2.2.1 Grid Electrification Summary	4
2.2.2 Future Electrification Targets	8
2.2.3 RE Generation and Rural Electrification Summary	8
2.3 Demand for Energy	11
2.3.1 Latent Demand for Electrification	13
2.3.2 Mapping Households Without Access to Electricity	14
2.4 Energy-related Government Institutions And Strategic Documents	19
2.5 International Donors	22
2.6 Solar Association, Training Institutions, Incubators, and Accelerators	24
3 PICO-SOLAR SECTOR	26
3.1 SHS Sales Summary	26
3.2 Pico-Solar Commercial Overview	29
3.3 Overview of Off-Grid Households	31
3.4 Opportunities for Off-Grid Solar Companies	35
3.5 Barriers to Entry and Growth	41
3.6 Relevant Government and Donor Pico-Solar Programs	41
3.7 Pico-Solar Relevant Regulations	41
3.7.1 Import Duties and Taxes	42
3.7.2 Quality Standards	42
3.7.3 Electrical Equipment Waste	43
3.8 Pico-Solar Financing Overview	43
3.8.1 Commercial Finance	44
3.8.2 Consumer Finance	45
3.8.3 Crowdfunding Organizations	46
3.8.4 International Impact Funds	46
3.8.5 Mobile Money in Cameroon	49
3.9 Pico-Solar Distribution Partners	52
3.10 Pico-Solar Gender Mainstreaming	52
4 MINI-GRID COMPANIES	53
4.1 Mini-Grid Overview and Applicability to Cameroon	53
4.2 Relevant Government and Donor Mini-Grid Support Programs	55
4.3 Relevant Mini-Grid Regulations	56

4.4	Mini-Grid Financing Overview	57
4.5	Mini-Grid Gender Mainstreaming	58
5	AGRICULTURAL AND PRODUCTIVE-USE SOLAR COMPANIES	59
5.1	Relevant Government and Donor Agriculture and Productive-Use Programs	59
5.2	Agriculture and Productive-Use Relevant Regulations	60
5.3	Agricultural and Productive-Use Financing Overview	60
5.4	Productive Use and Gender Inclusion	61
	ANNEX A POWER AFRICA GEOSPATIAL ANALYSIS DATA SOURCES	A-1

FIGURES

Figure ES-1.	The Project Provides Support to 20 Countries in Africa	ES-2
Figure 1.	Electricity Generation Sources in Cameroon	5
Figure 2.	Share of Installed Energy Capacity in Cameroon	6
Figure 3.	Electrification Target Rates in Different Regions of Cameroon	9
Figure 4.	Potential Renewable Energy Mix of Cameroon	9
Figure 5.	Total Non-Electrified Population in Cameroon	11
Figure 6.	Percentage of Households per Square Kilometer that Reported Not Having Electricity	14
Figure 7.	Percentages of Households that Report Not Having Electricity per Square Kilometer, Overlaid with Medium-Voltage Lines	15
Figure 8.	Number of Households Without Electricity per 10km x 10km Grid	16
Figure 9.	Buffers Used for Analysis	17
Figure 10.	Number of Households in the Modest-Consumption Power Group per 10km x 10km Grid	32
Figure 11.	Number of Households in the Medium-Consumption Power Group per 10km x 10km Grid	33
Figure 12.	Number of Households in the Large-Consumption Power Group per 10km x 10km Grid	34
Figure 13.	Number of Households Without Electricity per 10km x 10km Grid in the Adamawa Region	36
Figure 14.	Number of Households Without Electricity per 10km x 10km Grid in the Center Region	37
Figure 15.	Number of Households Without Electricity per 10km x 10km Grid in the East Region	37
Figure 16.	Number of Households Without Electricity per 10km x 10km Grid in the Far North Region	38
Figure 17.	Number of Households Without Electricity per 10km x 10km Grid in the Littoral Region	38
Figure 18.	Number of Households Without Electricity per 10km x 10km Grid in the North Region	39
Figure 19.	Number of Households Without Electricity per 10km x 10km Grid in the North-West Region	39
Figure 20.	Number of Households Without Electricity per 10km x 10km Grid in the West Region	40
Figure 21.	Number of Households Without Electricity per 10km x 10km Grid in the South Region	40

Figure 22. Number of Households Without Electricity per 10km x 10km Grid in the South-West Region	41
Figure 23. Total Sales of Solar Systems by Cash Payments or PAYGO	52
Figure 24. Installed Capacity by Region	57

TABLES

Table 1. Cameroon Socio-Economic Indicators Summary	1
Table 2. Recent Economic Development in Cameroon	2
Table 2. Recent Economic Development in Cameroon (Continued)	3
Table 3. Electricity Tariffs for Low-Voltage Consumers	7
Table 4. Other Non-Residential Uses	7
Table 5. Electricity Usage Regime and Tariffs in Cameroon	7
Table 6. Renewable Energy Targets in Cameroon by Source	10
Table 7. Distance of Non-Electrified Households and Populations from Main Grid Network in Cameroon	12
Table 8. Percentages of Energy Sources for Lighting in Off-Grid Areas	12
Table 9. Percentages of Energy Sources for Lighting in Off-Grid Areas	12
Table 10. Willingness to Pay for Solar Lanterns in Off-Grid Areas	13
Table 11. Summary of Households Without Electricity within 1km, 10km, and Farther than 10km from the National Medium-Voltage Lines	18
Table 12. Potential Energy Savings by Sector in Cameroon, according to the NEEP	22
Table 13. Sales Data in Cameroon by Product Category	26
Table 14. Sales Data in Cameroon by Product Category	26
Table 15. Market Value in Cameroon by Product Category	27
Table 16. Market Value in Cameroon by Business Model	27
Table 17. Sales Data by Quality Verified and by Non-Quality Verified Products	27
Table 18. Estimated Sales Data of Bundled Appliances for the Central Africa Region	28
Table 19. Sales Data by Appliance Type (July through December 2018)	28
Table 20. Estimated Market Penetration	28
Table 21. Country Level Trends	28
Table 22. Estimated Impacts in Cameroon from 2016 Through December 2018	29
Table 23. Summary of Pico-Solar Companies in Cameroon	30
Table 24. Distance from the Network	35
Table 25. Off-Grid Market Potential for Households without Electricity	36
Table 26. GOGLA Breakdown of Central Africa Region Funding Types, Transactions, Business Model, Use of Funding and Funding Flow by Investor Type: Type of Investment	47
Table 27. GOGLA Breakdown of Central Africa Region Funding Types, Transactions, Business Model, Use of Funding and Funding Flow by Investor Type: Transactions	47
Table 28. GOGLA Breakdown of hhhhCentral Africa Region Funding Types, Transactions, Business Model, Use of Funding and Funding Flow by Investor Type: Business Model	48

Table 29. GOGLA Breakdown of Central Africa Region Funding Types, Transactions, Business Model, Use of Funding and Funding Flow by Investor Type: Use of Funding	48
Table 30. GOGLA Breakdown of Central Africa Region Funding Types, Transactions, Business Model, Use of Funding and Funding Flow by Investor Type: Funding Flow by Investor Type	49
Table 31. Orange Money	50
Table 32. MTN Money	51
Table 33. Summary of Mini-Grid Companies in Cameroon	53
Table 33. Summary of Mini-Grid Companies in Cameroon (continued)	54
Table 34. Summary of Main Barriers Facing the Mini-Grid Sector in Cameroon by Resource Type	55
Table A - 1. Data Dictionary	A-1
Table A - 1. Data Dictionary (Continued)	A-2
Table A - 2. Information on Electrified Localities	A-2
Table A - 3. Characteristics of Households With and Without Electricity	A-3
Table A - 4. Household Characteristics by Consumption Power Group	A-4
Table A - 5. Household Characteristics Used to Analyze Latent Demand	A-5

Abbreviations and Acronyms

°C	Degrees Celsius
ACEP Cameroon	Agency for Private Enterprise Credit in Cameroon (Agence de Credit pour l'Entreprise Privée au Cameroun)
AER	Rural Electrification Agency (Agence d'Electrification Rurale)
AFB	Afriland First Bank
AFD	French Development Agency (Agence Française de Développement)
AfDB	African Development Bank Group
AIMDP	Agriculture Investment and Market Development Project
ANOR	Standards and Quality Agency (Agence des Normes et de la Qualité)
ARSEL	Electricity Sector Regulatory Agency (Agence de Régulation du Secteur de l'Electricité)
ART	Telecommunications Regulatory Agency (Agence de Régulation des Télécommunications)
BAC	Atlantic Bank of Cameroon (Banque Atlantique du Cameroun)
BADEA	Arab Bank for Economic Development in Africa (Banque Arabe pour le Développement Économique en Afrique)
BC-PME	Cameroonian Bank of Small and Medium Enterprises (Banque Camerounaise des Petites et Moyennes Entreprises)
BEAC	Bank of Central African States (Banque des Etats de l'Afrique Centrale)
BGFI	Gabonese Bank for International Financing (Banque Gabonaise pour le Financement International)
BICEC	Cameroonian International Bank for Savings and Credit (Banque International du Cameroun pour l'Épargne et le Crédit)
BipBop	Business, Innovation, and People at the Base of the Pyramid
BOA	Bank of Africa
BOAD	West African Development Bank (Banque Ouest Africaine de Développement)
CamCCUL	Cameroon Cooperative Credit Union League
CAMTEL	Cameroon Telecommunications

CBC	Commercial Bank Cameroon
CCA Bank	African Community Credit Bank (Credit Communautaire d'Afrique Bank)
CE	Cameroonian Energy (Camerounaise d'Énergie)
CEO	Chief Executive Officer
CPF	Polyvalent Training Center of Mbouo-Bandjoun (Centre Polyvalent de Formation de Mbouo–Bandjoun)
CSPH	Stabilization Fund for Hydrocarbon Prices (Caisse de Stabilisation des Prix des Hydrocarbures)
CVECA	Village Savings and Self-Directed Credit Fund (Caisse Villageoise d'Épargne et de Crédit Autogérée)
DERME	Department of Renewable Energy and Energy Management (Département des Énergies Renouvelables et de la Maitrise de l'Énergie)
DHS	Demographic and Health Surveys
DPDC	Dibamba Power Development Corporation
DRC	Democratic Republic of the Congo
DSCE	Growth and Employment Strategy Document (Document de Stratégie pour la Croissance et l'Emploi)
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EDC	Electricity Development Corporation
Eneo	Eneo Cameroon S.A.
EU	European Union
FCFA	Franc of the African Financial Community (Franc de la Communauté Financière Africaine)
FEICOM	Special Council Support Fund for Mutual Assistance (Fonds Spécial d'Équipement et d'Intervention Intercommunale)
FER	Rural Energy Fund (Fonds d'Énergie Rurale)
GABAC	Task Force on Money Laundering in Central Africa (Groupe d'Action contre le Blanchiment d'Argent en Afrique Centrale)
GCF	Green Climate Fund

GDP	Gross Domestic Product
GICAM	Inter-Patronal Grouping of Cameroon (Groupement Inter-Patronal du Cameroun)
GIZ	German Society for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit)
GOGLA	Global Off-Grid Lighting Association
GSAC	German Solar Academy Cameroon
GWh	Gigawatt hour
IAI	African Institute of Informatics (Institut Africain d'Informatique)
ICT	Information and Communication Technology
IFC	International Finance Corporation
ILO	International Labour Organization
INDC	Intended Nationally Determined Contribution
IPP	Independent Power Producer
ITEM	Environmental Technical Institute for the Promotion of Renewable Energies in Maroua (Institut Technique Environnemental pour la promotion des Energies Renouvelables à Maroua)
ITEMEES	Institute for Energy Transition and Management of the Environment and Sustainable Energy (Institut pour la Transition Énergétique et le Management de l'Environnement et de l'Énergie durable)
JICA	Japanese International Cooperation Agency
KfW	Credit Institute for Reconstruction (Kreditanstalt für Wiederaufbau), also known as the KfW Development Bank
km	Kilometer
km ²	Square kilometer
KOICA	Korea International Cooperation Agency
KPDC	Kribi Power Development Company
kV	Kilovolt
kWh	Kilowatt hour
kWh/m ² /day	Kilowatt hours per square meter per day
kWp	Kilowattpeak

LED	Light-Emitting Diode
m	Meter
m/s	Meters per second
m ³	Cubic meter
MC2	Mutual Community Growth (Mutuelle Communautaire de Croissance)
MEA	Mifed Energy Access
MFI	Microfinance institution
MICS	Multiple Indicator Cluster Survey
MIFED	Microfinance and Development (Microfinance et Développement)
MIINEE	Ministry of Energy and Water Resources (Ministère de l'Énergie et de l'Eau)
mm	Millimeter
MTN	Mobile Telecommunications Network
MUCADEC	Mutual Cameroon Savings and Credit (Mutuelle Camerounaise d'épargne et de crédit)
MUFFA	Financial Mutual of African Women (Mutuelle Financière des Femmes Africaines)
MVN	Medium-Voltage Network
MW	Megawatt
NCCP	National Confederation of Cotton Producers
NEEP	National Energy Efficiency Policy
NFCB	National Financial Credit Bank S.A.
NIS	National Institute of Statistics
NOWEFOCH	North West Farmers Organisations Credit House
OPEC	Organization of the Petroleum Exporting Countries
PAID-WA	Pan African Institute for Development–West Africa
PAMIGA	Participatory Microfinance Group for Africa
PANERP	National Energy Action Plan for the Reduction of Poverty (Plan d'Action National Energie pour la Réduction de la Pauvreté)

PAOP	Power Africa Off-grid Project
PARFIP	Public Finance Reform Support Program (Programme d'Appui à la Réforme des Finances Publiques)
PAYGO	Pay-As-You-Go
PDER	Rural Electrification Master Plan (Plan Directeur d'Électrification Rurale)
PDSE 2030	Long-Term Development Plan for the Electricity Sector (Plan de Développement à Long Terme du Secteur de l'Électricité)
PEC	Persistent Energy Capital
PILER	Projects of Local Initiative of Rural Energy (Projets d'Initiative Locale d'Énergie Rurale)
Plan VER	Decentralized Electricity Production and Valorization of Rural Electrification for Agriculture and Rural Development in Cameroon (Production décentralisée d'électricité et Valorisation de l'Électrification Rurale pour l'Agriculture et le Développement Rural au Cameroun)
PME-PMI	Small and Medium Enterprise - Small and Medium Industry (Petite et Moyenne Entreprise – Petite et Moyenne Industris)
PPA	Power Purchase Agreement
PPER	Priority Projects of Rural Energy (Projets Prioritaires d'Énergie Rurale)
PRERETD	Project for Strengthening and Extension of Transmission and Distribution Power Grids (Projet de Renforcement et d'Extension des Réseaux Electriques de Transport et de Distribution)
PRODEL	Livestock Development Project (Projet de Développement de l'Elevage)
PV	Photovoltaic
REIC	Renewable Energy Innovators Cameroon
RIE	East Interconnected Network (Réseau Interconnecté Est)
RIN	North Interconnected Network (Réseau Interconnecté Nord)
RIS	South Interconnected Network (Réseau Interconnecté Sud)
ROGEP	Regional Off-Grid Electrification Project
SCB	Commercial Bank Corporation (Société Commerciale de Banque)
SCBC	Standard Chartered Bank Cameroon
SCM	Cameroonian Mobile Company (Société Camerounaise de Mobile - MOBILIS)
SGC	Société Générale Cameroun

SHS	Solar Home System
SNH	National Hydrocarbons Corporation (Société Nationale des Hydrocarbures)
SODECOTON	Cameroon Cotton Development Corporation (Société de Développement du Coton)
SONARA	National Refining Company (Société Nationale de Raffinage)
SONATREL	National Electricity Transmission Company (Société Nationale de Transport d'Électricité)
SUNREF	Sustainable Use of Natural Resources and Energy Finance
tCO ₂ eq	Ton of carbon dioxide equivalent
TWh	Terawatt hour

TWh/day	Terawatt hours per day
UBA	Union Bank for Cameroon
UCAC-ICAM	Catholic University of Central Africa (Université Catholique d'Afrique Centrale)
UdM	University of the Mountains (Université des Montagnes)
UNCDF	United Nations Capital Development Fund
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
VAT	Value-Added Tax
Wp	Watt-peak

INTRODUCTION

This report by Power Africa provides insights into the opportunities and risks associated with Cameroon’s off-grid solar energy market and gives companies, investors, governments, and other stakeholders a deeper understanding of the market. While other stakeholders (i.e., development partners) have conducted market assessments, Power Africa has identified market information gaps and seeks to bridge those gaps in the following ways:



This report provides a comprehensive and detailed review of solar home systems (SHSs), mini-grids, productive use of energy, and other aspects of the off-grid solar value chain. Additionally, this report includes details on policy and regulatory issues, the structure and historical context of the energy sector, and gender mainstreaming.



This report draws upon the most up-to-date sales and investment data from GOGLA in order to keep pace with the ever-changing dynamics of the off-grid solar sector. It also includes a geospatial analysis that highlights potential areas for off-grid solar market expansion.



Insights in this report help Power Africa Off-grid Project (PAOP) plan and prioritize activities across work streams of policy and regulations, market intelligence, business performance, access to finance, and cross-sectoral integration throughout sub-Saharan Africa.

The report also serves as a baseline for Power Africa’s technical advisors to guide their continuing work and provides a snapshot that can be used to determine growth and changing dynamics of the market over time. Insights provided in this report include characteristics of Cameroon’s electricity sector, electrification targets, government regulations, donor-funded activities, and details on subsectors of the off-grid solar energy market. Additionally, this report includes expert knowledge from Power Africa lead advisors, information gathered from stakeholder interviews, and data from the Global Off-Grid Lighting Association (GOGLA). For five countries (Cameroon, Côte d’Ivoire, the Democratic Republic of the Congo, Ethiopia, and Niger), a geospatial analysis was performed that leveraged machine learning to identify the potential local markets for off-grid solar energy. The geospatial analysis provides granular details (i.e., latent electricity demand by household income) that will assist companies seeking to expand into new geographic markets.

About Power Africa and the Power Africa Off-grid Project (PAOP)

Power Africa aims to accelerate off-grid electrification across sub-Saharan Africa through targeted, context-specific interventions with private-sector companies, governments, investors, and donors. Power Africa’s goal is to increase electricity access by adding 30MW of new generation capacity, and 60 million new connections through grid and off-grid solutions by 2030. The goal of the Power Africa Off-grid Project is to provide support to private off-grid companies and make the markets in sub-Saharan Africa more attractive for investment and operations. Power Africa defines “access” as the direct or actual number of new households and businesses connected to electricity via an on- or off-grid solution. The project focuses on accelerating off-grid energy access through household SHSs and mini-grids, with the goal of facilitating

six million new connections by 2022. The project aims to accelerate off-grid electrification across ten focus countries in Africa: Cameroon, the Democratic Republic of the Congo, Côte d'Ivoire, Ethiopia, Ghana, Kenya, Niger, Rwanda, Senegal, and Tanzania. Figure ES-1 identifies the countries in Africa receiving Power Africa support, with the focus countries highlighted. The pins represent the locations of the project's in-country advisors.

FIGURE ES-1. THE PROJECT PROVIDES SUPPORT TO 20 COUNTRIES IN AFRICA



The Power Africa Off-grid Project is a Power Africa project funded by the U.S. Agency for International Development (USAID). Power Africa brings together technical experts with stakeholders from the public and private sectors to increase energy access rates in sub-Saharan Africa. The Power Africa Off-grid Project is implemented by RTI International and headquartered in Pretoria, South Africa.



I EXECUTIVE SUMMARY

Cameroon overview. Cameroon is a Central African state, approximately 475,442 square kilometers (km²) in size, with a coastline on the Gulf of Guinea of approximately 420 kilometers. Its population is approximately 23 million people, 56 percent of whom live in urban areas. Life expectancy is 58 years. The population density is 49 people per km², and the country's annual population growth is 2.6 percent. Cameroon's key economic indicators include:

- › The gross domestic product was approximately \$34 million in 2017, with a growth rate of 3.5 percent and a per capita income of \$1,447.
- › Cameroon's main exports are aluminum, bananas, cocoa beans, coffee, cotton, petroleum, palm oil, rubber, and wood.
- › The main employment sector in Cameroon is agriculture, which employs 60 percent of the country's workforce, of which approximately 60 percent are women and 40 percent are men.

Cameroon's Vision 2035 outlines the country's development policy goals. However, the country must overcome several challenges on the way, as it faces unprecedented violence in the Northwest and Southwest Regions, where thousands of internally displaced persons are registered. The economy is at a standstill in these regions and social conditions have completely degraded.

Grid electrification. Eneo Cameroon S.A. (Eneo) is Cameroon's electric utility. Eneo is a public-private partnership initiated in 2014. The company owns 56 percent of the shares, and 44 percent belong to the Government of Cameroon (GOC). In 2018, Eneo had 1,224,505 customers. Cameroon has several sources of electricity generation, including hydropower, solar, wind, micro-hydro, thermal, and biomass. In 2014, installed capacity was estimated at 2,327 megawatts (MW), for a total production of 7,696 gigawatt hours (GWh), transmitted along 37,194 km of power lines. The National Electricity Transmission Company (Société Nationale de Transport d'Électricité [SONATREL]) has overseen this operation since October 2015. However, Eneo is charged with managing electricity distribution in Cameroon. The national grid access rate in Cameroon was 62 percent in 2014¹ with an urban electrification rate of 96 percent and rural electrification rate of just 35 percent (Ministry of Energy and Water Resources, and The World Bank 2016).

Geospatial analysis. A comprehensive geospatial analysis indicates that large urban areas, such as Yaoundé, Douala, Bamenda, Garoua, and Ngaoundéré, as well as smaller communities near major road corridors have relatively higher access to electricity. Nationally, Cameroon's total off-grid market potential is approximately 2.3 million households (or approximately 41 percent of households), with approximately 86 percent of these households outside urban areas.² Findings from the analysis seems to indicate that 10 percent of households in urban areas compared with 77 percent of households in rural areas reported not having access to electricity.

Support programs. The Ministry of Water Resources and Energy (Ministère de l'Eau et de l'Énergie [MINEE]) is responsible for developing and implementing government policies in terms of production, transportation, and distribution of energy within Cameroon. Within MINEE, the Department of Renewable Energy and Energy Management (Département des Énergies Renouvelables et de la Maitrise de l'Énergie [DERME]) is mandated to support the development of renewable energy, including the development of

¹ These data are the most current, although an official report with data from 2016–2017 is expected to be published later in 2019.

² National Institute of Statistics, "Multiple Indicator Cluster Survey (MICS5): Cameroon."

policies and strategies. Although network extension is priority in Cameroon, off-grid electrification is in progress with a project involving 166 solar mini-grids, implemented with the technical support of the Chinese company Huawei. To date, 135 mini-grids are already operational, and more than 6,000 households are connected. The Rural Electrification Agency (Agence d'Électrification Rurale [AER]) was established in 1998 to promote rural electrification throughout the country. AER manages the Rural Energy Fund (Fonds d'Énergie Rurale [FER]), which was created in 2009 to subsidize up to 80 percent of the investment cost in the energy sector to increase access to electricity in rural areas. Most projects have focused on small hydro and network extensions. None of the projects have focused on off-grid solar.

The main international donors supporting rural electrification include the African Development Bank Group (AfDB), the World Bank, the Islamic Development Bank, European Union, USAID, and the Japanese International Cooperation Agency (JICA). Additional support for off-grid projects is being provided by organizations such as the French Development Agency (Agence Française de Développement [AFD]), Korea International Cooperation Agency (KOICA), and Credit Institute for Reconstruction (Kreditanstalt für Wiederaufbau [KfW]), also known as the KfW Development Bank.

In 2013, an initiative was conducted, with support from the German Society for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit [GIZ]), SNV, and the Total Group, to create a solar energy association, with the aim of implementing advocacy to reduce custom duties on importation of pico-solar systems into Cameroon. However, the initiative was unsuccessful, and currently no such solar or renewable energy association exists in Cameroon. GIZ has created a program to support pico-lighting system companies. GIZ has developed relevant training documents and trained more than 100 solar entrepreneurs, specifically targeting women, from rural areas. Several other organizations are providing training and resources for renewable energy.

Pico-solar sector overview. Although several pico-solar companies are active in Cameroon, the sector is still in its relatively early stages of development. Active companies include upOwa, the Total Group, Light4All Cameroun, MPower Ventures, SolarWorX, Haute Energy Systems Ltd., Schneider Electric, and YANDALUX Cameroun SARL.

From mid-2016 until late 2018, portable solar lanterns with single lights or single lights with mobile charging (0–3 Watt peak [Wp]) were the main systems sold. To date, the number of solar home systems (SHS) sold is still very small compared with solar lanterns. In addition, most pico-solar systems products are sold on a cash basis, with only approximately four percent sold via the pay-as-you-go (PAYGO) model, since PAYGO is not yet widespread in Cameroon. Most Global Off-Grid Lighting Association (GOGLA) members have been selling quality-verified products. Very few businesses are selling non-quality-verified systems. Limited data exist regarding the sale of bundled appliances in Cameroon and in Central Africa more widely. However, GOGLA 2019 data indicates that the sale of televisions only began in late 2017. The sale of fans has not yet begun. From July through December 2018, approximately 59 appliances were sold in Cameroon, exclusively with cash payment.

The data also show that Cameroon has a large population without access to electricity and that there is currently a very low market penetration rate of solar systems of approximately 17 percent. Total sales of solar systems increased rapidly from 2017 to 2018, although sales rose slowly during 2018. The sale of multi-light systems decreased through 2018. Data regarding investments in Central Africa show that 2017 saw the greatest investment thus far, dominated by grants from a donor program, with investment levels dropping in 2018.



Investments in 2017 and 2018 mainly focused on regional expansion and the scaling up of existing business models. There was a significant increase in crowdfunding in 2018, which indicates a very positive trend for future investments in Central Africa.³

The main market barriers facing the off-grid solar sector in Cameroon include limited policies and regulations, limited access to finance, a lack of commercial activity, and a lack of an importation (custom duties) process. The most important barriers include: access to finance in general and a lack of commercial activity in the Northwest, Southwest, and Far North Regions of the country due to political and social insecurity. These regions represent 49 percent of the potential off-grid population.

GOC's executive and budgetary guidance under Circular 001/CF/MINEFI/CAB, dated June 9, 2012, specifies that an exemption from the value-added tax (VAT) is beneficial for all solar and wind energy equipment. The Directorate-General of Customs and the Directorate-General of Taxes regularly conduct post-clearance checks to confirm the destination of these products and to ensure that the equipment is used as intended. For import taxes, different codes correspond to different products. Pico-solar companies are typically subject to 30-percent taxes for electric lighting devices, although there is a move to allow pico-solar systems to pay just ten percent of taxes under a different code for photo-sensitive devices. Regarding quality control and standards, the Standards and Quality Agency (Agence des Normes et de la Qualité [ANOR]) has not yet provided any relevant specifications, thus many low-quality products are currently available in the market.

Cameroon has 15 commercial banks, yet only 19 percent of the population currently has access to financial services. In addition, Cameroon has more than 411 microfinance institutions (MFIs), divided into three categories: Category 1 MFIs collect savings and grant loans exclusively for their members; Category 2 MFIs collect savings and grant loans exclusively for their members and third parties; and Category 3 MFIs only grant loans to third parties without collecting savings.

Cameroon currently has four mobile telecommunication companies: Cameroon Telecommunications (CAMTEL), Orange, Mobile Telecommunications Network (MTN), and Nexttel. An estimated 83 percent of residents used mobile networks in 2017, and 98 percent of urban households have a mobile telephone, compared to 83 percent of households in rural areas.

There are a number of potential future distribution partners for pico-solar companies operating in Cameroon. Mobile telephone operators may be highly suitable partners to assist with distribution, advertising, communication, and raising awareness. In addition, two MFIs, Credit Sahel (Crédit du Sahel) and Microfinance and Development (Microfinance et Développement [MIFED]), are developing partnerships with pico-solar companies, which could be scaled up and other MFIs could replicate throughout Cameroon. Gas/petrol stations are also involved with distributing pico-solar products, and many supermarkets are also distributors.

Activities within the pico-solar sector in Cameroon have been limited in terms of mainstreaming gender equality and women's economic empowerment. However, the Financial Mutual of African Women (Mutuelle Financière des Femmes Africaines [MUFFA]) aims to provide financial services to low-income women and to those in the informal sector in urban and peri-urban areas. MUFFA is also considering developing financial products for pico-solar systems for women.

³ GOGLA, "Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data."

Mini-grid sector overview. The mini-grid sector in Cameroon is still in a relatively early stage of development, although there are more than 12 companies that have been installing mini-grids, including Renewable Energy Innovators Cameroon (REIC), Sagemcom, Solkamtech, WeeY Energie et Eau, Idratel Energy Cameroon, and SunErgy Power. Most have only installed a few systems.

A lack of access to finance is the most critical market barrier. Mini-grid companies do not have reliable access to investment funds, banks, and MFIs. In addition to a lack of technical skills, there is a lack of suitable regulations and no regulatory framework to protect mini-grid operators. Proparco, a subsidiary of AFD, focuses on private-sector development and has an interest in off-grid projects, notably mini-grids; however, there have been no private-sector projects submitted to Proparco for funding. Companies that wish to develop mini-grids from renewable energy sources in Cameroon must adhere to concessions, licenses, authorizations, and declarations from MINEE, with the Electricity Sector Regulatory Board granting all other types of documents.

Productive-use sector overview. Because rural areas tend to have fewer households with electricity, there is the potential to increase the agricultural productivity of off-grid households. Nationally, approximately 67 percent of households without electricity own livestock and approximately 87 percent own agricultural land. Both the World Bank and AfDB are running agricultural support programs in Cameroon that could potentially support productive uses of energy. However, no such projects have yet been developed. In addition, several investors, including the Agency for Private Enterprise Credit in Cameroon (Agence de Credit pour l'Entreprise Privée au Cameroun [ACEP Cameroon]), Credit Sahel, and AGRO-PME, are potentially interested in supporting productive-use projects in Cameroon.

2 CAMEROON ENERGY SECTOR OVERVIEW

2.1 COUNTRY INTRODUCTION

2.1.1 PHYSICAL FRAMEWORK

Cameroon is a Central African state located in the Gulf of Guinea, bordered to the west by Nigeria (1,700 kilometer [km] border) with a coastline of approximately 420 km along the Atlantic Ocean; to the south by the Republic of Congo (520 km), Gabon (300 km) and Equatorial Guinea (400 km); and to the east by the Central African Republic (800 km) and Chad (1,100 km). Cameroon is triangular in shape with a surface area of 475,442 square kilometers (km²). Cameroon’s geographical diversity is reflected in several areas. For instance, three sedimentary basins are particularly conducive to the formation of hydrocarbons: the Rio Del Rey basin (7,000 km²), the Douala-Kribi-Campo basin (19,000 km²), and the North Cameroon Logone Birni basin.⁴

2.1.2 SOCIO-ECONOMIC INDICATORS

Table 1 presents a summary of Cameroon’s socio-economic indicators, and Table 2 outlines its economic development profile.

TABLE 1. CAMEROON SOCIO-ECONOMIC INDICATORS SUMMARY

SOCIO-ECONOMIC INDICATORS	SUMMARY
Population size and life expectancy	Population: 25,216,237 (2018) Male residents: 49% Female residents: 51% Life expectancy: 58 years (2017)
Population density and growth rate	Density: 53 inhabitants per km ² (2018) Annual population growth rate: 2.6% (2018)
Religion	Animism (45%), Christian (30–40%), and Islam (15–20%)
Number of households	4,211,147 households
Urban and rural populations and the rate of urbanization	Urban population: 14,215,401 (2018) Rural population: 11,000,836 (2018) Urbanization rate: 54.6% (2014)
Local main languages spoken	Languages: French, English, Ewondo, Fulfuldé, Douala, Fèfè, Banganté, and Bamoun, among others
Other relevant data	Poverty rate: 37.5% Urban poverty: 8.9% Rural poverty: 56.8% Male residents: 38.9% Female residents: 32.8%

Source:⁵

⁴ National Institute of Statistics, “Annual Statistics of Cameroon.”

⁵ The World Bank, “Data: Cameroon.”

TABLE 2. RECENT ECONOMIC DEVELOPMENT IN CAMEROON

ECONOMIC DEVELOPMENT	SUMMARY
Gross domestic product (GDP) and other recent economic growth indicators	GDP: \$38.502 million Growth rate: 3.36% GDP per capita: \$1,526.9 Inflation rate: 1.1% Index of human development: 151 out of 189 countries in 2017
Main local and export production	Aluminum, bananas, cocoa, coffee, cotton, palm oil wood, rubber, and petroleum
Main source of employment for men and women	Agriculture employs 60% of the country's workforce, of which approximately 60% are women and 40% are men
Land size and usage	Land area: 475,442 km ² , of which 60% can be used to grow crops
Main crops and livestock	Cassava, macabo, maize, millet, plantains, potatoes, rice, sorghum, sweet potatoes, taro, and yams 72,758,691 poultry; 5,805,297 cattle; 6,298,058 caprine; 3,112,973 pigs; and 2,952,624 sheep
Major organizations, including investors, active within the crop and livestock sectors	World Bank Group Focus of Agriculture Investment and Market Development Project (AIM-DP): cassava, maize, and sorghum Focus of the Livestock Development Project (pour la Realisation d'une Etude de Reference du Projet de Developpement de l'Elevage [PRODEL]): pigs and cows United Nations Industrial Development Organization (UNIDO): Palm oil project in West and Central Africa AfDB value chains: pineapple, plantains, and palm oil World Food Program: Support for the development of (i) tilapia breeding and (ii) fruit crops

Sources:⁶

⁶ National Institute of Statistics, "Annual Statistics of Cameroon"; National Institute of Statistics, "Evolution of Inflation during the Year 2018"; United Nations Development Programme, "Human Development Indices and Indicators: 2018 Statistical Update"; The World Bank, "Data: Cameroon."

TABLE 2. RECENT ECONOMIC DEVELOPMENT IN CAMEROON (CONTINUED)

ECONOMIC DEVELOPMENT	SUMMARY
Other relevant economic indicators	<p>Unemployment rate according to the International Labour Organization (ILO): 3.7% (2014)</p> <ul style="list-style-type: none"> › Male residents: 3.2%; female residents: 4.3% › Urban area: 7.4% › Rural area: 1.1% <p>Overall underemployment rate: 77% (ILO, 2014)</p> <ul style="list-style-type: none"> › Male residents: 67.6% › Female residents: 86.9% › Urban area: 65% › Rural area: 85% <p>GOC developed and implemented the 2035 vision to serve as a compass for national development policy.</p>

Sources:⁷

2.1.3 OVERALL POLITICAL LANDSCAPE

The security crisis in the Far North Region is rooted in the gradual shift of activities of the Boko Haram terrorist sect of Nigeria to Cameroon. Although the situation is under control as of August 2019, it has had significant economic, social, and humanitarian consequences. Some of the consequences include a total breakdown of the local economy, an interruption in the functioning of the education system and public administrative services in most departments and districts, abandoned villages and towns, massive displacement of internal populations, and an influx of refugees from Nigeria to Cameroon. The security crisis has resulted in a significant drop in state revenues, pressure on natural resources, and greater risk of conflict between refugees and host populations. There has also been a near total cessation of agricultural and pastoral activities, which has exposed populations to high risks of famine and food crises.

Not like the crisis in the Far North Region, the crisis in the Northwest and Southwest Regions began with demands of lawyers and teachers who called to reconsider the appointments of Francophone judges in predominantly Anglophone territories.⁸ Over time, secessionist groups entered the scene, which led to armed conflicts. These two regions are currently characterized by economies at near standstills. This has affected education and health systems, resulting in sluggish administrative public services and many internally displaced persons. There have been several abductions as well.⁹

⁷ National Institute of Statistics, “Annual Statistics of Cameroon”; National Institute of Statistics, “Evolution of Inflation during the Year 2018”; United Nations Development Programme, “Human Development Indices and Indicators: 2018 Statistical Update”; The World Bank, “Data: Cameroon.”

⁸ Stone, “‘Imagine in Five Years’: How Education Became a Casualty of Cameroon’s War.”

⁹ Human Rights Watch, “Cameroon.”

The humanitarian consequences of the Boko Haram attacks and separatist insurgency are a growing concern. As of November 2018, the United Nations estimated that more than 244,000 civilians were displaced in the Far North Region and 437,500 in the anglophone Northwest and Southwest Regions. Approximately 32,600 Cameroonians found refuge in Nigeria.¹⁰

Cameroon has more than 300 political parties. On October 22, 2018, Cameroon's Constitutional Council validated President Biya's re-election results, with 71.3 percent of the vote. This re-election represents the seventh term obtained during presidential election held on October 7, 2019.¹¹

2.2 ENERGY SECTOR

2.2.1 GRID ELECTRIFICATION SUMMARY

Eneo Cameroon S.A. (Eneo), the electric utility company in Cameroon, started its activities in September 2014. Eneo is a public-private partnership, with the company owning 56 percent of the shares and GOC owning 44 percent. In 2018, Eneo had 1,224,505 customers.¹²

Cameroon has several sources of electricity generation, including hydroelectric power,¹³ solar energy, wind, thermal power, and biomass. The most recent data estimate that installed capacity in 2014 was at 2,327 megawatts (MW), for a total production of 7,696 gigawatt hours (GWh), as shown in Figure 1.¹⁴

¹⁰ Human Rights Watch, "World Report 2019."

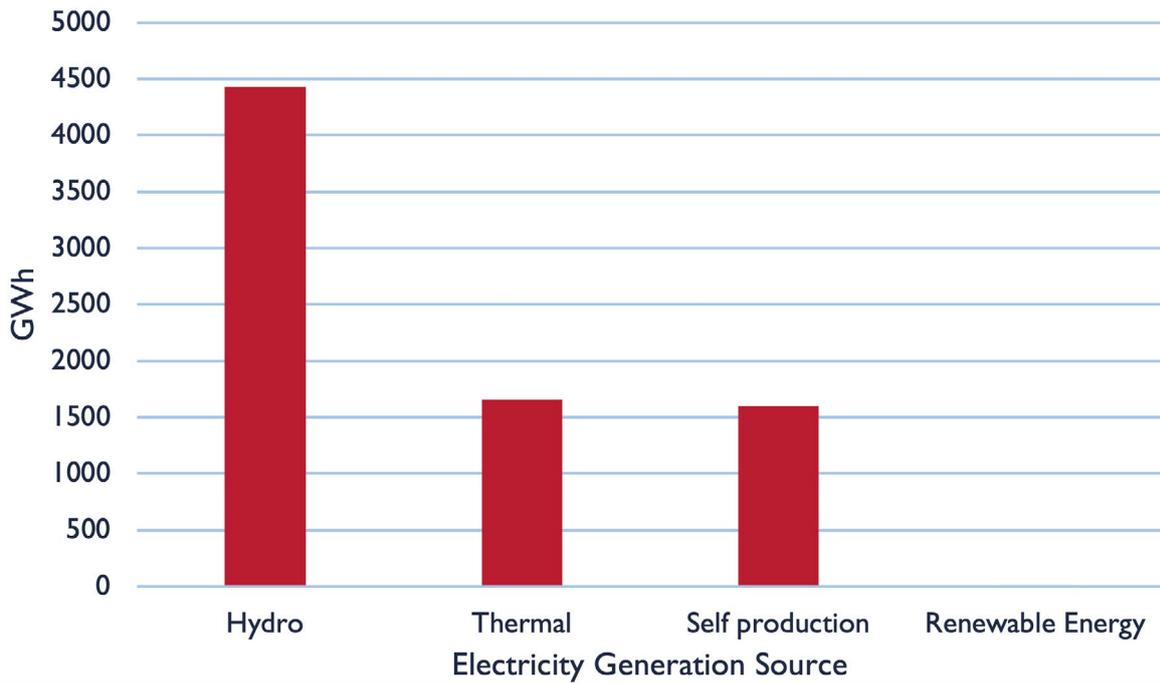
¹¹ Human Rights Watch, "Cameroon."

¹² Ministry of Water Resources and Energy, "Cameroon's Energy Situation."

¹³ Hereafter referred to as hydropower.

¹⁴ Ministry of Water Resources and Energy, "Cameroon's Energy Situation."

FIGURE I. ELECTRICITY GENERATION SOURCES IN CAMEROON



Source: ¹⁵

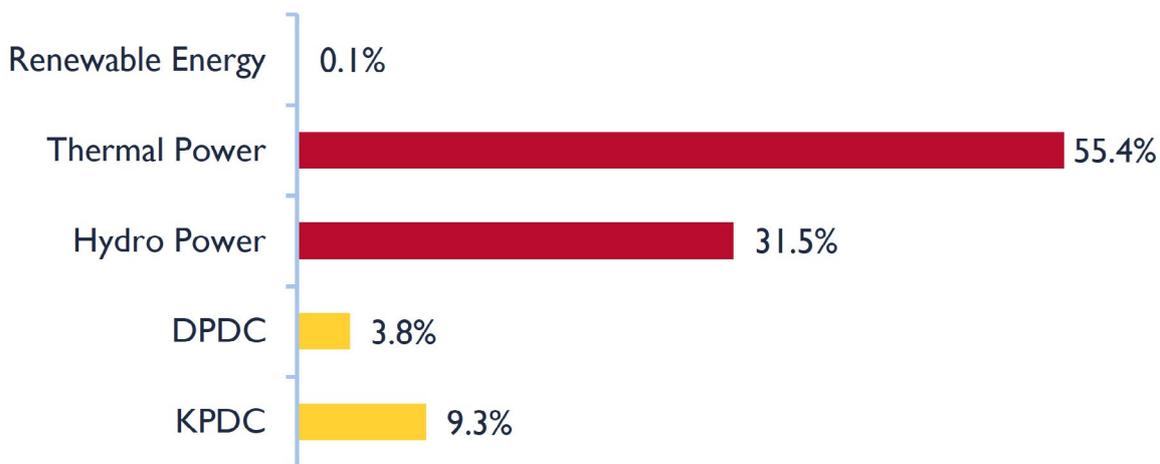
Not including hydropower, the share of renewable energy in total electricity production is less than one percent. The renewable energy production mix indicates that biomass accounts for 56 percent of production and solar energy for 38 percent.¹⁶

Cameroon has two independent power producers (IPPs) operating in the country: the Kribi Power Development Company (KPDC), which was established in April 2013 and manages the Kribi gas plant of 216 MW installed capacity; and an 88-MW heavy fuel thermal plant managed by the Dibamba Power Development Corporation (DPDC), which was established in November 2009. The installed capacity of both IPPs represents 13 percent of the total energy generation of the country, as shown in Figure 4.

¹⁵ Ministry of Water Resources and Energy.

¹⁶ Ministry of Water Resources and Energy.

FIGURE 2. SHARE OF INSTALLED ENERGY CAPACITY IN CAMEROON



Source: ¹⁷

In Cameroon, other projects are currently in development, including the Memve’ele Hydropower plant (211 MW), the Mékin Hydropower (15 MW), and Nachtigal Hydropower (420 MW). Regarding PPAs, IED-Invest recently finalized licensing agreements with the Electricity Sector Regulatory Agency (Agence de Régulation du Secteur de l’Electricité [ARSEL]) and purchase agreement with Eneo. The 1.4-MW Mbakaou Carriere mini-hydropower plant project (expandable to 2.8 MW) in the western Djerem Region is expected to be completed in 2020 as the first private, independent operator granted an IPP license. The project has mobilized €4.8 million (\$5.4 million) from IED-Invest and a €2.5 million (\$2.8 million) grant from the European Union (EU). These funds will finance the construction of the hydropower plant and a 70-km medium- and low-voltage distribution network. Early plans call for IED-Invest to operate both the hydropower plant and the distribution of electricity to nearby villages.

Eneo is no longer in charge of electricity transmission. The National Electricity Transmission Company (Société Nationale de Transport d’Électricité [SONATREL]) has overseen this operation since October 2015. However, Eneo is charged with managing electricity distribution in Cameroon.

Low-Voltage Customers

Table 3 presents the electricity tariffs for different consumer groups. Table 4 presents the tariffs for other non-residential uses in dollars per kilowatt hour (kWh).

¹⁷ Ministry of Water Resources and Energy.

TABLE 3. ELECTRICITY TARIFFS FOR LOW-VOLTAGE CONSUMERS

MONTHLY CONSUMPTION RANGES	TARIFFS IN \$/KWH (\$1 = FCFA 500)
Consumption lower than or equal to 110 kWh	0.1
Consumption between 111 kWh and 400 kWh	0.158
Consumption between 401 and 800 kWh	0.188
Consumption exceeding 801 kWh	0.198

Source:¹⁸**TABLE 4. OTHER NON-RESIDENTIAL USES**

MONTHLY CONSUMPTION RANGES	TARIFFS IN \$/KWH (\$1 = FCFA 500)
Consumption between 111 kWh and 400 kWh	0.168
Consumption between 111kWh and 400 kWh	0.184
Consumption exceeding 401 kWh	0.198
Public lighting	0.132

Source:¹⁹

Medium-Voltage Customers

The rate consists of a fixed monthly premium of \$7.40 per kWh of subscribed power and a proportional rate per kWh consumed, which is a function of the number of hours that the contract power is used per month and the period of use, as shown in Table 5.

TABLE 5. ELECTRICITY USAGE REGIME AND TARIFFS IN CAMEROON

NUMBER OF HOURS	GENERAL REGIME: <1MW		REGIME ≥1MW		FREE POINTS REGIME	
	Between 23 Hours and 18 Hours	Between 18 Hours and 23 Hours	Between 23 Hours and 18 Hours	Between 18 Hours and 23 Hours	Between 23 Hours and 18 Hours	Between 18 Hours and 23 Hours
0 to 200	0.14	0.17	0.14	0.17	0.14	0.17
201 to 400	0.13	0.17	0.13	0.17	0.13	0.17
≥401	0.12	0.17	0.12	0.17	0.12	0.17

Source:²⁰¹⁸ Electricity Sector Regulatory Agency, “Electricity Sale Fixed Rates for 2012.”¹⁹ Electricity Sector Regulatory Agency.²⁰ Electricity Sector Regulatory Agency.

National Grid Access Rate

In Cameroon, the national grid access rate was 62 percent in 2014, comprised of 96-percent access in urban areas and 35 percent in rural areas.²¹

2.2.2 FUTURE ELECTRIFICATION TARGETS

Forecasts of medium- and long-term network expansion by 2030 are presented in the Long-Term Development Plan for the Electricity Sector (Plan de Développement à Long Terme du Secteur de l'Électricité [PDSE 2030]). Cameroon has the following three interconnected networks:

- › The North Interconnected Network (Réseau Interconnecté Nord [RIN]) is the Lagdo hydropower plant, with a capacity of 72 MW. This network covers the Far North, North, and Adamaoua Regions.
- › The East Interconnected Network (Réseau Interconnecté Est [RIE]) has six thermal power plants, with a total installed capacity of 12 MW. This network covers the East Region.
- › The South Interconnected Network (Réseau Interconnecté Sud [RIS]) covers the six other regions of Cameroon (Center, Littoral, Northwest, South, Southwest and West). This network has two hydroelectric plants: Songloulou (384 MW) and Edea (276 MW).

As of 2014, according to Ministry of Water Resources and Energy, Cameroon's 37,194 km of power lines included:

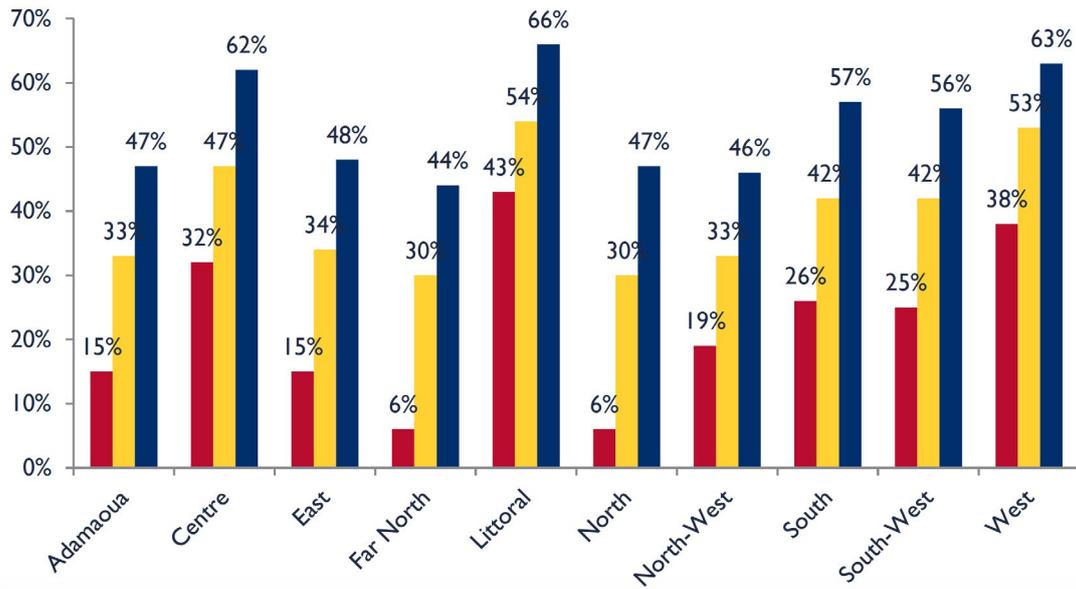
- › 796 km of 225 kilovolts (kV) lines
- › 338 km of 110 kV lines
- › 1,210 km of 90 kV lines
- › 17,473 km of medium-voltage lines (voltage between 1.5 kV and 30 kV)
- › 17,377 km of low-voltage lines (voltage between 1 kV and 1.5 kV).



The PDSE 2030 plans for an additional 2,420 km of power lines by 2030, with an estimated investment cost of \$1.76 million. Targets for grid electrification rates in different regions, updated in the Rural Electrification Master Plan by 2035, are shown in Figure 6.

²¹ Ministry of Water Resources and Energy, "Cameroon's Energy Situation."

FIGURE 3. ELECTRIFICATION TARGET RATES IN DIFFERENT REGIONS OF CAMEROON



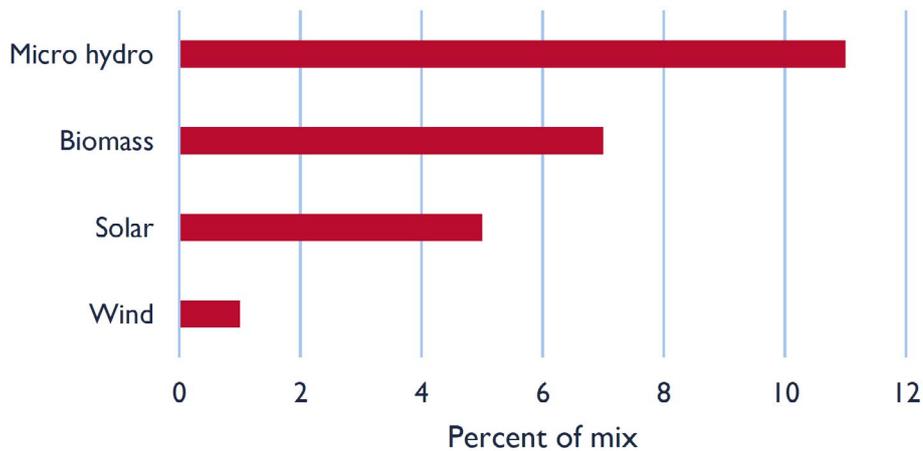
Source: ²²

The main international donors supporting rural electrification include AfDB, the World Bank, the Islamic Development Bank, the EU, and JICA. AFD, KOICA, USAID, and KfW are providing additional support for off-grid projects.

2.2.3 RE GENERATION AND RURAL ELECTRIFICATION SUMMARY

The overall electrification rate target is 55 percent in 2035. In rural areas, the target is 37 percent as indicated in Figure 4.²³ Estimates in the Intended Nationally Determined Contribution (INDC) policy project that the share of renewable energy in the energy mix should be 25 percent by 2035. Solar energy should represent five percent of the energy mix (Figure 8).

FIGURE 4. POTENTIAL RENEWABLE ENERGY MIX OF CAMEROON



Source: ²⁴

²² Ministry of Energy and Water Resources and The World Bank, “Rural Electrification Master Plan.”

²³ Republic of Cameroon, “Republic of Cameroon Intended Nationally Determined Contribution (INDC).”

²⁴ Republic of Cameroon.

Using the long-term renewable energy deployment targets of the INDC, the Renewable Energy Master Plan sets yearly targets for each renewable energy source. The total annual renewable energy generation in 2035 should be 5,953.8 GWh, constituting 25 percent of the total annual generation. To reach the targets of six percent for solar photovoltaic (PV), one percent for wind power, 11 percent for micro hydro, and seven percent for bioenergy, annual generations should be 1,426.9 GWh; 244.1 GWh; 2,617.9 GWh; and 1,664.8 GWh in 2035, respectively (Table 6).

TABLE 6. RENEWABLE ENERGY TARGETS IN CAMEROON BY SOURCE

RENEWABLE ENERGY SOURCE	2020 (GWH)	2025 (GWH)	2030 (GWH)	2035 (GWH)
Solar PV	28.4	104.9	386.9	1,426.9
Wind	33.8	73.1	143.9	244.1
Small Hydro	54.2	244.3	967.2	2,617.9
Bioenergy	22.1	106.0	476.4	1,664.8
Total (GWh)	138.5	528.3	1,974.3	5,953.8

Source: ²⁵

Potential of Biomass Energy: The estimated generation of electricity from biomass residues is approximately 1,050 GWh, corresponding to one quarter of the country’s electricity consumption.

Approximately 700 GWh could be injected into the electricity grid. Biomass has the potential to replace imported fossil fuels, help reduce greenhouse gases, create jobs, and provide electricity in areas where no grid extension is planned. However, Cameroon must overcome significant technical, social, and economic barriers before it can realize the potential value of biomass.

Wind Energy: The wind speed is generally low, rarely reaching five meters per second (m/s) in some areas. This potential is too low for the commercial production of electricity. Despite such relatively low wind speeds, however, the National Energy Plan (NEP), published in 1990, identified the North and Far North Regions as potential areas for wind energy exploitation, with average wind speeds greater than two m/s. The Kaele and Kousseri areas in the Far North region, as well as the Bamboutos Mountains in the East Region, represent important production reservoirs, with wind speeds estimated at between 2.53 m/s and 4.2 m/s.

Small Hydropower: A global study estimated that the exploitable potential in small hydropower in Cameroon at 1,115 terawatt hours (TWh). The estimated installed hydro systems range from five kW to ten MW, and the total equipment potential of these sites is 340 MW distributed.²⁶

Solar Energy: Cameroon has abundant solar energy potential and availability, especially in the northern portion of the country. According to estimates from ARSEL, the average insolation is 5.8 kilowatt hours per square meter per day (kWh/m²/day) in the northern portion of the country, four kWh/m²/day in the southern portion, and an average of 4.9 kWh/m²/day for the entire country. However, this exploitation remains weak. The sun provides a daily technical potential of 780 terawatt hours per day (TWh/day) or 172 TWh/day for just the North and Far North regions of Cameroon.

²⁵ Ministry of Energy and Water Resources, “Renewable Energy Master Plan.”

²⁶ Ministry of Water Resources and Energy, “Cameroon’s Energy Situation.”

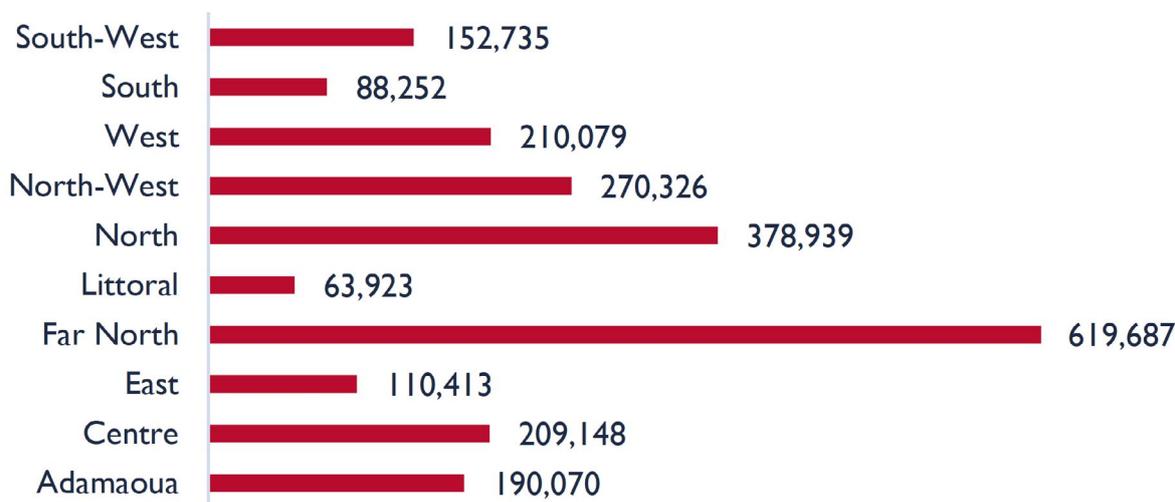
Off-grid solar, including pico-solar, solar home systems (SHS), and mini-grids, were not integrated into the Rural Electrification Master Plan (Plan Directeur d'Électrification Rurale [PDER]). Targets presented up to 2035 have not accounted for off-grid solar energy. GOC has prioritized small hydropower and grid extension.

The Rural Electrification Project and Project for Strengthening and Extension of Transmission and Distribution Power Grids (Projet de Renforcement et d'Extension des Réseaux Electriques de Transport et de Distribution [PRERETD]) are the principal mechanisms targeting rural electrification through the extension of the grid. Phase I of the Rural Electrification Project resulted in the electrification of 3,935 households across 33 population centers. In 2016, the Ministry and Water Resources and Energy (Ministère de l'Eau et de l'Énergie [MINEE]), in collaboration with the Islamic Development Bank, launched phase II of the Rural Electrification Project. Phase II aims to support the connection of an additional 102 population centers across the country. Funding commitments for Phase II include FCFA 12.2 billion (\$20.8 million) from the Islamic Development Bank, FCFA 8.45 billion (\$14.3 million) from the Organization of the Petroleum Exporting Countries (OPEC), FCFA 6.31 billion (\$10.8 million) from the Arab Bank for Economic Development in Africa (Banque Arabe pour le Développement Économique en Afrique [BADEA]), and FCFA 1.35 billion (\$2.3 million) from GOC.

2.3 DEMAND FOR ENERGY

The total non-electrified population of Cameroon is approximately 5.6 million, distributed among the regions as shown in Figure 5.

FIGURE 5. TOTAL NON-ELECTRIFIED POPULATION IN CAMEROON



Sources: ²⁷ and Power Africa Geospatial Analysis 2019

Table 7 lists the distance that separates the non-electrified population from the main network, and indicates that 77 percent of the non-electrified population, some 4.5 million people, lives up to 20 km from the grid.

²⁷ National Institute of Statistics, "Multiple Indicator Cluster Survey (MICS5): Cameroon."

TABLE 7. DISTANCE OF NON-ELECTRIFIED HOUSEHOLDS AND POPULATIONS FROM MAIN GRID NETWORK IN CAMEROON

HOUSEHOLDS AND POPULATIONS	BUFFER 10 KM	BUFFER 20 KM	BUFFER 30 KM
Non-electrified households	5,918	7,406	8,678
Non-electrified households (percentage remaining to electrify)	60%	76%	88%
Non-electrified population	3,606,809	4,470,699	5,168,997
Non-electrified population (percentage remaining to electrify)	62%	77%	88%

Source: ²⁸

As shown in Table 8, in coastal, northern and southern rural areas, most unelectrified households use kerosene lamps, torches and generators.

TABLE 8. PERCENTAGES OF ENERGY SOURCES FOR LIGHTING IN OFF-GRID AREAS

ENERGY SOURCES	COASTAL AREA	NORTHERN AREA	SOUTHERN AREA
Kerosene	98.7%	27.8%	95.7%
Accumulators and torches	44.5%	95.2%	19.1%
Generators	43.2%	3.9%	3%
Candles	2.2%	1.7%	3.9%

Source: ²⁹

As shown in Table 9, average monthly expenditures for lighting are higher for male heads of households.

TABLE 9. PERCENTAGES OF ENERGY SOURCES FOR LIGHTING IN OFF-GRID AREAS

HEADS OF HOUSEHOLD	COASTAL AREA	NORTHERN AREA	SOUTHERN AREA
Men	\$9.11	\$2.24	\$3.69
Women	\$6.78	\$1.04	\$2.88

Source: ³⁰

Lighting costs are relatively higher in the coastal area and lower in the northern area, as outlined in Table 9. Unlike other areas, the coastal area reports relatively higher lighting costs for non-connected households. One reason may be that generators contribute up to 30 percent in lighting expenses per household not connected to the main grid.

EED's 2013 study *Improving Access to Solar Energy through a Base of the Pyramid Approach* provides estimates of the willingness to pay for two different models of solar lanterns (models S10 [0.3w] and S250 [3w]) sold by the Total Group (Table 10).

²⁸ Ministry of Energy and Water Resources and The World Bank, "Rural Electrification Master Plan."

²⁹ Engineering Development Studies (EED), "Improving access to solar energy through a bottom of the pyramid approach."

³⁰ Engineering Development Studies (EED).

TABLE 10. WILLINGNESS TO PAY FOR SOLAR LANTERNS IN OFF-GRID AREAS

D.LIGHT MODELS	COASTAL AREA	NORTHERN AREA	SOUTHERN AREA
S10	\$7.0	\$7.4	\$5.4
S250	\$15.4	\$19.0	\$14.6

Source: ³¹

2.3.1 LATENT DEMAND FOR ELECTRIFICATION

To understand potential latent demand for electrification, Power Africa drew data from the 2014 Multiple Indicator Cluster Survey (MICS) to analyze the asset ownership and wealth levels of households without electricity in the large-consumption power group (Annex A Table A-1). Power Africa then compared this group to similar households with electricity that also had the same determining characteristics (i.e., must own at least one high-cost appliance, including a television, a refrigerator, a car, or a computer) and comparable wealth levels.³² This analysis illustrates the extent to which there is a potential for energy demand once these large-consumption households have access to reliable electricity.

Table A-5 in Annex A contains a table that describes household characteristics of the large-consumption power group compared with similar households with electricity.

This analysis revealed that households without electricity in the large-consumption group closely resemble comparable households with electricity access. Additional findings from the analysis are as follows:

- › In addition to having similar household characteristics and information about the education levels of heads of household, both groups have similar levels of asset ownership. For example, according to the responses, approximately 90 percent of large-consumption households have televisions, 93 percent own mobile telephones, and six percent own refrigerators. Meanwhile, 99 percent of similar households with electricity reported owning a television, 95 percent reported owning mobile telephones, and five percent reported owning refrigerators.
- › Nonetheless, there are a few differences between these groups. For instance, households without electricity tend to be more rural. Additionally, approximately 50 percent of adults in the large-consumption power households watch television at least once a week, compared with 85 percent in similar households with electricity.
- › Households without electricity are also shown to have higher levels of financial inclusion with slightly higher levels of bank account ownership (ten percent) than their counterparts with electricity (five percent).

The geospatial analysis suggests that households without electricity in the large-consumption power group demonstrate a notable demand for electrification in order to power their electric appliances and assets. An interesting finding is the disparity between high levels of television ownership and relatively low levels of regular television viewership among this group. This finding might indicate that even though the households have televisions, they might not have sufficient and/or reliable access to electricity to power these assets.

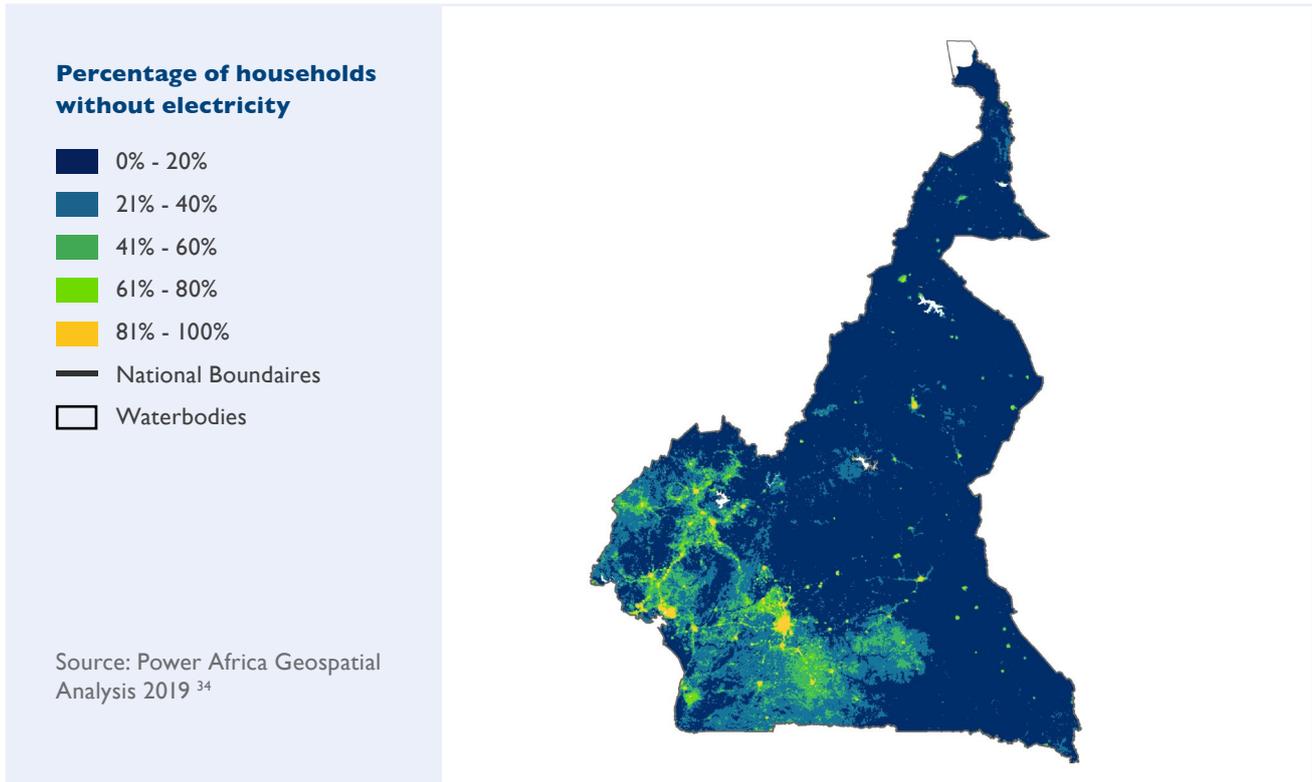
³¹ Engineering Development Studies (EED).

³² Power Africa determined the comparable wealth levels by calculating the average wealth levels for households without electricity in the 50th percentile. Power Africa then identified all households with and without electricity that fell within one standard deviation of this value.

2.3.2 MAPPING HOUSEHOLDS WITHOUT ACCESS TO ELECTRICITY

As part of the geospatial analysis, Power Africa calculated the proportion and number of households that compose the off-grid market potential in 1-km × 1-km grids across Cameroon. Nationally in Cameroon, 41 percent of households compose the off-grid market potential. Approximately 86 percent of these households are outside of urban areas (Figure 6). Large urban areas, such as Yaoundé, Douala, Bamenda, Garoua, and Ngaoundéré, and smaller communities near major road corridors reported having relatively higher access to electricity.³³

FIGURE 6. PERCENTAGE OF HOUSEHOLDS PER SQUARE KILOMETER THAT REPORTED NOT HAVING ELECTRICITY



Locating the Medium-Voltage Network

To understand electricity access in relation to the national grid, Power Africa augmented its geospatial mapping of electricity access using information about Cameroon’s medium-voltage network. The Rural Electrification Agency (Agence d’Electrification Rurale [AER]) provided information about medium- and high-voltage lines, including existing and planned lines. The AER prepared these data for Cameroon’s 2016 PDER, which received financial support from the World Bank. GOC’s planned expansion of the grid is concentrated in the Center and Adamawa Regions, as well as in the southeastern portions of Cameroon, including the East Region.

The analysis used geospatial data on transmission lines prepared by the World Bank through its Electricity Transmission and Reform project.³⁵ Although the World Bank identifies these transmission lines as

³³ National Institute of Statistics, “Multiple Indicator Cluster Survey (MICS5): Cameroon.”

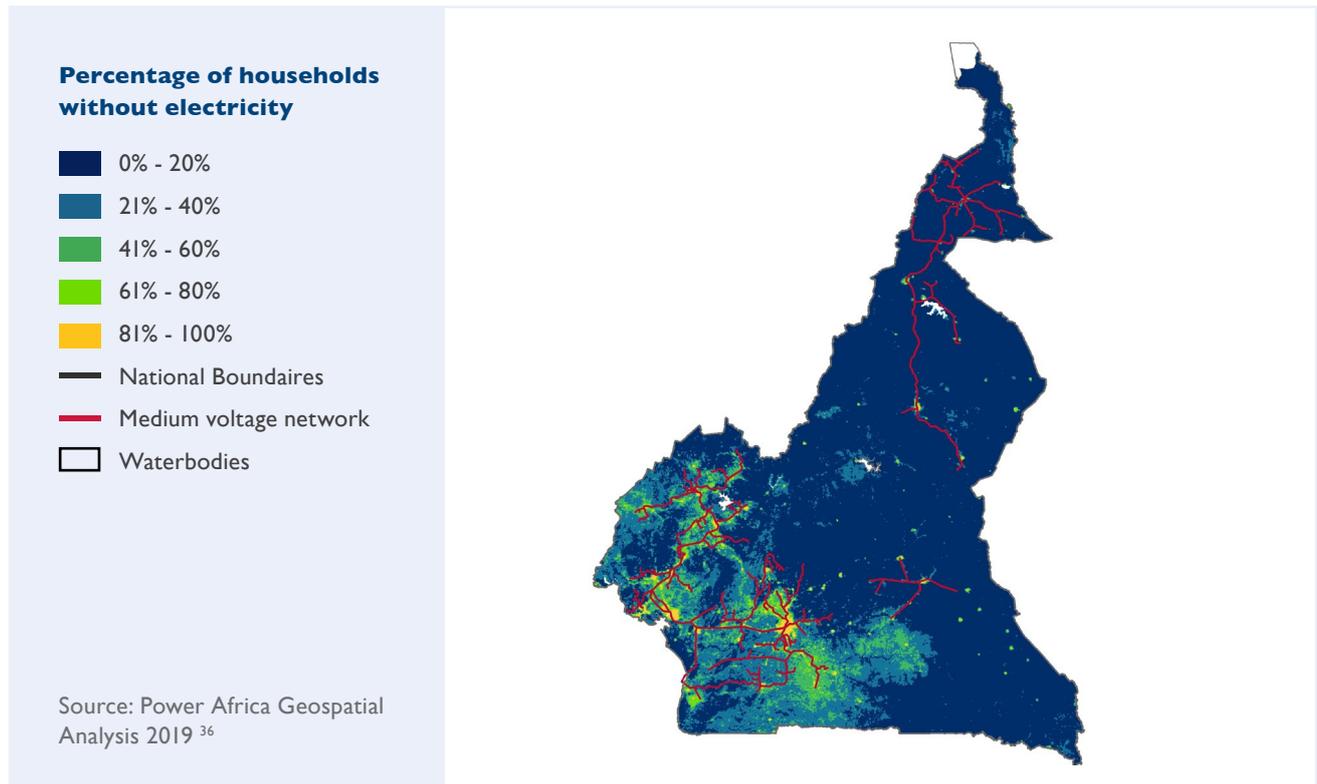
³⁴ National Institute of Statistics.

³⁵ The World Bank, “INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT PROJECT APPRAISAL DOCUMENT ON A PROPOSED LOAN IN THE AMOUNT OF EURO 291.1 MILLION TO THE REPUBLIC OF CAMEROON FOR AN ELECTRICITY TRANSMISSION AND REFORM PROJECT.”

high-voltage lines, these data more closely align with the medium-voltage network (MVN) identified in the PDER documents. This report therefore refers to the transmission lines from the World Bank report as “medium-voltage lines,” which are pictured in Figure 11 (high voltage is voltage between 30 kV and 225 kV; medium voltage is voltage between 1.5 kV and 30 kV [direct current]; low voltage is voltage between 1 kV and 1.5 kV).

The electricity access estimates align closely with the MVN across Cameroon. Areas with a higher proportion of households with access to electricity tend to be located near the MVN.

FIGURE 7. PERCENTAGES OF HOUSEHOLDS THAT REPORT NOT HAVING ELECTRICITY PER SQUARE KILOMETER, OVERLAID WITH MEDIUM-VOLTAGE LINES



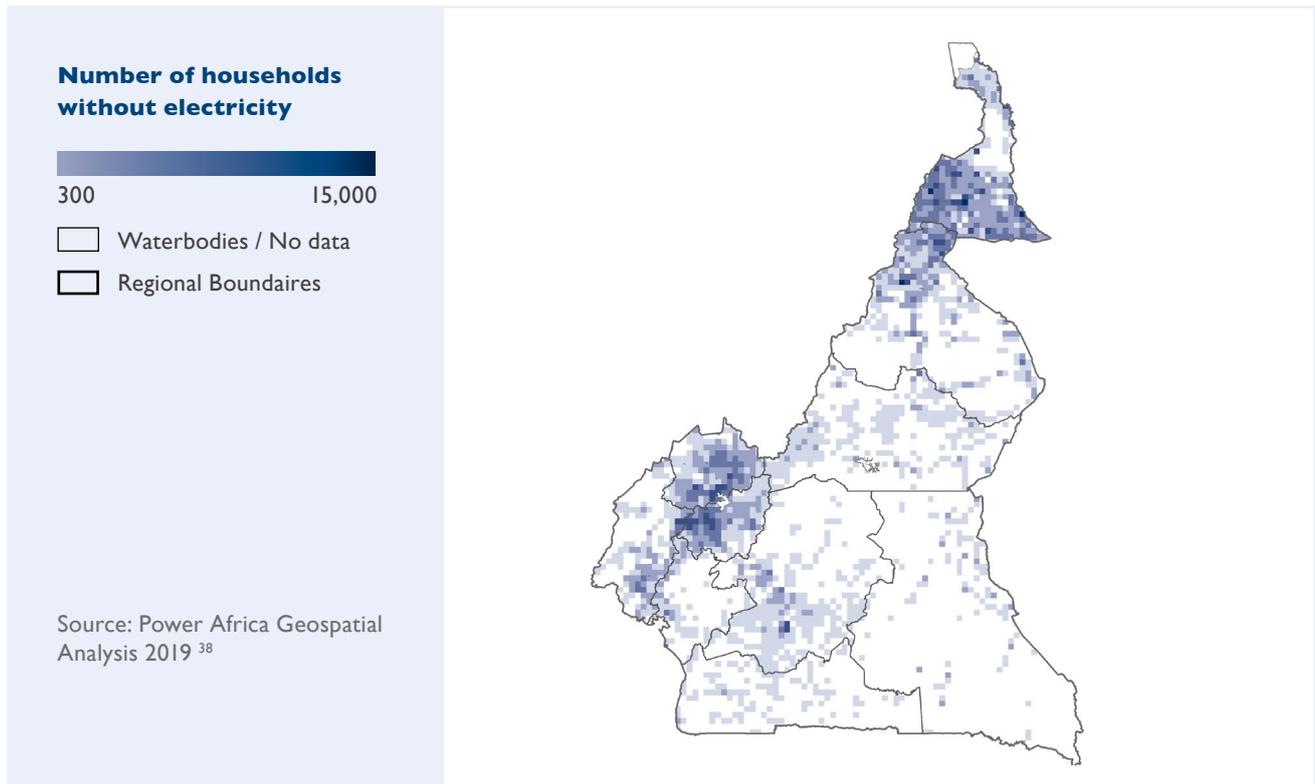
³⁶ The World Bank.

Analyzing Households Without Electricity in Cameroon

Nationally, Cameroon's total off-grid market potential is approximately 2.3 million households.³⁷ This group comprises approximately 41 percent of households in Cameroon, most of which are in rural areas. Figure 12 identifies the locations of these households without electricity.

- › In urban areas, ten percent of households reported not having access to electricity.
- › In rural areas, 77 percent of households reported not having access to electricity.

FIGURE 8. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-X 10KM GRIDS



Note: Areas with fewer than 250 households per 10-km × 10-km grids or with insufficient data are gray, water bodies are white, and regional boundaries are black.

³⁷ National Institute of Statistics, "Multiple Indicator Cluster Survey (MICS5): Cameroon."

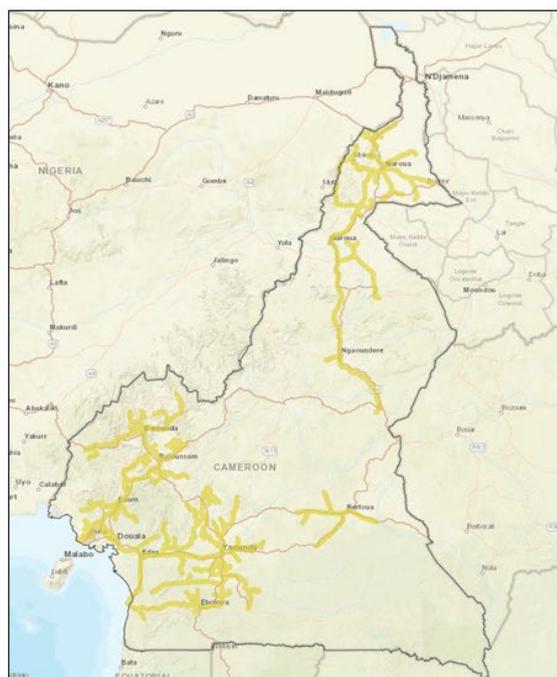
³⁸ National Institute of Statistics.

To analyze access to electricity, Power Africa created the following three buffers, as shown in Figure 9:

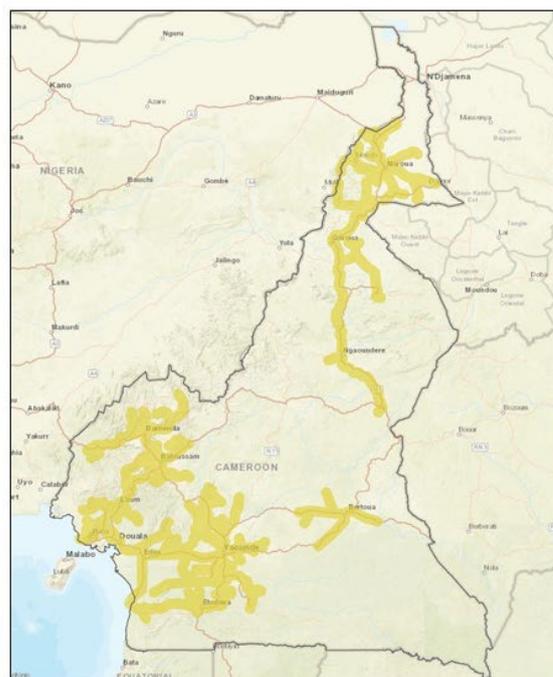
- › Within one km from the MVN lines
- › Within 10 km from the MVN lines
- › Farther than 10 km from the MVN lines.

FIGURE 9. BUFFERS USED FOR ANALYSIS

Within 1 km of the MVN Lines



Within 10 km of the MVN Lines



Source: Power Africa Geospatial Analysis 2019 ³⁹

Approximately 900,000 Cameroonian households are located within one km of MVN lines, which account for approximately 16 percent of the national population.⁴⁰

However, electricity access rates vary from community to community within one km of the MVN lines. For example, in the Center Region, approximately five percent of households located within one km of the MVN lines do not have electricity, compared with 47 percent in the North Region.⁴¹

This analysis provides a useful framework to understand the nature of the total off-grid market potential, as well as different potential strategies to develop energy solutions country-wide. The framework and strategies are presented as follows and in Table II:

³⁹ National Institute of Statistics.

⁴⁰ National Institute of Statistics.

⁴¹ The Government of Cameroon prepared an analysis of electrified localities surrounding the transmissions lines. The analysis is presented in Annex A, table A-2 of this report.

- › **Households without electricity within one km of MVN lines:**
 - » These households are in communities that are more likely to be serviced with national grid expansion.
 - » Almost 20 percent of households (approximately 175,000 households) located within one km of the MVN lines reported not having access to electricity.
 - » These households compose approximately eight percent of the total off-grid market potential.
- › **Households without electricity in areas between one and 10 km of the MVN lines:**
 - » It might take longer for the national grid to expand into these areas.
 - » Approximately 32 percent of households (approximately 960,000 households) located between one and ten km of the MVN lines reported not having access to electricity.
 - » These households compose approximately 42 percent of the total off-grid market potential.
- › **Households located ten km or farther from the grid:**
 - » These households are located in communities that are far enough from the national grid that expansion may take considerable time, especially in more rural areas.
 - » Although households farther than ten km from the MVN lines represent approximately 30 percent of all Cameroonian households, they account for half of the country’s total off-grid market potential. In these areas, approximately 70 percent of households (almost 1.2 million households) do not have electricity.
 - » Households in these areas could benefit from mini-grids, which offer an attractive energy solution for larger communities with adequate concentrations of households with sufficient spending power. Additionally, a full range of solar lighting and energy systems would offer attractive solutions for smaller communities and for households with low spending power.

TABLE 11. SUMMARY OF HOUSEHOLDS WITHOUT ELECTRICITY WITHIN 1 KM, 10 KM, AND FARTHER THAN 10 KM FROM THE NATIONAL MEDIUM-VOLTAGE LINES

INDICATOR	HOUSEHOLDS WITHIN 1 KM OF THE MVN LINES	HOUSEHOLDS BETWEEN 1 AND 10 KM OF THE MVN LINES	HOUSEHOLDS 10 + KM FROM THE MVN LINES	NATIONAL
Total households	901,000	2,990,000	1,650,000	5,540,000
Households without electricity	175,000	961,000	1,158,000	2,293,600
Percentages of households without electricity	19%	32%	70%	41%

Source: Power Africa Geospatial Analysis 2019

Outline of Households Without Electricity Access in Cameroon

Power Africa compared important characteristics of households with and without electricity. The table in Annex A, Table B-3 of this report contains statistics regarding household characteristics, which Power Africa extracted from the 2014 MICS. In summary, compared with households with electricity, those households without electricity tend to:

- › Have homes built out of less durable materials. For example, 20 percent of households without electricity have floors made of sturdy materials (e.g., cement, vinyl, tile, carpet). However, approximately 86 percent of households with electricity have floors made of these sturdy materials.
- › Have lower levels of media consumption. Approximately 28 percent of adults in households without electricity, compared with 90 percent of adults in households with electricity, reported watching television once a week.
- › Have lower levels of financial inclusion. Approximately two percent of households without electricity, compared with 23 percent of households with electricity, reported having at least one bank account.
- › Have lower mobile telephone ownership rates. Approximately 61 percent of households without electricity (approximately 81,000 households) own at least one mobile telephone, compared to approximately 97 percent of households with electricity. There is significant opportunity for growth in mobile banking and mobile money, which could help facilitate payment plans for solar energy products.



The urban–rural divide in access to electricity is notable. In rural areas, there are approximately 83 percent of households without electricity compared with 14 percent of households with electricity.

2.4 ENERGY-RELATED GOVERNMENT INSTITUTIONS AND STRATEGIC DOCUMENTS

The main institutional and administrative framework of Cameroon’s energy sector is summarized as follows:

- › **MINEE** is responsible for developing and implementing government policies in terms of production, transportation, and distribution of energy. Within MINEE, DERME is mandated to support the development of renewable energy, including creating policies and strategies, identifying renewable energy resources, transferring technologies, and promoting renewable energy within the country. Although network extension is high priority in Cameroon, off-grid electrification is in progress with a project involving 166 solar mini-grids, implemented with the technical support of the Chinese company Huawei. However, no data currently exist regarding where these mini-grids will be installed.
- › **The Ministry of Economy, Planning, and Regional Development** works with MINEE to promote investments in the electricity sector.
- › **The Ministry of Finance** provides financial support and different incentives, such as value-added tax (VAT) exemptions, to boost the renewable energy sector.
- › **The Ministry of Scientific Research and Innovation** is responsible for conducting research in the energy and hydrological fields and, in conjunction with MINEE, is responsible for promoting new energy.

- › Established by Decree 98/022 of December 24, 1998, **AER** is responsible for promoting rural electrification across the country. Within AER, a **Rural Energy Fund (Fonds d'Énergie Rurale [FER])** was created in 2009. The objective of FER is to promote through subsidization (up to 80 percent) of the investment cost in the energy sector to increase access to electricity in rural areas. In 2014, FER launched a call for applications and selected some projects that have received funding. Most of the projects selected focused on small hydropower and network extension and not on off-grid projects (pico-solar and solar mini-grids).
- › Established by Decree No. 098/022 on December 24, 1998, **ARSEL**'s main role is to regulate, control, and monitor the activities of electricity sector operators. ARSEL is also in charge of providing authorizations for companies that would like to produce and sell electricity.
- › Established by Decree No. 2006/406 on November 29, 2006, the **Electricity Development Corporation (EDC)** plays a strategic role in the development of the electricity sector by preserving Cameroon's assets.
- › On November 8, 2013, the British investment fund Actis bought the shares of the former AES-SONEL company. This repurchase was materialized by the agreement of the Government of Cameroon on January 23, 2014. As the manager of the public electricity service of Cameroon, **Eneo**, which is a limited company, is principally responsible for the transmission and distribution of electricity in Cameroon.
- › **The National Hydrocarbons Corporation (Société Nationale des Hydrocarbures [SNH])**, which was established by Decree No. 80/86 on March 12, 1980, is responsible for oil prospection and exploration and manages GOC's interests in this sector.
- › **The National Refining Company (Société Nationale de Raffinage [SONARA])**, which was established by Decree No.73/135 on March 24, 1973, refines crude oil and supplies the domestic market with finished products.
- › Created in October 2015, **SONATREL** is a public company that ensures the transmission of electricity and the management of the public electricity network.
- › **Stabilization Fund for Hydrocarbon Prices (Caisse de Stabilisation des Prix des Hydrocarbures [CSPH])**, which was established by Decree No. 74/458 on May 10, 1974, ensures stabilization and equalization in the distribution of finished petroleum products.

The main strategic documents that are related to the energy sector in Cameroon are Vision 2035 and the Growth and Employment Strategy Document (Document de Stratégie pour la Croissance et l'Emploi [DSCE] 2010–2020), which underpin Cameroon's energy policy. The country's energy strategy aims to ensure an efficient, reliable, clean supply of energy that meets the country's demand; develop and guarantee long-term access to modern energy services; and ensure that energy is a contributor to Cameroon's global industrial competitiveness. These objectives are being delivered through many plans, including the Development Plan for the Electricity Sector Horizon 2030 (PDSE), the PDER, and the National Energy Action Plan for the Reduction of Poverty (Plan d'Action Nationale Energie pour la Réduction de la Pauvreté [PANERP]). PDSE, PDER, and PANERP highlight the need to increase large-scale hydropower and fossil fuel generation capacity, extend the power grid to meet electrification targets, and increase renewables.

Cameroon's Growth and Employment Strategy Document provides the reference framework for its national development policy for the period of 2010-2020. It focuses on accelerating growth, creating formal jobs, and reducing poverty and aims to achieve three objectives, as follows:

- › Bring annual growth to 5.5 percent during the period of 2010 through 2020
- › Reduce underemployment from 75.8 percent to less than 50 percent by 2020 with the creation of tens of thousands of formal jobs per year in the next ten years
- › Reduce the monetary poverty rate from 39.9 percent in 2007 to 28.7 percent in 2020.

The **Rural Electrification Master Plan (PDER)** is the framework document that guides the development of the electricity sector in Cameroon. Importantly, PDER places a special emphasis on the electrification of rural areas. PDER aims to increase the energy supply in all localities of Cameroon by 2035, reaching 500 new localities per year. In addition, it aims to provide the strategy for the electrification of all localities of Cameroon through connecting to the main MVN, achieving 50,000 new connections over a 20-year period. Renewable energy generation also plays an important role within PDER, with 20,000 new connections to be powered by RE by 2020, including the construction of local mini-grids that will have a direct impact in increasing access of rural populations to electricity.

PANERP is the framework for the mobilization, coherence, consultation, coordination of interventions, awareness, simplification, capacity building, and technical and technological innovation for a sustainable supply of basic energy services for the poor, particularly in rural and peri-urban areas. Cameroon adopted PANERP as the framework for solving its challenging poverty issue from an energy perspective. Its main objective was to place energy access at the center of Cameroon's economic and social development. In Cameroon, energy poverty has a strong gender dimension as women represent 52 percent of the poor population with households in rural and peri-urban areas spending approximately 50 percent of their daily time cooking with traditional energy sources (94 percent of rural households use biomass for cooking). Integration of modern energy sources will enable 30 percent of rural households and 60 percent of peri-urban households access improved cooking stoves and domestic gas for cooking.

The **2011 Electricity Sector Act** aims to improve the legal and regulatory framework of the electricity sector by regulating all related activities. The main objective of the act is to ensure the modernization and development of the electricity sector in Cameroon, including the production, transportation, distribution, export, import, and sale of electricity by companies and individuals. The act defines the conditions of competition and rules for the preservation of the environment, guaranteeing the continuity of services and protecting consumers' interests in terms of price, supply, and safety of services.

The **INDC** aims to reduce the carbon footprint of Cameroon's development without slowing down its growth. The goal is to reduce greenhouse gas emissions by 32 percent, compared against its baseline. GOC intends to achieve this goal by prioritizing mitigation options with high co-benefits, enhancing resilience to climate change in the country, aligning sectoral policies, and strengthening implementation tools to achieve its targets. Achieving the goal requires increasing the share of RE within Cameroon's energy mix by approximately 25 percent by 2035, including 11 percent from micro-hydro, seven percent from biomass, six percent from solar PV, and one percent from wind.

Cameroon's **National Energy Efficiency Policy (NEEP)** is the framework document that defines the country's energy efficiency policy and strategy, including its action plan. NEEP aims to fill the gap between supply and demand by focusing on energy savings, focusing on the industrial, residential and public buildings and electrical system sectors. If the action plan is properly implemented, potential energy savings can be achieved, as summarized in Table 12.

TABLE 12. POTENTIAL ENERGY SAVINGS BY SECTOR IN CAMEROON, ACCORDING TO THE NEEP

SECTOR	GWH
Industry	1,165
Tertiary buildings sector	505
Residential and end use	280
Electricity supply	300
Total	2,250

Source: ⁴²

2.5 INTERNATIONAL DONORS

The main international donors that are related to the energy sector in Cameroon are discussed below.

- › The **German Society for International Cooperation (Deutsche Gesellschaft für Internationale Zusammenarbeit [GIZ])** is active in the Far North, North, East, Center, and Southwest Regions. In 2013, GIZ and the Total Group carried out an off-grid project, which involved supporting the distribution of solar lanterns and SHS. GIZ also supported another initiative involving off-grid electrification for education. Currently, GIZ's projects focus on the valorization of forest products and wood energy; however, there is a possibility to include off-grid electrification as a component, given that most of municipalities where GIZ operates are not electrified.
- › The **AFD** launched the program titled Sustainable Use of Natural Resources and Energy Finance (SUNREF), which is a financing scheme for renewable energy and energy efficiency projects for the private sector, through the Commercial Bank Corporation (Société Commerciale de Banque). A credit line of €15 million (\$16.9 million) is available for energy efficiency projects and renewable energy projects (both grid and off-grid), with a maximum installed capacity of ten MW. The focus technologies are small hydropower, biomass, solar thermal, wind energy, and solar PV. The SUNREF program is set up for three years (2021) and is implemented by the Inter-Patronal Grouping of Cameroon (Groupement Inter-Patronal du Cameroun [GICAM]), in partnership with the Commercial Bank Corporation. Proparco, a subsidiary of AFD, is focused on private-sector development and has been assessing off-grid projects in Cameroon since 2018.
- › The **World Bank Group** initiated the Regional Off-Grid Electrification Project (ROGEP), covering 15 countries in the Economic Communities of West African States (ECOWAS – Benin, Burkina Faso, Cabo Verde, Ghana, Guinea, Guinea Bissau, Ivory Coast, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, The Gambia, Togo) and four Sahelian countries (Cameroon, Central Africa Republic, Chad and Mauritania). ROGEP was designed to help achieve ECOWAS's renewable energy targets for 2020 and 2030, which include increasing the share of renewable energy in the region's overall electricity mix to ten percent in 2020 and 19 percent in 2030 by extending into the four Sahelian countries. There are two agencies implementing ROGEP. The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) is the technical implementation agency and the West African Development Bank (Banque Ouest Africaine de Développement [BOAD]) is the financial implementation agency. ROGEP primarily seeks to promote a harmonized regional market that provides the incentive for the proliferation of stand-alone solar equipment (e.g., solar lanterns, SHS, solar water pumps, solar milling equipment) to homes, business, and communities without access to electrical grid infrastructure.

⁴² Electricity Sector Regulatory Agency (ARSEL), "National Energy Efficiency Policy, Strategy and Action Plan in the Electricity Sector in Cameroon."

ROGEP developed a gender strategy as part of its framework to mainstream gender into different project activities, close gender gaps, and provide opportunities for equal participation of women and men as beneficiaries. Implementing the gender strategy involves engaging stakeholders, raising awareness, and building capacity. Key targeted stakeholders include private companies, regional development banks, commercial financial institutions, solar companies, and end users of solar equipment.

- › The **EU** has been very active in supporting energy projects in Cameroon and has provided funding and technical assistance to GOC. The EU has a partnership with the European Bank of Investment for projects in northern Cameroon, notably the Adamaoua and North Regions. The EU, in partnership with the World Bank, is supporting a project in Far North, East, Northwest and Southwest Regions, as well as a project to support the Cameroon Cotton Development Corporation's (Société de Développement du Coton's [SODECOTON's]) production process by building a solar plant. For another EU project, direct funding for renewable energy projects through the EU Delegation in Cameroon has been exhausted but will be available during the next European Development Fund, that will start in 2021. EU has a partnership with ElectriFI to finance renewable energy projects. EU also supports MINEE regarding policy and regulatory aspects involving the preparation of a procedures manual about off-grid rural electrification projects and network extension, support for new independent power production connected to the grid, and new mini-grid projects.
- › While **AfDB** has various funding programs involving energy access across the continent, the bank has not yet implemented a specific energy access project in Cameroon. However, AfDB has been assessing the off-grid sector since 2017. AfDB is planning to start new programs in the upcoming years, although no details are currently available.
- › The **Green Climate Fund (GCF)** is a global fund created to support developing countries in responding to climate change, as highlighted below. Three projects have already been approved in Cameroon: (i) Transforming Financial Systems for Climate; (ii) Energy Generation and Access; and (iii) Programme for Integrated Development and Adaptation to Climate Change in the Niger Basin. For these projects, GCF results areas include energy generation and access; forests and land use; buildings, cities, industries, and appliances; health, food, and water security; livelihoods of people and communities; infrastructure and built environment; and ecosystems and ecosystem services.

Case Study: GCF Scaling-up Clean Energy Access through Solar-Based Mini-Grids in Mali

The GCF Board approved the Mali Solar Rural Electrification project at its 22nd meeting in February 2019. The project is expected to provide funding to solar based mini grids for rural electrification, with a total investment of €46.2 million (\$52 million), of which €33.64 million (\$38 million) in high concessional sovereign loan and a €2 million (\$2.2 million) grant for technical assistance. GCF funding will additionally mobilize €10.6 million (\$12 million) from BOAD. The first approved stage of this project will deliver access to clean energy to 50 localities in Mali, reaching 28,300 new households and reducing 821,000 tons of carbon dioxide equivalent (tCO₂eq) of emissions over the project's lifespan.

- › **The International Finance Corporation (IFC)** is interested in grid-connected projects with a minimum installed capacity of 25 MW and does not finance off-grid electrification projects. The IFC can provide a loan that is 30 percent to 40 percent (corresponding to \$6 million to \$10 million) of the investment cost. Given that many mini-grids are deployed in Africa, the IFC will deepen the reflection about funding mechanisms to put in place through local banks, which will provide concessional rate credit to private developers.
- › **The United Nations Capital Development Fund (UNCDF)** is implementing the CleanStart program, which supports clean energy policy development and provides risk capital and technical assistance to competitively selected financial service providers and energy enterprises at regional and national levels. The CleanStart Program supports low-income households and micro-entrepreneurs to jump-start their access to clean energy through microfinance. The program also encourages greater financing choices for poor people, supported by high-quality technologies and services, as well as enabling ecosystems for energy and financial service providers to achieve scale and impacts. The UNCDF CleanStart Program invested \$26 million over six years (2012–2018) in Asia and Africa, to create a clean energy future for 2.5 million people. UNCDF’s activities in Cameroon include improving the accessibility of financial services to low-income populations in urban and rural areas. The CleanStart Program was implemented in Cameroon by the Participatory Microfinance Group for Africa (PAMIGA). PAMIGA has supported 11 Financial Service Providers—two of which are no longer offering green products—in six countries in sub-Saharan Africa: Benin, Cameroon, Ethiopia, Kenya, Senegal, and Tanzania. In addition, PAMIGA conducted a pre-scoping analysis in Burkina Faso and Madagascar.

2.6 SOLAR ASSOCIATION, TRAINING INSTITUTIONS, INCUBATORS, AND ACCELERATORS

In 2013, an initiative led by GIZ, SNV, and the Total Group created a solar energy association with the aim of implementing advocacy for the reduction of custom duties on pico-solar systems in Cameroon. However, the initiative was unsuccessful, and currently no solar or renewable energy association exists in Cameroon.

Cameroon also has several training institutions, incubators, and accelerators focused on the energy sector:

- › **GIZ** created a program to support pico-lighting system companies and developed relevant training documents and has trained more than 100 solar entrepreneurs, including women, from rural areas.
- › Owned by two Cameroonians, **Cameroonian Energy (Camerounaise d’Énergie [CE])** is a training center with a production unit. CE delivers training sessions about renewable energy and about the design and equipment manufacturing of solar and wind systems. CE is also one of the most important local designers and manufacturers of solar and wind equipment.
- › **Polyvalent Training Center of Mbouo-Bandjoun (Centre Polyvalent de Formation de Mbouo–Bandjoun [CPF])** is a vocational training center that delivers training sessions about solar energy, notably, the installation and maintenance of solar systems. Training sessions are offered under the supervision of the Ministry of Employment and Vocational Training.
- › **National Advanced School of Engineering –Yaoundé (Polytechnic School of Yaounde)** provides training sessions on topics related to renewable energy, notably, electrical engineering, industrial maintenance, and mechanical engineering. In 2016, the United Nations Industrial Development Organization (UNIDO) established a renewable energy center for small hydropower within the Polytechnic School of Yaounde.

- › **National Polytechnic University Institute–Bamenda** offers training sessions on topics related to renewable energy and water, notably, electrical power systems, as well as water systems and resource management.
- › **University of Bamenda** offers training sessions on renewable energy and waste recycling. Sessions are offered through the Higher Institute of Engineering and Technology.
- › **National Polytechnic University Institute–Maroua** provides training sessions on hydraulic and water management, environmental sciences, and renewable energy, specifically solar, wind, and biomass.
- › **National Advanced School of Public Works** in partnership with the University of Padua in Italy, established a master’s degree training program on renewable energy.
- › Based in Yaoundé, **African Institute of Informatics (Institut Africain d’Informatique [IAI])** specializes in Information and Communication Technologies (ICT). In February 2019, IAI signed an agreement with Blue Power to deliver trainings on solar energy as part of a Renewable Energy and ICT project with the aim of training 3,000 technicians on solar systems, including their installation and maintenance.
- › **Catholic University of Central Africa** provides training sessions in Douala on engineering, specifically focusing on the environment, energy efficiency, and renewable energy.
- › Located in Yaoundé, **Technipole** is an enterprise incubator that helps young entrepreneurs create their own businesses.
- › Based in Douala, the **German Solar Academy Cameroon (GSAC)** offers training sessions on solar and thermal energy; design, installation, and maintenance; and solar pumps, energy management, and optimization of energy consumption. GSAC has a PV laboratory in which students can learn about design and making simulations on PV installations.
- › **SunErgy Power** offers short-term training sessions for a maximum of three months to engineering students who would like to deepen their skills regarding solar energy. Students are trained in all aspects of solar energy, including solar power generation, transmission, and distribution; the solar business; and the SunErgy Power idea and vision. Students also actively participate by working in SunErgy Power’s villages.
- › Based in the West Region, **University of the Mountains (Université des Montagnes [UdM])** delivers training sessions for students pursuing Bachelor of Science and master’s degrees in renewable energy. The technologies discussed during the training include solar, wind, hydropower, and biomass.
- › Created in 1969, the **Pan African Institute for Development–West Africa (PAID-WA)** is part of the expanding network of the Pan African Institute for Development International (I’PAID). I’PAID is a highly respected African institution that provides capacity development and innovative research to accelerate the growth and development of the region. PAID-WA offers several training sessions, including entrepreneurship and micro-business management, as well as energy management.
- › The local partner of Purdue University, the **African Centre for Renewable Energy and Sustainable Technology (ACREST)** is a center for information, demonstration, awareness, production, and research regarding renewable energy and sustainable technologies in Africa. The main topics include energy, such as solar, wind, hydro, biogas, water, transport, food processing, and appropriate technologies.
- › **Institute for Energy Transition and Management of the Environment and Sustainable Energy (Institut pour la Transition Énergétique et le Management de l’Environnement et de l’Energie Soutenable [ITEMEES])** offers training in the following areas: energy efficiency of buildings or transport equipment, tools for energy management, geothermal energy, renewable thermal energy, solar energy, and intelligent energy networks.
- › **Environmental Technical Institute for the Promotion of Renewable Energies in Maroua (Institut Technique Environnemental pour la promotion des Energies Renouvelables à Maroua [ITEM])** offers vocational training sessions on renewable energy and environmental protection.

3 PICO-SOLAR COMPANIES

3.1 SHS SALES SUMMARY

Tables 13 through 22 provide summaries of pico-solar sales in Cameroon per information obtained by the Global Off-Grid Lighting Association (GOGLA) from its members.



From mid-2016 until late 2018, portable solar lanterns with single lights or single lights with mobile charging (zero to three Watt peak [Wp]) were the main systems sold in Cameroon.

To date, the number of SHS sold is still very small compared with solar lanterns.

TABLE 13. SALES DATA IN CAMEROON BY PRODUCT CATEGORY

SALES PERIODS IN CAMEROON	SUM OF 0–1.5 WP	SUM OF 1.5–3 WP	SUM OF 3–10 WP	SUM OF 11–20 WP	SUM OF TOTAL
July through December 2016	-	-	338	-	45,444
January through June 2017	15,573	-	502	-	30,886
July through December 2017	-	-	1,800	-	1,967
January through June 2018	36,109	8,550	4,126	927	49,715
July through December 2018	20,229	31,668	2,245	-	54,649
Total	71,911	40,218	9,011	927	182,661

Source: ⁴³

TABLE 14. SALES DATA IN CAMEROON BY PRODUCT CATEGORY

SALES VOLUMES IN CAMEROON	CASH+PAYGO	CASH ONLY	PAYGO ONLY
July through December 2016	45,444	-	-
January through June 2017	30,886	-	-
July through December 2017	1,967	-	-
January through June 2018	49,715	45,488	4,227
July through December 2018	54,649	51,944	2,705
Total	182,661	97,432	6,932

Source: ⁴⁴

In addition, most pico-solar systems products are sold on a cash basis, with only approximately four percent sold by using the PAYGO model, with PAYGO not yet taking off in Cameroon.

⁴³ GOGLA, “Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data.”

⁴⁴ GOGLA.

TABLE 15. MARKET VALUE IN CAMEROON BY PRODUCT CATEGORY

SALES PERIODS IN CAMEROON (\$)	SUM OF 0–1.5 WP	SUM OF 1.5–3 WP	SUM OF 3–10 WP	SUM OF TOTAL
January through June 2017	138,366	-	-	\$456,294
January through June 2018	209,925	372,342	47,733	\$690,329
July through December 2018	156,015	1,217,124	0	\$1,373,139
Total	504,307	1,589,466	47,733	\$2,519,762

Source:⁴⁵**TABLE 16. MARKET VALUE IN CAMEROON BY BUSINESS MODEL**

SALES VOLUMES IN CAMEROON (\$)	CASH ONLY	PAYGO ONLY
SALES VOLUMES IN CAMEROON (\$)	CASH ONLY	PAYGO ONLY
January through June 2017	\$456,294	-
January through June 2018	\$690,329	\$487,747
July through December 2018	\$1,373,139	-
Total	\$2,519,762	\$487,747

Source:⁴⁶**TABLE 17. SALES DATA BY QUALITY VERIFIED AND BY NON QUALITY VERIFIED PRODUCTS**

SALES PERIODS IN CAMEROON	SUM OF QUALITY VERIFIED	SUM OF NON-QUALITY VERIFIED	SUM OF TOTAL
July through December 2016	-	-	45,444
January through June 2017	30,886	-	30,886
July through December 2017	-	-	1,967
January through June 2018	45,971	3,744	49,715
July through December 2018	-	-	54,649
Total	76,857	3,744	182,661

Source:⁴⁷⁴⁵ GOGLA.⁴⁶ GOGLA.⁴⁷ GOGLA.

Limited data exist regarding the sale of bundled appliances in Cameroon and in Central Africa more widely. However, the data available indicate that sale of televisions only began in late 2017. The sale of fans has not yet begun. From July through December 2018, approximately 59 of all appliances were sold in Cameroon, exclusively with cash payment.

TABLE 18. ESTIMATED SALES DATA OF BUNDLED APPLIANCES FOR THE CENTRAL AFRICA REGION

APPLIANCES	PERIOD	SALES VOLUMES
Fans	July through December 2016	—
	January through June 2017	—
	July through December 2017	—
Televisions	July through December 2016	—
	January through June 2017	—
	July through December 2017	467

Source: ⁴⁸

TABLE 19. SALES DATA BY APPLIANCE TYPE (JULY THROUGH DECEMBER 2018)

Country	Cash+PAYGO	Cash Only	PAYGO Only
Cameroon	59	59	0

Source: ⁴⁹

The data in Table 20 show that there is currently a large population in Cameroon without access to electricity and that there is a currently very low market penetration rate of approximately 17 percent of the population.

TABLE 20. ESTIMATED MARKET PENETRATION

COUNTRY	WB ACCESS RATE (2017)	WB POPULATION WITHOUT ACCESS (2017)	MARKET PENETRATION ESTIMATION
Cameroon	61.40%	9,284,288	16.92%

Source: ⁵⁰

TABLE 21. COUNTRY LEVEL TRENDS

TREND TYPE	PERCENTAGE CHANGE H2 2018 TO H1 2018	PERCENTAGE CHANGE H2 2018 TO H2 2017
Total sales	10%	2,678%
Solar lanterns	16%	—
Multi-light systems	-46%	25%
SHS sales	—	—

Source: ⁵¹

Note: H1 = First Half of Year; H2 = Second Half of Year.

⁴⁸ GOGLA.

⁴⁹ GOGLA.

⁵⁰ GOGLA.

⁵¹ GOGLA

TABLE 22. ESTIMATED IMPACTS IN CAMEROON FROM 2016 THROUGH DECEMBER 2018

People with Improved Energy Access (Cumulatively)	1,591,268
People with Improved Energy Access (Currently)	1,570,630
People with Access to Tier 1 Energy Services (Currently)	676,744
People with Access to Tier 2 Energy Services (Currently)	3,212
People Who Have Started a New Job (Cumulatively)	4,864
Additional Income (Cumulatively)	\$19,890,666
Change in Light Hours Used (Cumulatively)	330,621,002
Change in Energy Spending (Cumulatively)	\$60,522,360
Change in Energy Spending (Household)	\$978
Greenhouse Gas Emissions Avoided (Cumulatively)	349,514

Source: ⁵²

3.2 PICO-SOLAR COMMERCIAL OVERVIEW

Although there are several pico-solar companies actively operating in Cameroon (Table 23), overall the off-grid sector is still in its relatively early stages of development.

⁵² GOGLA.

TABLE 23. SUMMARY OF SHS COMPANIES OPERATING IN CAMEROON

	<p>upOwa is a PAYGO company and the main distributor of Greenlight Planet products, which range in power from 6W to 40W. The company has already connected 5,000 households. upOwa plans to sell its systems to an additional 20,000 households in 2019.</p>
	<p>The Total Group was the exclusive distributor of d.light and Sundaya products in Cameroon for more than 10 years. The Total Group has developed its pico-solar systems and distributes them through its gas station network.</p>
	<p>Light4All Cameroun is a non-governmental organization. The company implemented a pilot project with financial support from GIZ. Light4All Cameroun. Since 2011, the company has distributed non-PAYGOO products from Omnivoltaic and WakaWaka, having already sold systems to more than 1,000 pico-solar systems.</p>
	<p>MPOWER Ventures has been active in the market since January 2019. The company raised funds from a Swiss investment fund to develop activities in Cameroon and Zambia. MPOWER Ventures company plans to sell systems to 230,000 households across Africa by 2022.</p>
	<p>SolarWorX manufactures a new generation of modular solar home and business systems that are being sold on a PAYGO basis. SolarWorX helped to electrify approximately 500,000 people in sub-Saharan Africa. Power range of systems vary between 100 watts (W) and 300 W. Solkamtech, a local company, has been a partner with SolarWorX since January 2019. To date, Solkamtech is the first PAYGO distributor in the Northern Region and is in the process of scaling up its distribution network and business model.</p>
	<p>Haute Energy Systems Ltd. was founded in 2005 and sells 3G-enabled SHS. The company is implementing a project for the Kerosene Lamp Eradication Programme Vision 2030. The objective of this project, which is a joint initiative with the Victoria Customs Cooperative Credit Union Ltd. (a microfinance institution [MFI]), is to eradicate the use of kerosene lamps in Cameroon by 2030.</p>
	<p>Schneider Electric has implemented the Business, Innovation, and People at the Base of the Pyramid (BipBop) Program with the following objectives:</p> <ul style="list-style-type: none"> One million households at the base of the pyramid will have access to energy because of Schneider Electric's solutions. 10,000 young people at the base of the pyramid will be trained in the electricity field. 500 contractors at the base of the pyramid will set up their activities in the electricity sector.
	<p>YANDALUX Cameroun SARL distributes SHS with a power range of 150 W to 600 W.</p>

Many other companies have expressed an interest in entering Cameroon soon, including d.light, Fenix International, Ilemel Energy Solutions, EcoZoom, and Solarli.

3.3 OVERVIEW OF OFF-GRID HOUSEHOLDS

To understand the potential market for different types of off-grid solutions, Power Africa segmented households without electricity based on key household characteristics and assets.⁵³ The goal is to understand different levels of consumption and potential spending power within this group. For large-consumption power households, Power Africa selected households without electricity that had reported owning at least one high-cost asset out of the following: car, computer, television, or refrigerator. For medium-consumption power households, Power Africa selected those that reported owning a mobile telephone and live in a household with at least one type of high-quality housing material for the roof, floor, or walls. For modest-consumption power households, Power Africa selected those that reported owning at least one radio or mobile telephone. Note that the groups are mutually exclusive, with each household being classified into the highest tier for which it is eligible.

For this analysis, Power Africa further validated this segmentation by analyzing the corresponding distribution of wealth for each group, proxying for wealth by using an index that is based on asset ownership and other household characteristics. This analysis confirmed that households with lower levels of wealth were classified as modest-consumption power households, and those with higher wealth were classified as large-consumption power households.⁵⁴ All households in the modest-, medium-, and large-consumption power groups report not having access to electricity.

Of the total off-grid market potential, 59 percent were classified as target consumer households. Additional findings from the geospatial analysis are presented as follows:

- › Approximately 21 percent of households (approximately 470,000) without electricity fit the profile for the modest-consumption power category.
- › Approximately 31 percent of households (approximately 700,000) without electricity fit the profile for the medium-consumption power category.
- › Approximately 9 percent of households (approximately 190,000) without electricity fit the profile for the large-consumption power category.

The remaining 39 percent of households without electricity did not meet the requirements for the modest, medium, or large-consumption power categories; therefore, this group primarily consisted of residents living in households constructed from less durable materials and had lower levels of asset ownership and wealth.

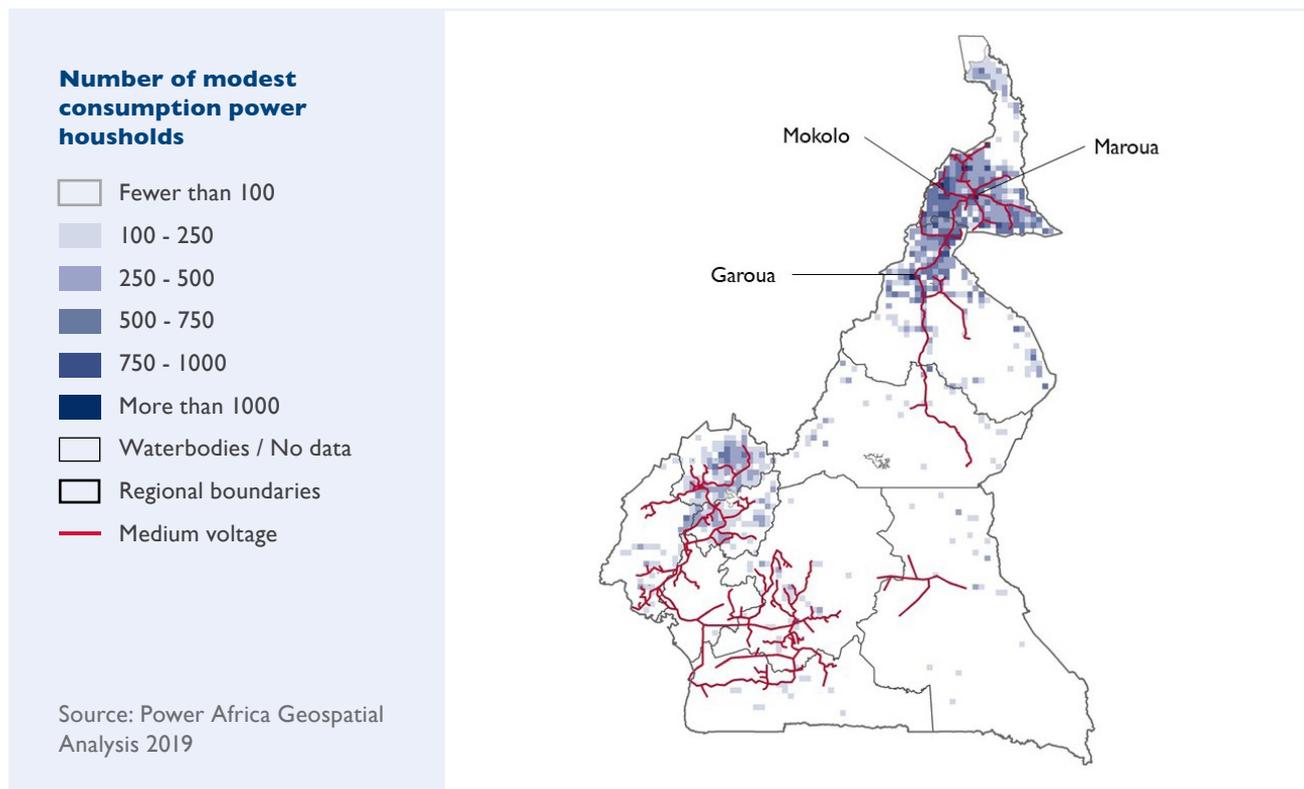
The table in Annex A Table B-4 of this report highlights key attributes of the different consumer profiles to provide solar companies with important information about potential target customers. Broadly, large-consumption power households are more likely to own more expensive assets, live in higher quality homes, and access financial tools.

⁵³ Recent detailed household spending data, including spending for specific energy sources and discretionary items, is unavailable in Cameroon.

⁵⁴ The DHS wealth index is a composite measure of a household's living standards. For a detailed discussion of the methodology used to construct this index see: DHS Wealth Index Construction.

These three consumption power groups have different geographic distributions across the country. Most modest-consumption power households are concentrated in the northern regions of the country, particularly the Far North Region. There are also notable pockets of this consumer group in the Northwest and West Regions (Figure 10).

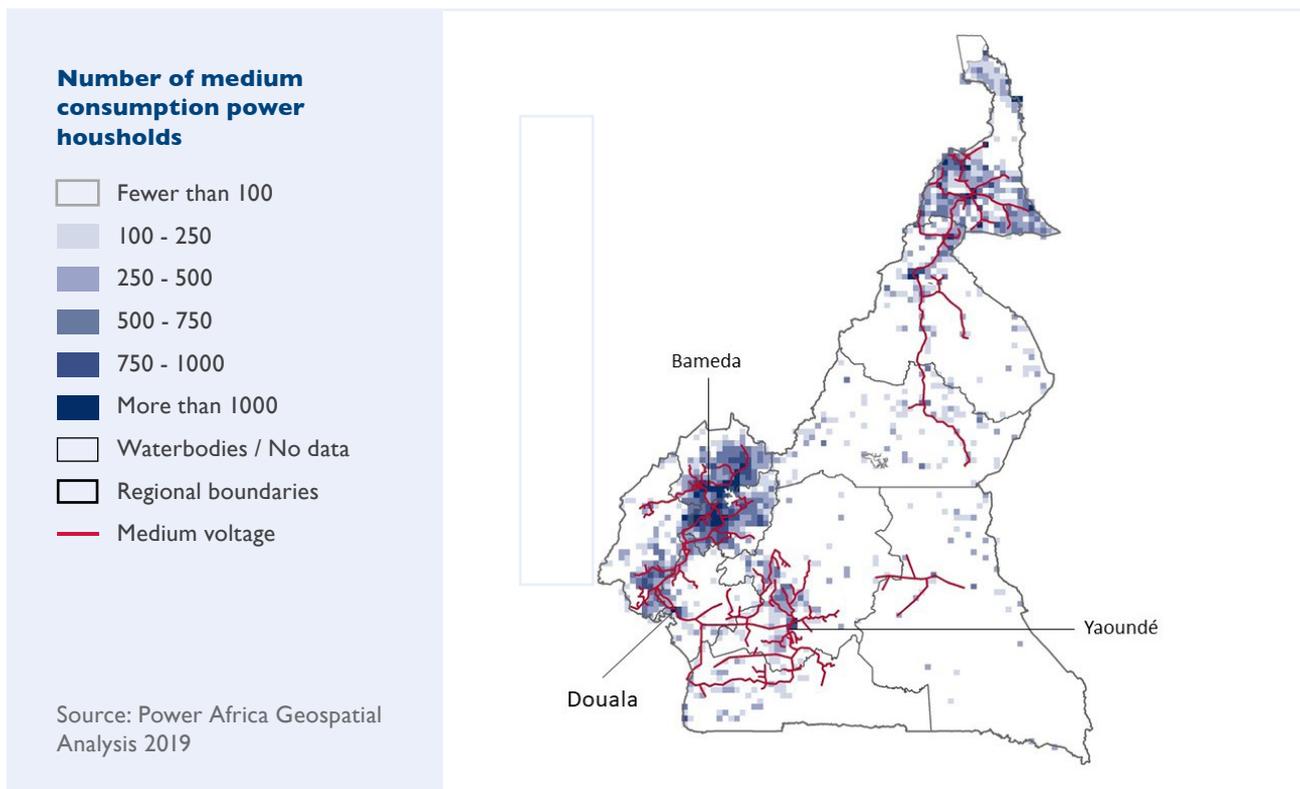
FIGURE 10. NUMBER OF HOUSEHOLDS IN THE MODEST-CONSUMPTION POWER GROUP PER 10-KM X 10KM GRID



Note: Areas with fewer than 150 households per 10-km × 10-km grid or with insufficient data are shown in gray, and regional boundaries are shown in black.

Most medium-consumption power households are concentrated in towns in the eastern and northern portions of the country. Notable numbers of this consumption group can be found farther away from the mapped MVN lines (Figure 11).

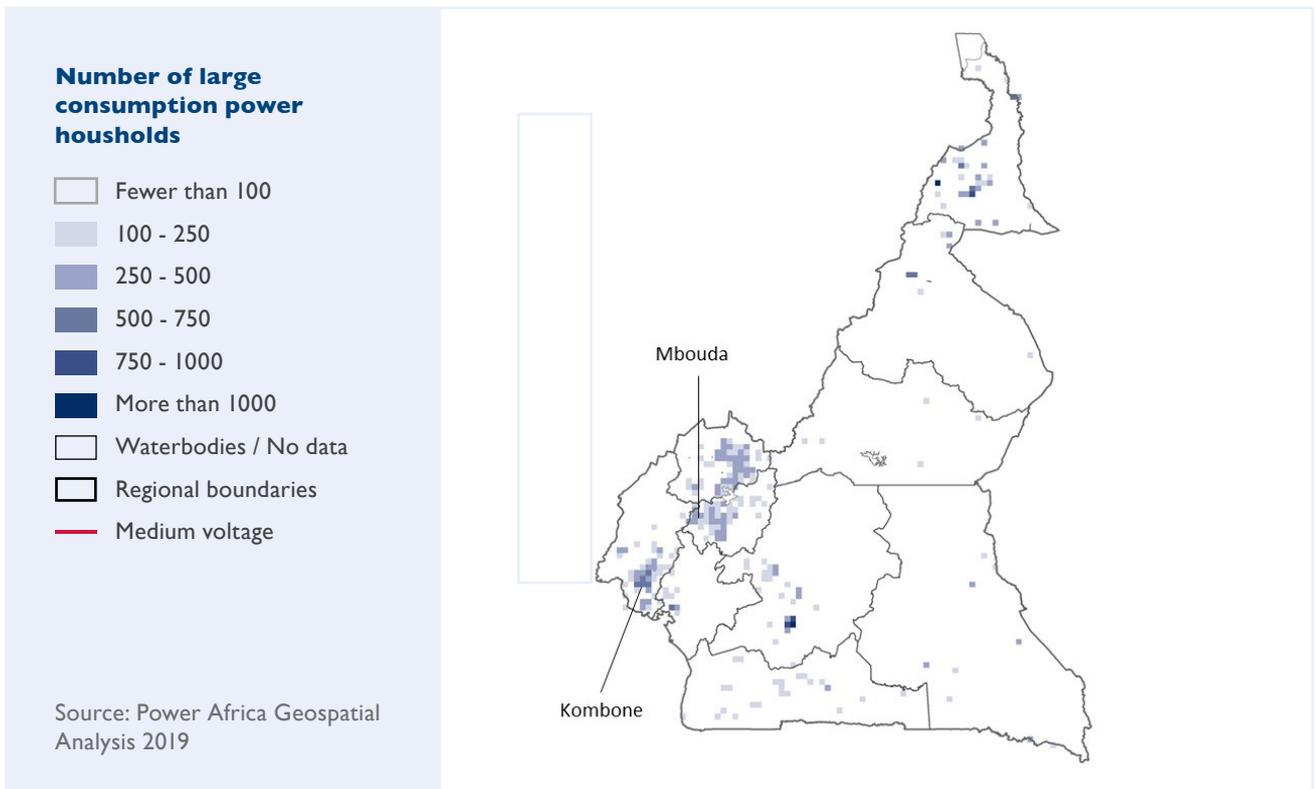
FIGURE 11. NUMBER OF HOUSEHOLDS IN THE MEDIUM-CONSUMPTION POWER GROUP PER 10-KM X 10KM GRID



Note: Areas with fewer than 150 households per 10-km × 10-km grid or with insufficient data are shown in gray, and regional boundaries are shown in black.

Most large-consumption power households are concentrated in towns in the eastern and northern portions of the country. This group is also located closer to large urban areas (Figure 12).

FIGURE 12. NUMBER OF HOUSEHOLDS IN THE LARGE-CONSUMPTION POWER GROUP PER 10-KM X 10KM GRID



Note: Areas with fewer than 150 households per 10-km × 10-km grid or with insufficient data are shown in gray, and regional boundaries are shown in black.

Generally, households across all three consumer groups live farther than one km from the MVN lines (Table 25). Most modest-consumption power households and approximately half of large-consumption power households are located farther than ten km from the grid. In comparison, most of the medium-consumption power households are located within ten km of the grid.

TABLE 24. DISTANCE FROM THE NETWORK

LEVEL	HOUSEHOLDS WITHOUT ELECTRICITY (MODEST-CONSUMPTION POWER GROUP)	HOUSEHOLDS WITHOUT ELECTRICITY (MEDIUM-CONSUMPTION POWER GROUP)	HOUSEHOLDS WITHOUT ELECTRICITY (LARGE-CONSUMPTION POWER GROUP)	TOTAL HOUSEHOLDS WITHOUT ELECTRICITY
National	471,000	702,000	189,000	2,294,000
<1 km from the MVN lines	32,000	68,000	16,000	175,000
Within 1 km–10 km of the MVN lines	185,000	336,000	77,000	961,000
>10 km from the MVN lines	255,000	298,000	97,000	1,158,000

Source: Power Africa Geospatial Analysis 2019

3.4 OPPORTUNITIES FOR OFF-GRID SOLAR COMPANIES

With regard to mapping the total off-grid potential market, three regions in Cameroon account for more than 50 percent of the total off-grid market potential (Power Africa Geospatial Analysis 2019). These three regions are discussed as follows:

- › Far North Region: Approximately 77 percent of households in the Far North Region reported not having electricity (Table 26); 620,000 households without electricity represent 27 percent of the total off-grid market potential.
- › North Region: Approximately 72 percent of households in the North Region reported not having electricity; 379,000 households without electricity represent 17 percent of the total off-grid market potential.
- › Northwest Region: Approximately 51 percent of households in the Northwest Region reported not having electricity; 270,000 households without electricity represent 12 percent of the total off-grid market potential.

TABLE 25. OFF GRID MARKET POTENTIAL FOR HOUSEHOLDS WITHOUT ELECTRICITY

REGIONS	TOTAL HOUSEHOLDS	HOUSEHOLDS WITHOUT ELECTRICITY	PERCENTAGES OF HOUSEHOLDS WITHOUT ELECTRICITY
Adamawa	273,000	190,000	70%
Center	1,131,000	209,000	18%
East	177,000	110,000	62%
Far North	801,000	620,000	77%
Littoral	930,000	64,000	7%
North	524,000	379,000	72%
Northwest	530,000	270,000	51%
West	540,000	210,000	39%
South	205,000	88,000	43%
Southwest	430,000	153,000	36%

Source: Power Africa Geospatial Analysis 2019

Maps indicating the number of households without electricity are provided in Figures 13 to 22.

FIGURE 13. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-KM × 10-KM GRID IN THE ADAMAWA REGION

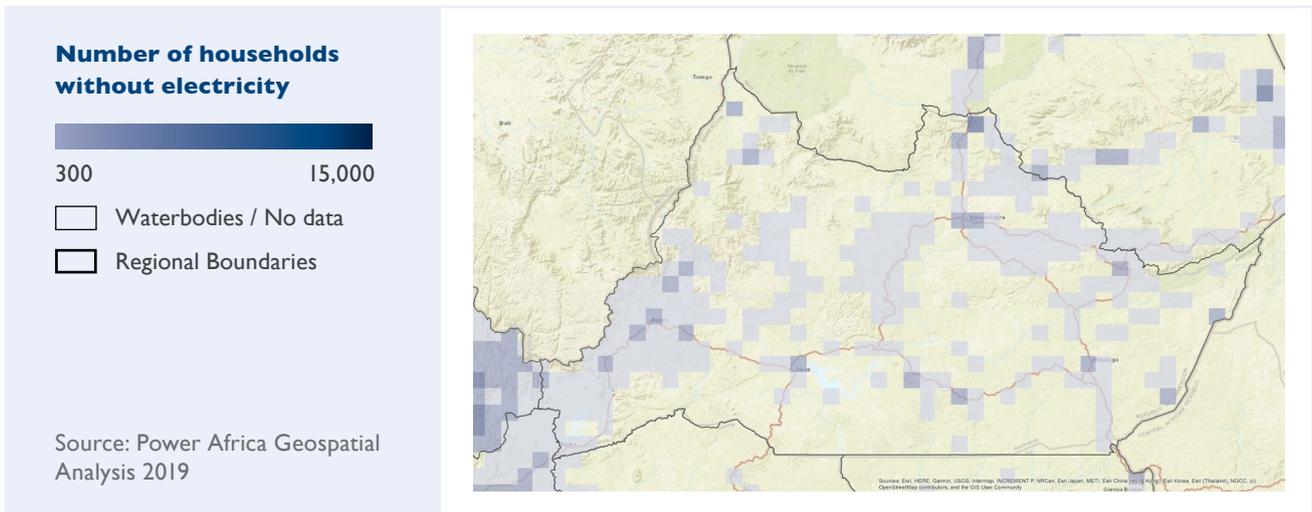


FIGURE 14. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-KM × 10KM GRID IN THE CENTER REGION

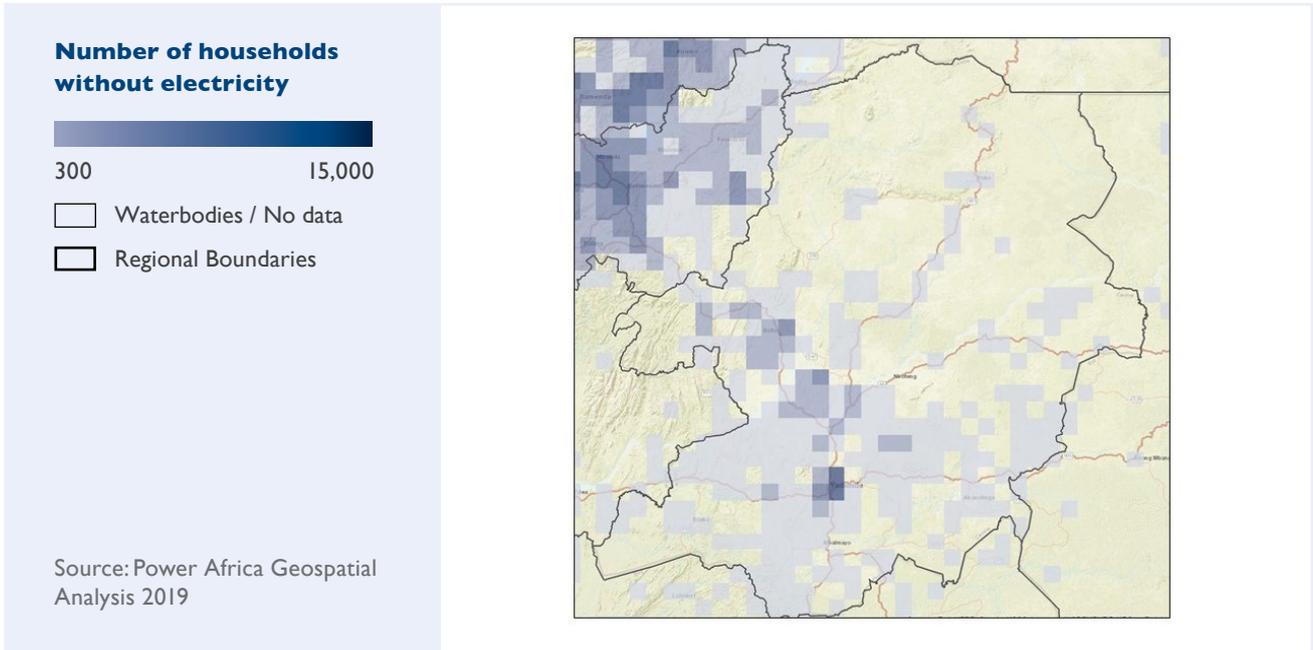


FIGURE 15. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-KM × 10-KM GRID IN THE EAST REGION

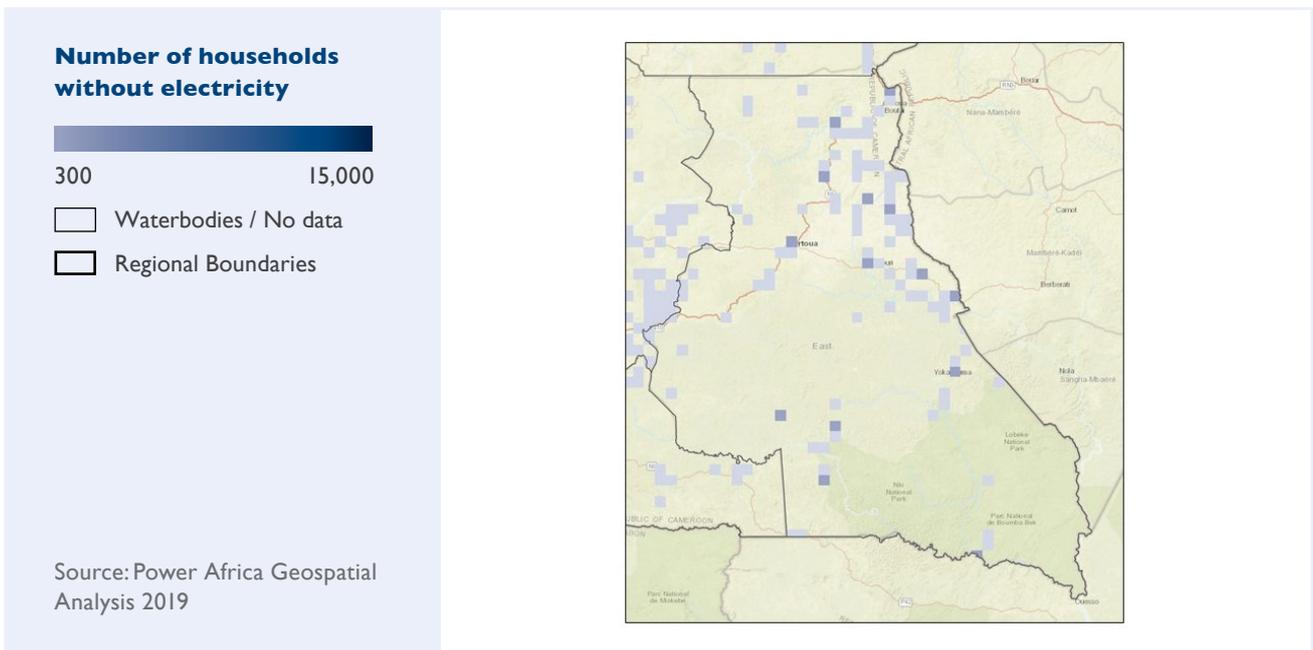


FIGURE 16. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-KM × 10-KM GRID IN THE FAR NORTH REGION

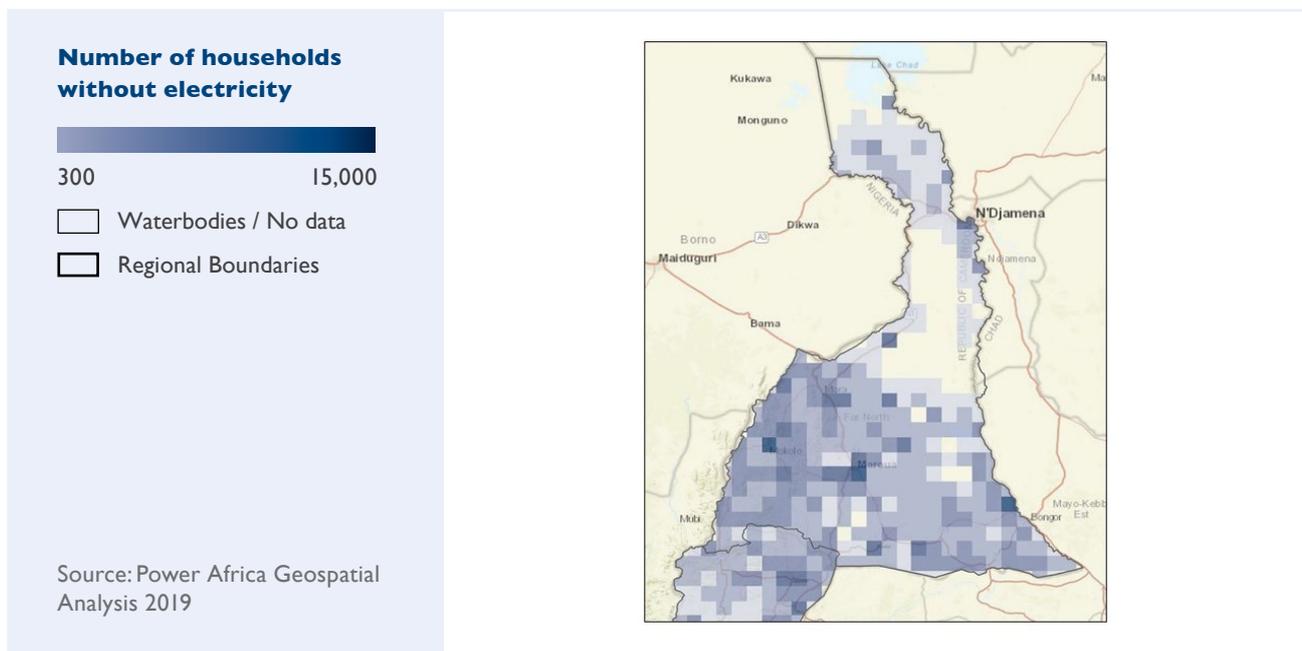


FIGURE 17. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-KM × 10-KM GRID IN THE LITTORAL REGION

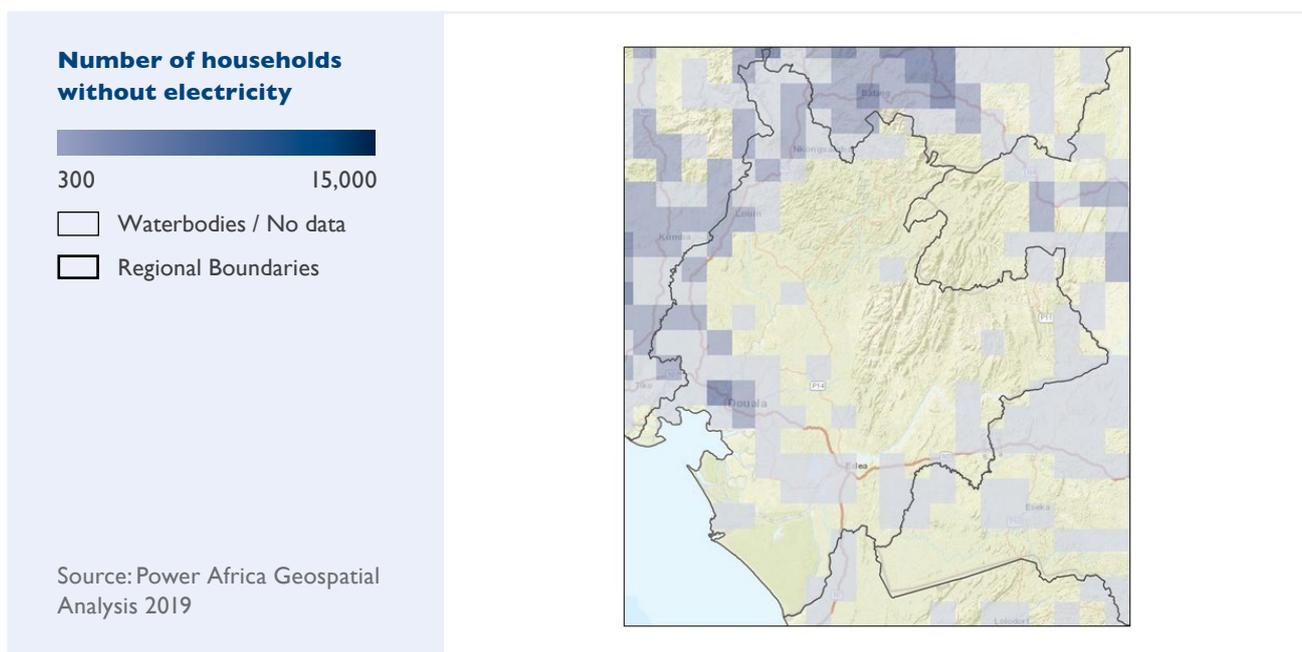


FIGURE 18. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-KM × 10-KM GRID IN THE NORTH REGION

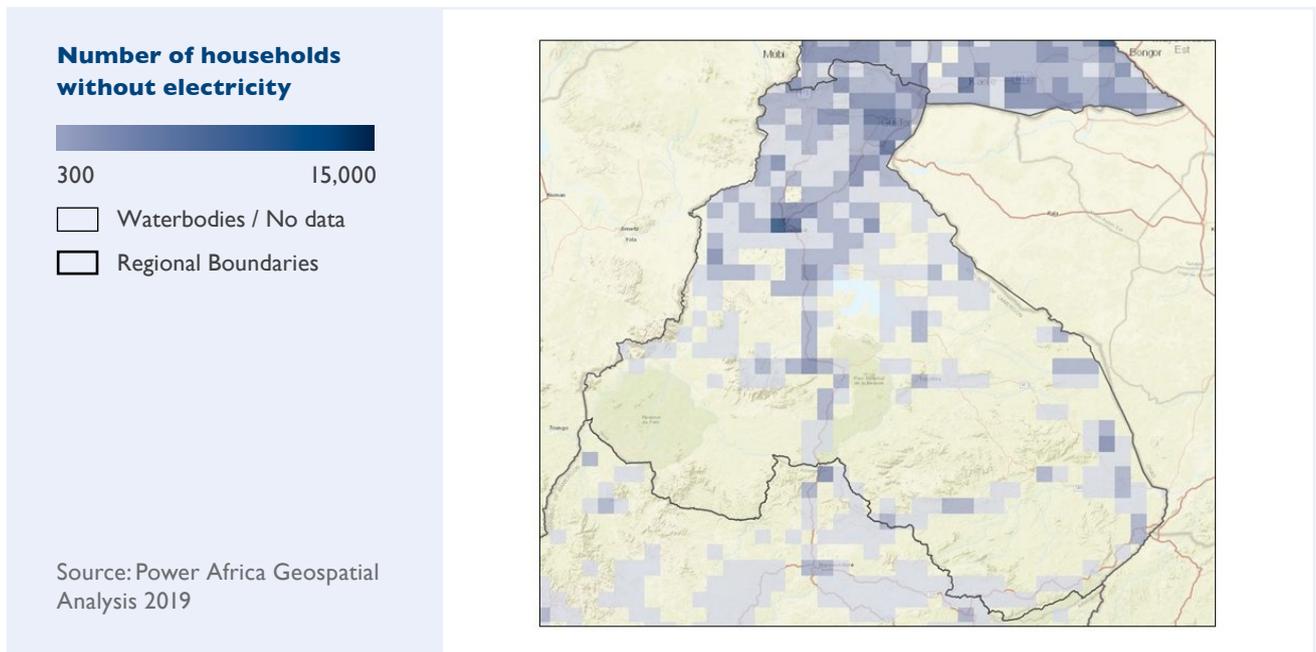


FIGURE 19. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-KM × 10-KM GRID IN THE NORTH-WEST REGION

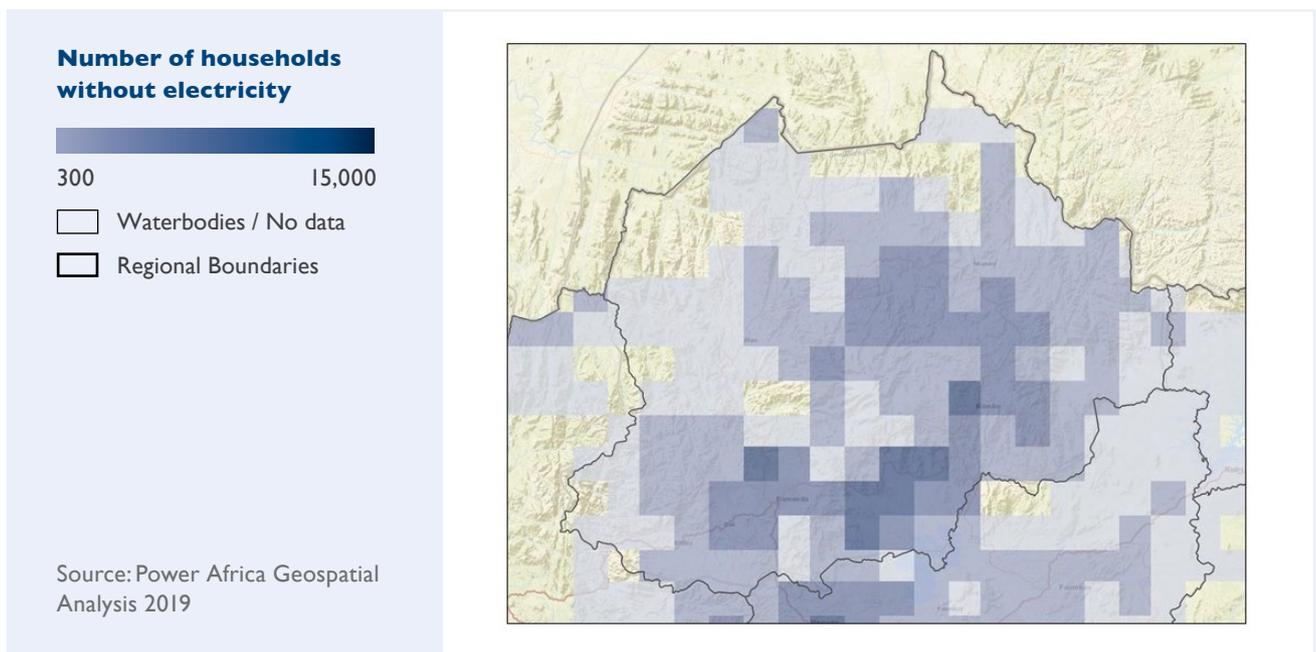


FIGURE 20. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-KM × 10-KM GRID IN THE WEST REGION

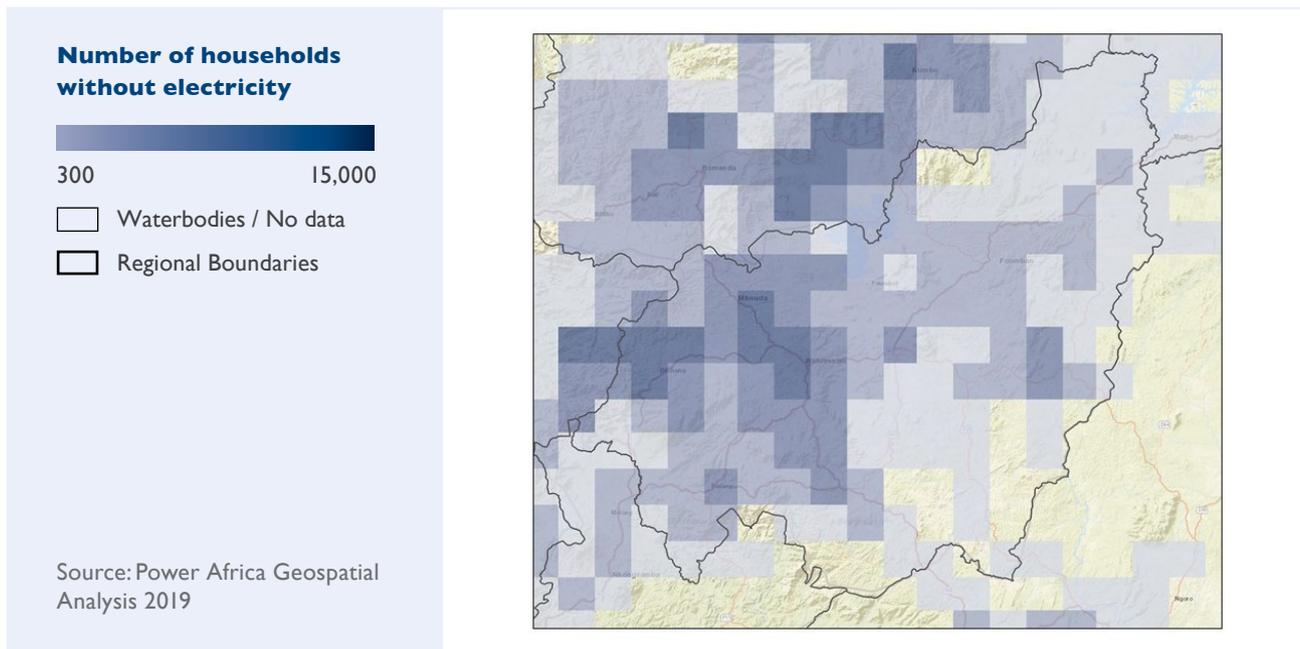


FIGURE 21. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-KM × 10-KM GRID IN THE SOUTH REGION

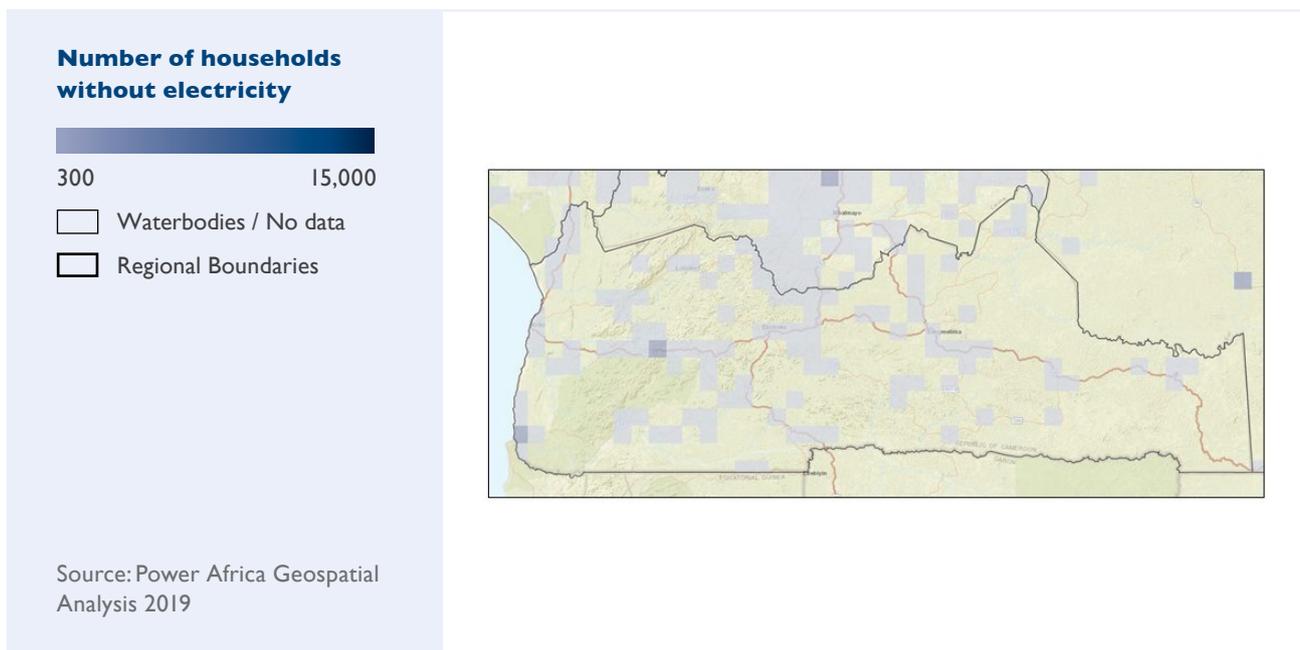
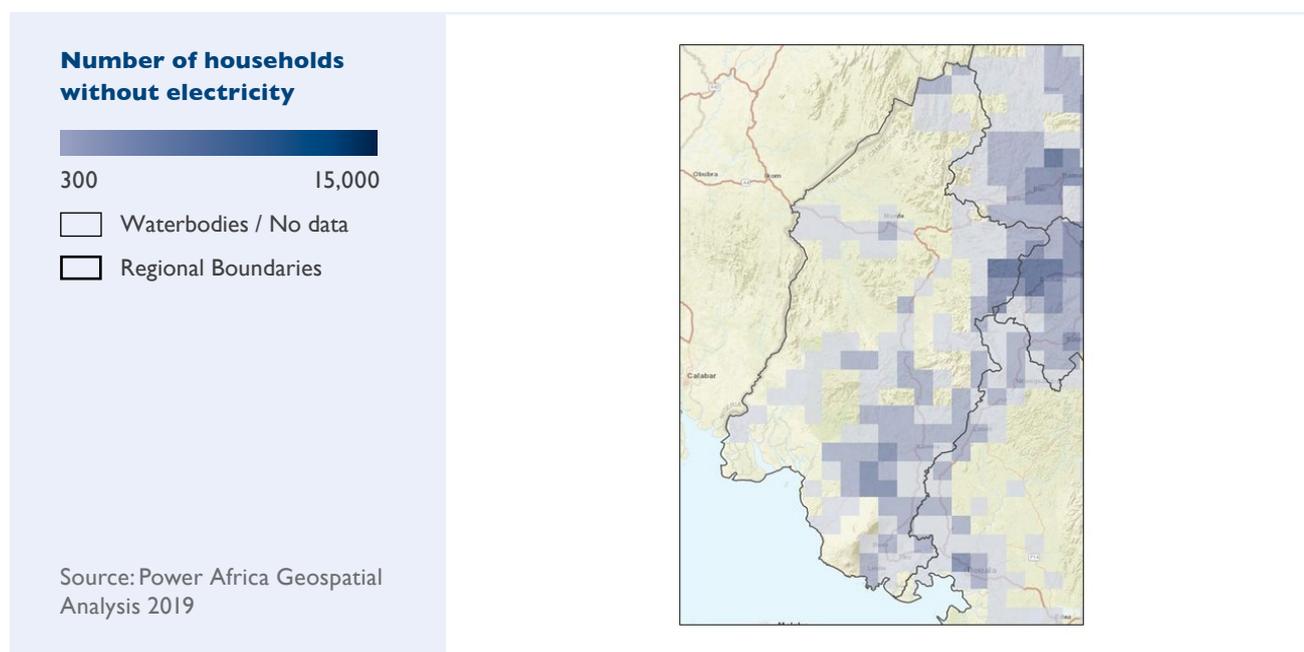


FIGURE 22. NUMBER OF HOUSEHOLDS WITHOUT ELECTRICITY PER 10-KM × 10-KM GRID IN THE SOUTH-WEST REGION



3.5 BARRIERS TO ENTRY AND GROWTH

Among the four main barriers raised by stakeholders, the most important are “access to finance” and “commercial,” which are linked, followed by “importation (custom duties),” and lastly by “policies and regulations.”

Regarding the commercial barrier, it is not possible to have a viable commercial activity in the Northwest, the Southwest, and the Far North Regions because of the insecurity in those locations. Those regions represent 49 percent of the potential off-grid population.

3.6 RELEVANT GOVERNMENT AND DONOR PICO-SOLAR PROGRAMS

The overall objective of FER is to promote access to various forms of modern energy in rural areas, including rural electrification, for the satisfaction of domestic, social, communal, artisanal, commercial, and industrial needs. FER provides a partial subsidy for the realization of the Priority Projects of Rural Energy (Projets Prioritaires d’Énergie Rurale [PPER]) and the Projects of Local Initiative of Rural Energy (Projets d’Initiative Locale d’Énergie Rurale [PILER]), up to 80 percent of the cost of the feasibility studies and 70 percent of the cost of infrastructure and work. These subsidies are also available for private-sector companies.

3.7 PICO-SOLAR RELEVANT REGULATIONS

There are no specific regulations regarding the distribution of pico-solar equipment. Pico-solar companies in Cameroon are typically just distributors of solar products, which are normally overseen by the Ministry of Trade, and such companies only need to be registered at MINEE. Currently, no formal registration procedure is in place; a company just needs to inform DERME, under MINEE, which then includes the company in its database.

3.7.1 IMPORT DUTIES AND TAXES

As outlined by the Ministry of Finance, investments in the following priority sectors benefit from specific tax and customs incentives:

- › Agriculture, fisheries, or livestock
- › Agroindustry
- › Tourism, recreation, and crafts
- › Habitat and social housing
- › Manufacturing industry
- › Heavy industry manufacturing, including iron and steel processing, and construction materials
- › Pharmaceutical industry
- › Energy and water

Regarding the energy sector, Circular 001/CF/MINEFI/CAB (dated June 9, 2012) specifies that equipment for the exploitation of solar and wind energy benefits from an exemption of the VAT. More details about the specific equipment are discussed as follows:

- › Solar radiation energy equipment: This type of equipment includes PV modules, generators, systems transformers, inverters, controllers, cables, accumulators, switches, batteries, battery chargers, solar torches, generator-powered milling machines, control panels for PV pumps, solar dryer equipment, and solar devices for water filtering.
- › Wind energy equipment: This type of equipment includes the turbine system, blades, generators, pumps, transformers, inverters, and controllers.

The Directorate-General of Customs and the Directorate-General of Taxes regularly conduct post-clearance checks to confirm that the destination of these products and the equipment is exclusively for the purposes of agriculture, livestock, fisheries, pharmaceuticals, and solar and wind energy exploitation.

Regarding import taxes, different codes corresponding to different taxes are applied to pico-solar equipment, with a resultant total tax implication of approximately 30 percent. However, companies and customs offices are often unclear as to which code is applicable. Off-grid solar systems are currently included under:

- › 9405409000: Other electric lighting devices
- › 9405200000: Bedside lamps, desk lamps, and indoor electric floor lamps.

However, to reduce the selling price for off-grid households, pico-solar companies would like to benefit from the following code, which corresponds to an import tax of ten percent:

- › 8541400000: Photo-sensitive devices with semiconductors, including PV cells, whether or not assembled in modules or in panels, and lighting-emitting diodes.

3.7.2 QUALITY STANDARDS

Regarding quality control and standards, the Standards and Quality Agency (Agence des Normes et de la Qualité [ANOR]) has not provided any specifications. In this regard, low-quality products that have not met Lighting Global Quality Standards are available in the market.

3.7.3 ELECTRICAL EQUIPMENT WASTE

Environmental regulations for managing the waste from electrical equipment (e-waste) and lighting equipment are framed by the following two regulations:

- › Decree Number 2012/2809/PM of September 26, 2012 outlines the conditions for sorting, collecting, storing, transporting, recovering, recycling, treating, and disposing of waste.
- › Joint Order Number 005/MEPNSD/MT sets the specific conditions for managing electrical and electronic equipment and for disposing of waste from such equipment. The Order also applies to all components, sub-components, and consumable products which were part of the product at the time of waste.

Some of the equipment that must be managed according to these previously mentioned conditions include radios, televisions, camcorders, video recorders, amplifiers, musical instruments, lighting devices with fluorescent tubes (except for domestic lighting fixtures), and lighting fixtures intended to diffuse or control light, except for filament bulbs.

According to Decree Number 2012/2809/PM 2012, for each category of equipment on the market, producers must adhere to the following requirements:

- › Producers must ensure the selective collection of household electrical and electronic equipment waste by establishing an individual system for selective collection of wastes or contribute to this collection by paying a financial contribution to an authorized organization.
- › Electrical and electro-technical equipment waste that is collected must be stored under conditions to ensure their selective sorting.
- › Municipalities, producers, distributors, and organizations must implement appropriate actions to inform users of electrical and household equipment.
- › The obligation for producers, distributors, and other actors is not to mix waste electrical and electronic equipment with unsorted household refuse.

Regarding e-waste, manufacturers, distributors, and municipalities are required to take steps to reduce the quantities of electrical and electronic equipment waste that is discarded together with unsorted household waste. Once collected, the electrical and electronic equipment waste is stored for sorting and the recovery of relevant materials. End-users are responsible for the disposal and treatment of electrical and electronic equipment waste from companies in the market, unless the users have an agreement with the seller. In addition, the valorization of waste electrical and electronic equipment is required to take precedence over its destruction. Regarding the collection of electrical and household equipment waste, it is recommended that companies take measures to reduce the quantity of such waste materials by ensuring that all used electrical and household equipment is collected at the end of their lifetimes.

3.8 PICO-SOLAR FINANCING OVERVIEW

This section provides an overview of commercial finance, consumer finance, and mobile money related to pico-solar systems and products. If safeguarding mechanisms, such as bank guarantees or credit lines, are put in place by international institutions, then most local banks have stated they are ready to start funding the sector, both for pico-solar and mini-grids.

3.8.1 COMMERCIAL FINANCE

Cameroon has 15 commercial banks, but only 19 percent of the population has access to financial services through banks and MFIs, as follows (Ministry of Finance, 2017):

- › African Community Credit Bank (Credit Communautaire d’Afrique Bank [CCA Bank])
- › Afriland First Bank (AFB)
- › Atlantic Bank of Cameroon (Banque Atlantique du Cameroun [BAC])
- › Bank of Africa (BOA)
- › Cameroonian Bank of Small and Medium Enterprises (Banque Camerounaise des Petites et Moyennes Entreprises [BC-PME])
- › Cameroonian International Bank for Savings and Credit (Banque International du Cameroun pour l’Epargne et le Cr dit [BICEC])
- › Citibank Cameroon (CITI Group)
- › Commercial Bank Cameroon (CBC)
- › Commercial Bank Corporation (Societe Commerciale de Banque, [SCB])
- › Ecobank Cameroon S.A. (Ecobank Cameroun S.A. [Ecobank])
- › Gabonese Bank for International Financing (Banque Gabonaise pour le Financement International [BGFI])
- › National Financial Credit Bank S.A. (NFCB)
- › Standard Chartered Bank Cameroon (SCBC)
- › Societe Generale Cameroon (Soci t  G n rale Cameroun [SGC])
- › Union Bank for Cameroon (UBA).

The remainder of this section is a summary of some of the local banks in Cameroon in relation to energy-related products and services.

- › **BC-PME** is a public institution established to finance local small and medium enterprises. While BC-PME has granted financing to companies in the renewable energy sector, there are no energy-specific financial products available, and all companies are subject to the same services and conditions for granting loans at interest rates of 11 percent before tax.
- › **BAC** does not have renewable energy sector companies in its portfolio because the bank has not yet been solicited by such companies. BAC appears to have little interest in this sector as it is relatively new and untested, which means that it is considered high-risk.
- › **CBC** does not yet have a portfolio of renewable energy projects. One of the main challenges is that people with renewable energy skills are not employed at the bank.
- › **SGC** has a few companies from the renewable energy sector in its portfolio, which are subsidiaries of foreign companies that receive funds from their parent companies for grid supply projects. To date, three local solar companies are seeking credits. SGC has been interested in the off-grid energy sector for several years but does not currently offer financial products to companies in this sector. If a loan guarantee mechanism is put in place with international organizations, then the SGC will more easily finance the electrification projects.
- › **SCB** was chosen to manage SUNREF’s €15 million (\$17 million) credit line in Cameroon. SCB also offers an “ecological credit” that aims to finance renewable energy and energy efficiency projects. Each project can be financed up to €6 million (\$6.7 million), at an interest rate of between 8 and 9 percent, and the loan duration varies between three to eight years.

3.8.2 CONSUMER FINANCE

By 2018, Cameroon had more than 412 MFIs in the following categories (Ministry of Finance, 2017):

- › **Category 1.** The MFIs in this category collect savings, and they grant loans exclusively to their members. There are 116 MFIs in Category 1.
- › **Category 2.** The MFIs in this category collect savings, and they grant loans exclusively to their members and third parties. There are 47 MFIs in Category 2.
- › **Category 3.** The MFIs in this category grant loans to third parties without collecting savings. There are three MFIs in Category 3.

The following MFI networks are currently operating in Cameroon:

- › Cameroon Cooperative Credit Union League (CamCCUL) – 169 members
- › CVECA network – 27 members
- › Binum network – 18 members
- › UCCGN (Union des Caisses villageoises d'épargne et de Crédit autogérées du Grand Nord) network – 9 members
- › NOWEFOCH (North West Farmers Organisations Credit House) network – 9 members
- › Cooperative Credit Union network – 7 members
- › MUCADEC (Mutuelle Camerounaise d'Épargne et de Crédit) network – 6 members

Some of the leading MFIs and MFI organizations in Cameroon are summarized as follows:

- › **Microfinance and Development (Microfinance et Développement [MIFED])** is a Cameroonian non-governmental organization that provides technical assistance to MFIs in Cameroon. Since 2013, MIFED has been very active in the energy sector, specifically regarding SHS, by providing loans to rural households and promoting rural entrepreneurship. PAMIGA and MIFED developed a program that aims to facilitate access to energy in partnership with MFIs and solar distributors. Both PAMIGA and MIFED are helping to create a team of last-mile energy entrepreneurs. The pilot phase of the program helped to establish a network of 39 energy entrepreneurs who are collaborating with six MFIs. As a result, in 2017, more than 6,100 rural households have invested in a solar solution thanks to the program. In 2018, MIFED created a branch within the MFI called Mifed Energy Access (MEA). MEA's mission is to improve access to solar energy for rural populations in the country. A partnership with MPower Ventures was signed in 2019.
- › **CamCCUL** represents Cameroon's biggest network of MFIs, with approximately 170 MFIs affiliated. CamCCUL helps to provide finance and support for new MFI products involving agriculture, health, trade, buildings, and livestock, among others. However, CamCCUL has not yet developed any financial products regarding pico-solar systems because no one within the institution has skills regarding renewable energy. CamCCUL is potentially interested in developing financial products through its network in order to facilitate access to SHS in rural areas in the future.
- › **Credit Sahel (Crédit du Sahel)** is a second-tier MFI. Since January 2019, Credit Sahel has begun marketing Greenlight Planet products. In three months, Credit Sahel has distributed more than 200 Sun King solar kits and lamps varying from 2.7 W to 12 W without PAYGO. Credit Sahel sells the systems to customers directly through its branches, with credit payable in six monthly installments.

⁵⁵ PAMIGA, "PAMIGA Microfinance in Africa Newsletters."

- › Mutual Community Growth (Mutuelle Communautaire de Croissance [MC2]) is a network of more than 100 micro-banks dispatched in the secondary cities and the rural areas of Cameroon. MC2 has already added approximately \$290 million to the Cameroonian economy, especially in rural areas. MC2 represents an excellent solution to address the difficulties experienced in the country regarding access to credit, thanks to interest rates that rarely exceed 15 percent. In 2013, Light4All Cameroon worked with MC2 to develop financial products for SHS in the Far North Region. The project received financial support from GIZ.
- › Advans is a third-tier MFI that has not yet supported companies specializing in renewable energy, including solar kits. However, Advans is willing to work with companies operating in this industry and to implement energy-based financial products (specifically SHS).
- › The Agency for Private Enterprise Credit in Cameroon (Agence de Credit pour l'Entreprise Privée au Cameroun [ACEP Cameroon]) is an independent financial institution operating since 2005. With a capital entry of local and foreign shareholders, ACEP Cameroon has presence in seven out of ten regions of Cameroon, with a network of 24 branches, both in urban and rural areas. Although the company was originally focused on very small enterprises, ACEP Cameroon has also diversified its target clientele. In addition to very small enterprises, the company also serves individuals (i.e., employees of the private sector, civil servants, state agents, and retirees) and small- and medium-sized enterprises. ACEP Cameroon is currently looking at structuring loans so its small business clients can acquire renewable energy equipment.

3.8.3 CROWDFUNDING ORGANIZATIONS

Some of the leading crowdfunding organizations in Cameroon include Kiva and Lendahand. Kiva is present in through two mechanisms: (i) direct working capital loans up to \$50,000 through the Direct to Social Enterprise Loan program and (ii) through its partnership with ACEP Cameroon. A few SHS companies in Cameroon have already applied for the program. This crowdfunding platform is particularly adapted to the needs of the market because a few companies want to pilot their business model or add new business lines. In 2018, Lendahand concluded its first transaction by providing working capital loans to upOwa.

3.8.4 INTERNATIONAL IMPACT FUNDS

The international impact funds active in Cameroon include mainly those with a marked preference for first round and technical assistance offers, such as Persistent Energy Capital (PEC), Investisseurs & Partenaires, and the Gaia Impact Fund. Funds focusing on more established transactions, such as Triple Jump, Grameen Crédit Agricole, and Bamboo Capital, have invested mainly in MFIs such as Advans or ACEP in Cameroon.

Data regarding investments in Central Africa only became available from 2016. The data show that 2017 had the greatest investment so far, dominated by grants from a donor program, with investment levels dropping in 2018 to similar levels to 2016, although the number of financial transactions has steadily increased each year (Table 26).



Investments in 2017 and 2018 mainly focused on regional expansion and scaling up of existing business models, with a significant increase in crowdfunding in 2018, which indicates a very positive trend for future investments in Central Africa.

TABLE 26. GOGLA BREAKDOWN OF CENTRAL AFRICA REGION FUNDING TYPES, TRANSACTIONS, BUSINESS MODEL, USE OF FUNDING AND FUNDING FLOW BY INVESTOR TYPE: TYPE OF INVESTMENT

TYPE OF INVESTMENT	2012	2013	2014	2015	2016	2017	2018
Grant	\$0	\$0	\$0	\$0	\$1,518,745	\$3,750,000	\$0
Equity - Common Shares	\$0	\$0	\$0	\$0	\$0	\$250,000	\$0
Equity - Preferred Shares	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Debt - Note / Bond	\$0	\$0	\$0	\$0	\$0	\$50,000	\$275,568
Debt - Bank or FI Loan	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Debt - Crowdfunding	\$0	\$0	\$0	\$0	\$0	\$0	\$1,102,270
Debt - Securitization and/or Factoring	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$0	\$0	\$0	\$0	\$1,518,745	\$4,050,000	\$1,377,838

Source: ⁵⁶

TABLE 27. GOGLA BREAKDOWN OF CENTRAL AFRICA REGION FUNDING TYPES, TRANSACTIONS, BUSINESS MODEL, USE OF FUNDING AND FUNDING FLOW BY INVESTOR TYPE: TRANSACTIONS

	2012	2013	2014	2015	2016	2017	2018
Number of transactions	0	0	0	0	3	4	5
Average transaction size	—	—	—	—	\$506,248	\$1,012,500	\$275,568
Median transaction size	—	—	—	—	\$300,000	\$500,000	\$275,568

Source: ⁵⁷

⁵⁶ GOGLA, “Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data.”

⁵⁷ GOGLA.

TABLE 28. GOGLA BREAKDOWN OF CENTRAL AFRICA REGION FUNDING TYPES, TRANSACTIONS, BUSINESS MODEL, USE OF FUNDING AND FUNDING FLOW BY INVESTOR TYPE: BUSINESS MODEL

	2012	2013	2014	2015	2016	2017	2018
PAYGO	\$0	\$0	\$0	\$0	\$1,518,745	\$4,050,000	\$1,377,838
Non-PAYGO	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$0	\$0	\$0	\$0	\$1,518,745	\$4,050,000	\$1,377,838

Source: ⁵⁸

TABLE 29. GOGLA BREAKDOWN OF CENTRAL AFRICA REGION FUNDING TYPES, TRANSACTIONS, BUSINESS MODEL, USE OF FUNDING AND FUNDING FLOW BY INVESTOR TYPE: USE OF FUNDING

	2012	2013	2014	2015	2016	2017	2018
Uncertain	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Business plan development, corporate set up, and proof of concept	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Introduction of product to the market and/or product refinement	\$0	\$0	\$0	\$0	\$0	\$50,000	\$0
Scale up business and reach critical mass of customers	\$0	\$0	\$0	\$0	\$518,745	\$0	\$1,377,838
Geographic expansion, add new products, and/or make acquisition	\$0	\$0	\$0	\$0	\$1,000,000	\$4,000,000	\$0
Bridge working capital needs, including financing of consumer loans extended	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Refinancing existing liabilities	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Total	\$0	\$0	\$0	\$0	\$1,518,745	\$4,050,000	\$1,377,838

Source: ⁵⁹

⁵⁸ GOGLA.

⁵⁹ GOGLA.

TABLE 30. GOGLA BREAKDOWN OF CENTRAL AFRICA REGION FUNDING TYPES, TRANSACTIONS, BUSINESS MODEL, USE OF FUNDING AND FUNDING FLOW BY INVESTOR TYPE: FUNDING FLOW BY INVESTOR TYPE

	2012	2013	2014	2015	2016	2017	2018
Crowdfunding	\$0	\$0	\$0	\$0	\$0	\$50,000	\$1,377,838
Government, including donor funding	\$0	\$0	\$0	\$0	\$1,518,745	\$3,750,000	\$0
Strategic corporates	\$0	\$0	\$0	\$0	\$0	\$250,000	\$0
For-profit finance	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Family office or foundation	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Impact finance	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Unknown	0	0	0	0	0	0	0
Total	\$0	\$0	\$0	\$0	\$1,518,745	\$4,050,000	\$1,377,838

Source: ⁶⁰

3.8.5 MOBILE MONEY IN CAMEROON

An estimated 83 percent of residents used mobile networks in 2017, and 98 percent of urban households have a mobile telephone, compared to 83 percent of households in rural areas. Cameroon currently has four mobile telecommunication companies in the market. These telecommunication companies are summarized as follows:

- › **Cameroon Telecommunications (CAMTEL)** is the original and the oldest mobile operator, starting its activities in 1998, just after the liberalization of mobile telephones. In 2014, CAMTEL acquired a mobile telephone license. CAMTEL is the only company in Cameroon to operate a landline telephone system (see summary of MTN).
- › **Orange**, which originally formed in 1999 as the Cameroonian Mobile Company (Société Camerounaise de Mobile [SCM], also known as MOBILIS), started its mobile telephone activities in 2000, becoming the first foreign mobile operator in Cameroon. In 2002, SCM (MOBILIS) changed its name and became Orange, which was formerly France Télécom, and had 7.2 million subscribers in 2017.
- › The **Mobile Telecommunications Network (MTN)** began its activities in February 2000, when the South African group MTN acquired the license of CAMTEL Mobile. MTN's capital is 70 percent owned by MTN International and 30 percent by the Cameroonian company Broad Band Telecom and had 7.1 million subscribers in 2017.
- › **Nexttel** is the most recent mobile operator to arrive in the mobile telecommunications market in Cameroon. Nexttel began its operations in September 2014, two years after obtaining the third mobile operating license in Cameroon. Nexttel's capital is 70 percent held by Viettel, a Vietnamese company, and 30 percent by Bestinver Cameroon SA. and had 4.5 million subscribers in 2017.

⁶⁰ GOGLA.

Mobile money services launched in 2011 in Cameroon, although only Orange and MTN share the market currently. In the Telecommunications Regulatory Agency’s (Agence de Régulation des Télécommunications [ART]) annual report about the state of the electronic communications sector in Cameroon, ART indicated that the number of mobile money subscribers had reached eight million in 2017. This service was offered to 49 percent of MTN and Orange network subscribers by 2017, representing a penetration rate of 34 percent of the national population. Regarding the volume of transactions by mobile money, the International Monetary Fund estimated that they reached \$7 million (17.5 percent of GDP) in 2017 compared with \$6 million in 2016. Tables 31 and 32 outline the transaction fees for mobile money applied by Orange and MTN.

TABLE 31. ORANGE MONEY

AMOUNT TRANSFERRED IN \$		ORANGE TO ORANGE TRANSFER	WITHDRAWAL	WITHDRAWAL
(\$1 = 500 XAF)	TO			
\$0.10	\$13.00	1%	3%	4%
\$13.00	\$20.00	\$0.10	\$0.40	\$0.50
\$20.00	\$27.00	\$0.20	\$0.60	\$0.80
\$27.00	\$50.00	\$0.30	\$0.70	\$1.10
\$46.00	\$100.00	\$0.30	\$1.40	\$1.80
\$100.00	\$160.00	\$0.400	\$2.70	\$3.40
\$160.00	\$200.00	\$0.40	\$3.60	\$4.60
\$200.00	\$400.00	\$0.60	\$4.30	\$5.40
\$200.00	\$400.00	\$0.60	\$4.30	\$5.40
\$400.00	\$600.00	\$0.60	\$5.20	\$5.40
\$600.00	\$800.00	\$0.60	\$6.20	\$7.20
\$800.00	\$1,000.00	\$1.00	\$7.20	\$8.00
\$1,000.00	\$2,000.00	\$1.00	Not applicable	Not applicable

Source: ⁶¹

TABLE 32. MTN MONEY

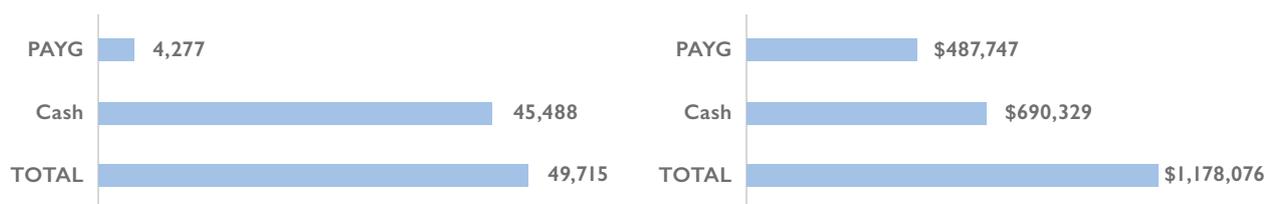
AMOUNT TRANSFERRED IN \$ (\$1 = 500 XAF)		DEPOSIT	TRANSFER FEES (XAF)		CASH-OUT FEES (XAF)	
FROM	<TO	IN MTN MOMO ACCOUNT	TO MTN MOMO SUBSCRIBER	TO ANY OTHER SUBSCRIBER	FOR ANY MTN MOMO SUBSCRIBER	FOR ANY OTHER SUBSCRIBER
\$0.20	\$11.10	FREE	1%	3%	3%	FREE
\$11.10	\$20.10		\$0.10		\$0.30	
\$20.10	\$27.10		\$0.20		\$0.60	
\$27.10	\$50.10				\$0.70	
\$50.10	\$100.10				\$1.40	
\$100.10	\$150.20		\$0.50		\$2.70	
\$150.20	\$200.20			\$3.40		
\$200.20	\$401.00			\$6.20	\$4.30	
\$401.00	\$601.00		\$1.00	\$7.00	\$5.00	
\$601.00	\$801.00			\$7.00	\$5.20	
\$801.00	\$1,000.00			\$8.00	\$5.50	
\$1,000.00	\$2,000.00			—	—	

Source: ⁶²

Total sales of solar systems (solar lamps and SHS), both through cash payments and through PAYGO, are presented in Figure 23, according to the Global Off-Grid Solar Market Report (2018).

⁶² MTN Cameroon, "Send and Receive Money in Cameroon."

FIGURE 23. TOTAL SALES OF SOLAR SYSTEMS BY CASH PAYMENTS OR PAYGO



Source: ⁶³

Since December 2010, the telecommunication sector is regulated by ART. Mobile money is considered to be a new means of payment, according to the Task Force on Money Laundering in Central Africa (Groupe d’Action contre le Blanchiment d’Argent en Afrique Centrale [GABAC]), in the same way as prepaid cards or online payments. There is currently a weakness in the legal framework regarding new means of payment; therefore, reinforcement of the legal framework for mobile money transactions is undergoing, under the supervision of Bank of Central African States (Banque des Etats de l’Afrique Centrale [BEAC]).

3.9 PICO-SOLAR DISTRIBUTION PARTNERS

There are several potential future distribution partners for pico-solar companies operating in Cameroon. Mobile telephone operators provide many forms of support to a range of types and categories of organizations and may be highly suitable partners for off-grid companies in Cameroon to assist with distribution, advertising, communication, and raising awareness. Mobile phone operators already have large databases of potential customers. In addition, they serve as facilitators because they are in contact with companies in various sectors, thereby allowing businesses to better reach their target customers.

Currently, two MFIs are involved with distributing pico-solar systems. Credit Sahel distributes GreenLight Planet’s products without PAYGO and has also a partnership with Solkamtech. This partnership includes the development of financial products that will enable to increase access to electricity in the Northern Cameroon. The second one is MIFED, which has a partnership with MPower Ventures for a pilot project in four villages. The partnership includes the development of financial products that will make it easier for households in pilot villages to access credit. Such partnerships could be scaled up and replicated with other MFIs.

Gas/petrol stations are also involved with distributing pico-solar products. For instance, the Total Group distributes products from d.light, Sundaya, and the Total Group; and OiLibya commercializes products from Schneider Electric. In Cameroon, some supermarkets are also distributors of pico-solar products.

3.10 PICO-SOLAR GENDER MAINSTREAMING

Although activities within the pico-solar sector in Cameroon have been limited regarding mainstreaming gender equality and women’s economic empowerment, it is interesting to look at the activities of the Financial Mutual of African Women (Mutuelle Financière des Femmes Africaines [MUFFA]). MUFFA is a Category I MFI that only works with its members. The aim of MUFFA is to provide financial services to low-income women and those in the informal sector in urban and peri-urban areas. MUFFA is an economic and social promotion body created and managed by women for women. MUFFA has not yet financed a renewable energy project, but it can develop financial products regarding pico-solar systems for women. Since 2013, MUFFA has been receiving technical assistance from Positive Planet as part of a project on the promotion and development of female entrepreneurship in Cameroon. With institutional support from PlaNet Finance, the project’s objective is to strengthen the financial autonomy of female entrepreneurs. Approximately 500 women from Yaoundé, Douala, and Bafoussam have undergone training.

⁶³ GOGLA, “Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data.”

4 MINI-GRID COMPANIES

There are several mini-grid companies actively operating in Cameroon (Table 33), although most are still in a relatively early stage of development.

4.1 MINI-GRID OVERVIEW AND APPLICABILITY TO CAMEROON

TABLE 33. SUMMARY OF MINI GRID COMPANIES IN CAMEROON

MINI-GRID COMPANIES	DESCRIPTION
	<p>Renewable Energy Innovators Cameroon (REIc) is a mini-grid company that built more than six mini-grids with power ranging from 2 kW to 30 kW in the North-West Region. Thus far, they have connected 70 businesses and 531 households to their mini-grids. Customers use smart meters, with the price of electricity ranging between \$0.60-\$1.00/kWh. REIc also provide solar charging stations for portable rechargeable battery devices for communities with dispersed settlements, as well as water pumps, solar water heaters, energy efficient bulbs, solar lamps, and solar chargers..</p>
	<p>Sagemcom supports engineering, procurement, and construction projects in the telecommunications and mini-grid sector. This company specializes in energy and telecommunications. Sagemcom has built a 1.25 MW solar park that provides energy to the international airport of Douala. Company is also the provider of smart meters to Eneo.</p>
	<p>Solkamtech built a 100 kW solar mini-grid in partnership with the municipality of Mayo Baleo, located in Northern Cameroon. More than 2,000 people are connected, and productive activities have been developed. Smart meters are installed in each household connected, and the tariff being charged is approximately \$0.30/kWh.</p>
	<p>WeeY Energie et Eau is an energy and water company that specializes in renewable energy, water purification, and training.</p>
	<p>Canopy has realized more than 10 solar installations, ranging from 500 W to 3,000 W, in schools and health centers in off-grid localities. Canopy's main activities involve the development, financing, and construction of major projects; the installation and maintenance of solar kits and mini-grids; and study and design and the distribution of innovative solutions.</p>
	<p>AFRISOLE TECH has installed many solar installations of 1,500 W, 3,500 W, and 4,500 W. AFRISOLE TECH has completed many solar installations, notably 4,500 W in Batouri in the East Region; 3,500 W in a health center in Idabato, a locality on the border with Nigeria; and 1,500 W at St. Martin Church in the East Region.</p>

TABLE 33. SUMMARY OF MINI GRID COMPANIES IN CAMEROON (CONTINUED)

MINI-GRID COMPANIES	DESCRIPTION
	<p>Schneider Electric provides off-grid solutions for Cameroon’s rural electrification. Under its BipBop program, Schneider Electric set up a mini-grid in the village of Pitti Gare in the Coastal Region of Cameroon. The solution used for the village of Pitti Gare supplies electricity for the cassava milling machine, school, clinic, as well as providing a domestic battery charging service for the local population.</p>
	<p>YANDALUX Cameroun SARL built an 11-kW hybrid off-grid system with a power generation of 19,116 kWh per year. Company is the Cameroon branch of YANDALUX GmbH, a Germany-based company that provides independent solar solutions, including on-grid hybrid systems, mini-grids, SHS, solar thermal, and solar lighting.</p>
	<p>Maguysama Technologies has installed a 2,250 W solar off-grid and several stand-alone systems. Company was created in 2003, has already installed 2,250W solar off-grid; 30kW solar plant at Isangele, a locality on the border with Nigeria that connect sixty households; and many stand-alone installations for residential uses.</p>
	<p>Idratel Energy Cameroon planned the construction of mini-hydro plants and the installation of solar PV plants for capacities between 3 MW and 9 MW.</p>
	<p>SunErgy Power provides electricity to 92 villages with approximately 115,000 families or 600,000 people, plus schools, health centers, and private and public enterprises.</p>
	<p>ACREST built a 30-kW small hydro mini-grid. More than 150 persons are connected, as well as ACREST’s Center.</p>
	<p>Based in Israel, Blue Power started activities in Cameroon since 2017 and has already equipped six health centers in Cameroon, with the financial support of the United Nations Children’s Fund (UNICEF). The following equipment are connected on BWATT systems installed in these centers: 20 light-emitting diode (LED) bulbs (5 W each), 10 LED bulbs (10 W each), one outdoor projector, two LED televisions (a 32 inch and a 40 inch), two laptops, one refrigerator to store vaccines, two fans, and 10 mobile telephone chargers.</p>

Mini-Grid Market Barriers

This section summarizes the main market barriers that are challenging the mini-grid sector in Cameroon, highlighting that access to finance is the most critical barrier (Table 34), followed by a lack of suitable regulations and technical skills.

TABLE 34. SUMMARY OF MAIN BARRIERS FACING THE MINI GRID SECTOR IN CAMEROON BY RESOURCE TYPE

	REGULATION	ACCESS TO FINANCE	TECHNOLOGY (AVAILABILITY OF EQUIPMENT: ELECTROMECHANICAL, SOLAR, BIOMASS)	CUSTOM DUTIES	MINI-GRID SKILLS
Small hydro	3	3	2	1	3
Solar	3	3	1	3	2
Biomass	2	3	3	1	3

Source: Information from Power Africa direct interviews performed with companies (June 2019).

Note: Rankings out of 3, with 3 being the largest barrier

The main areas in which the companies need support include:

- › Financial partners to develop activities, particularly investment funds, banks, and MFIs;
- › Support from the government to establish a regulatory framework to protect operators of mini-grids; and
- › Mainstreaming gender equality.

4.2 RELEVANT GOVERNMENT AND DONOR MINI-GRID SUPPORT PROGRAMS

Special Council Support Fund for Mutual Assistance (Fonds Spécial d'Équipement et d'Intervention Intercommunale [FEICOM]). FEICOM provides technical and financial assistance to councils to help them implement their development projects, which have the aim of improving the living conditions of the population. The financial assistance covers the following project and facilities:

- › Basic infrastructure projects include water and sanitation, infrastructures, energy, road networks and bridges, reforestation and development of green spaces, schools, and health centers
- › Public facilities include buildings accommodating local public services, social and cultural spaces (e.g., libraries, cyber cafés, museums, multi-purpose municipal halls), and social and sporting infrastructures (e.g., stadiums, centers and fitness trails, swimming pools)
- › Infrastructure projects include ceremonial halls, municipal housing, layouts, forests, and parks.

Proparco, the AFD subsidiary focused on private-sector development, has been promoting sustainable economic, social, and environmental development practices. Since 2018, Proparco has been interested in off-grid projects, notably mini-grids; however, no specific project has yet been submitted by the private sector for funding. Proparco is ready to finance projects with a minimum installed capacity of ten MW; however, Proparco can also assess a project that aims to build several mini-grids around the country if the total installed capacity of these mini-grids is greater than ten MW.

Regarding requirements, Proparco provides loans of at least €5 million (\$5.6 million). Proparco's funds can also be provided through local banks, where the interest rates are between five and seven percent, and duration is approximately 15 years. Proparco must assess the risks of each project and have a preference for projects that include smart meters.

4.3 RELEVANT MINI-GRID REGULATIONS

Following Law number 2011/022 of December 14, 2011, regarding governing the electricity sector in Cameroon, the following items are considered to be renewable energy (AfDB 2017):

- › Solar, thermal, and PV energy;
- › Wind energy;
- › Less than or equal to 5 MW of river hydroelectric energy; and
- › Biomass, geothermal, and marine energy.

Companies wishing to develop mini-grids from renewable energy sources must adhere to concessions, licenses, authorization, and declarations, as appropriate. MINEE grants concessions and licenses in Cameroon, with the Electricity Sector Regulatory Board granting all other types of documents.

Concession. The following activities are subject to the concession regime:

- › Water storage on public land for electricity production;
- › Generation of hydroelectric power in particular on public land;
- › Operation of the transmission network;
- › Electricity transmission; and
- › Electricity distribution.

Concession agreements shall determine the duration and condition of suspension, expiration and revision, renewal and cancellation of the contract by the granting authority as well as the settlement of disputes. The renewal of concession shall be done in accordance with the procedure laid down by regulation.

Licenses. Licenses are required for the independent production of electricity as well as the sale of extra high, high and medium-voltage electric power and the import and export of electricity.

Independent electricity producers shall produce and sell electricity to distributors or users. Electricity importers and exporters shall carry out their activities in accordance with the provisions of this law, its implementing instruments, and the international commitments of Cameroon.

Licenses to such extra high-, high-, and medium-voltage electricity power, as well as those for the independent production, import and export of electricity shall be granted only to operators who fulfill the technical requirements and provide adequate financial guarantees to carry out their activities.

Authorization. The authorization may be granted only where there is no public electricity service due to the lack or shortage of electricity generation transmission and distribution means in the area concerned. The following shall fall under the authorization schedule:

- › Private production installations of more than one MW
- › Setting up and operating electricity distribution installations with a view to directly or indirectly supplying power of net more than 100 kW
- › Installation of private electricity lines along or across a highway or running horizontally at distances of less than one km from an existing electric, telephone or telegraph line situated on public property.

Declaration. Where the output of installations for personal production of electricity is more than 100 kW and less than one MW, the owner of such installations shall be bound make a declaration to the Electricity Sector Regulatory Board before operating the said installations.

Free scheme:

- › Installation of private electricity lines shall be done without restriction where the facilities are entirely located on private property, provided such lines shall not run along or go across a highway, and that the wires shall at no point run horizontally at less than ten meters from an existing electric, telephone or telegraph line situated on public property
- › Installation of private electric lines must meet the required norms and standards.

Regarding rural electrification, specifically, it shall be carried out through connection to the interconnected network or by decentralized generation. According to the Law number 2011/022 of December 14, 2011, governing the electricity sector, decentralized production is “electricity production designed to meet the electricity needs of users located far from interconnected networks and unable to be connected thereto in the medium term.”

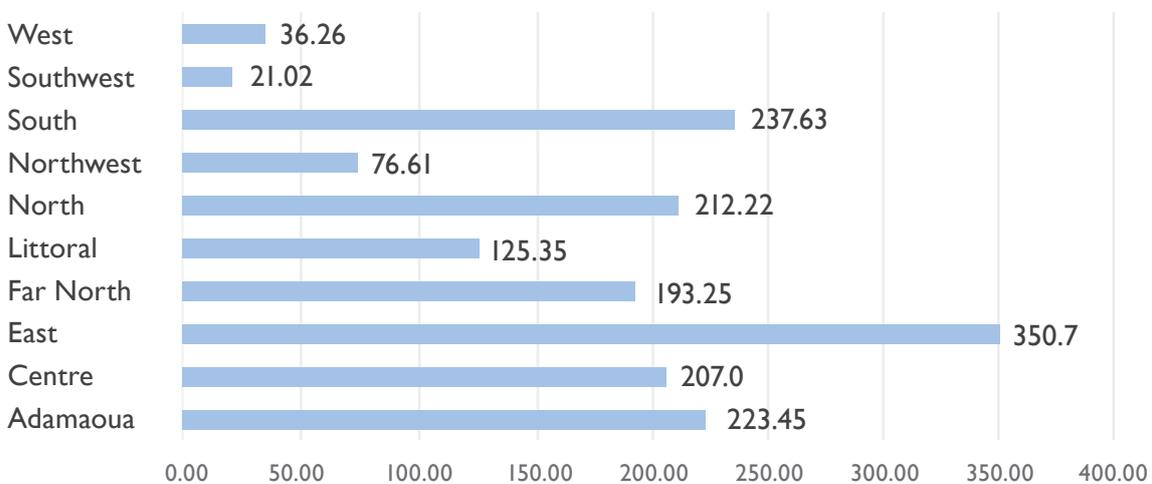
Within the context of rural electrification, the generation, especially of hydroelectric stations with a capacity of 5 MW or less, the supply and sale of electricity shall be by virtue of a simple authorization of the Electricity Sector Regulatory Board. No special requirements for tender notices or advertisement shall be imposed. Such activities shall be carried on in compliance with the rules of safety and environmental protection.

Although the legal framework regarding mini-grids is in place, many gaps must be filled to facilitate investments in off-grid electrification. There are two major uncertainties that are always raised by mini-grid developers: (i) What happens if the main grid reaches the site of a mini-grid? (ii) What happens if a mini-grid developer wants to build ten mini-grids of 100 kW each? Are ten authorizations required or is only one authorization corresponding to the total power of one MW sufficient? Both issues must be resolved in the near future.

4.4 MINI-GRID FINANCING OVERVIEW

Solar energy remains as the most popular type of renewable energy source in the country, although different projects that have been completed are at small scale with a capacity ranging from one to 100 kWp. The installed capacity is approximately 1.7 MW and is broken down by regions in Figure 28.

FIGURE 24. INSTALLED CAPACITY BY REGION



Source: ⁶⁴

⁶⁴Ministry of Water Resources and Energy, “Cameroon’s Energy Situation.”

Installed capacity is progressing with a project involving 166 localities that is being implemented by MINEE in partnership with Huawei. This project involves constructing solar power plants and the distribution networks, as well as connecting and installing metering systems in the localities concerned. Depending on the locality, the capacities of different mini-grids are 15 kW, 30 kW, 80 kW, 150 kW, and 200 kW and have a total installed capacity of 11.2 MW. To date, 135 mini-grids have already been installed.

FEICOM finances energy projects, both grid-connected and off-grid. The most recent solar mini-grid project financed is for 100 kW, completed by Solkamtech in partnership with the municipality of Mayo Baleo in the Adamaoua Region. This project, valued at approximately \$760,000, is a public–private partnership off-grid electrification project.

The Promoting Integrated Biomass and Small Hydro Solutions for Productive Uses in Cameroon project is being implemented by UNIDO, with \$2 million in financial support from the Global Environment Facility. The funding is being used to address the following:

- › Strengthen the policy and regulatory framework for renewable energy and its enforcement
- › Develop mechanisms to promote and sustain private-sector investments in renewable energy generation
- › Demonstrate the technical and commercial viability of renewable energy mini-grids
- › Conduct monitoring and evaluation of the whole project.



The project aims to remove barriers by demonstrating biomass and small hydro power mini-grids for productive uses in rural Cameroon. This project also aims to set up two small hydropower mini-grids and two biomass plants, with a total installed capacity of 2.825 MW.

Decentralized Electricity Production and Valorization of Rural Electrification for Agriculture and Rural Development in Cameroon (Production décentralisée d'électricité et Valorisation de l'Électrification Rurale pour l'Agriculture et le Développement Rural au Cameroun [Plan VER]) is funded by the EU (41 percent) and the Government of Cameroon (59 percent) through the Ministry of Agriculture and Rural Development, MINEE, and FEICOM. The aim of the project is to realize feasibility studies on ten small hydropower sites and build two mini-grids with a total installed capacity of 1.8 MW. The total cost of the project is \$26,000,000 and focuses on the following activities: feasibility studies, construction of two small hydropower mini-grids, distribution lines, training sessions, income-generating activities, and study tours.

4.5 MINI-GRID GENDER MAINSTREAMING

To promote gender mainstreaming, GOC is raising awareness among parents and the community, particularly in rural areas, to ensure that girls benefit from the same access to education as boys. Particular emphasis is also being placed on improving conditions favorable to the development of women to allow them to better contribute to socio-economic development, including the creation and rehabilitation of women's management structures. Within this context, there is an opportunity to support women to more actively engage within rural electrification programs, especially mini-grid projects. This will help communities transform their local production, including employment opportunities for women and limiting the rural exodus of young people. Recent studies have highlighted Cameroon's potential to more fully engage women within the renewable energy sector, including the development of solar energy, micro- and mini-hydro, and biomass plants.

5 AGRICULTURAL AND PRODUCTIVE-USE SOLAR COMPANIES

As households in Cameroon without electricity tend to be more rural than households with electricity, there is the potential to increase the agricultural productivity of these households. Approximately 85 percent of all modest-, medium-, and large-consumption power households are in rural areas.⁶⁵

Nationally, approximately 67 percent of households without electricity own livestock and approximately 87 percent own agricultural land, according to the Power Africa geospatial analysis.

- › Modest-consumption power households: Approximately 77 percent of these households own livestock and approximately 93 percent own agricultural land. This is the most rural consumer group, with 90 percent of households living in rural areas.
- › Medium-consumption power households: Approximately 64 percent of these households own livestock, 83 percent own agricultural land, and 81 percent live in rural areas.
- › Larger-consumption power households: Approximately 63 percent of these households own livestock, 83 percent own agricultural land, and 75 percent live in rural areas.

In rural homes, electrification can help extend the time that families have to pursue domestic and leisure activities. In addition, having electricity can help primarily agricultural households engage in other productive activities that might require electric devices and has even been shown to increase the labor supply in rural communities.⁶⁶



Agricultural households that grow crops or produce animal products that could use some amount of processing, such as cocoa beans, coffee, rubber, and meat, could benefit from increased productivity through solar home systems or mini-grids that provide electricity for processing plants.

5.1 RELEVANT GOVERNMENT AND DONOR AGRICULTURE AND PRODUCTIVE-USE PROGRAMS

The Agriculture Investment and Market Development Project (AIMDP), funded by the World Bank, is a pioneering tool for second-generation agriculture in Cameroon. Implemented in partnership with the Ministry of Agriculture and Rural Development, the AIMDP targets three crops with highly nutritious, commercial, and economic potentials: cassava, maize, and sorghum. The aims of AIMDP are to boost interest in cassava, maize, and sorghum, to demonstrate added value, and to meet the agriculture industry's needs. The main objective of AIMDP is to enhance production, in terms of quality and quantity, to satisfy the market and improve producers' incomes and living conditions daily.

AfDB's agricultural value chain development project is providing financial and technical support to farmers' organizations and young people in the agribusiness sector. This five-year project is designed to ensure food security by boosting the banana and plantain, palm oil, and pineapple sectors. The project is being implemented in the East, Center, Littoral, and Southwest Regions. AfDB financing covers 77 percent of the

⁶⁵National Institute of Statistics, "Multiple Indicator Cluster Survey (MICS5): Cameroon."

⁶⁶Van de Walle, "Long Term Impacts of Household Electrification in Rural India."

project, and the government is expected to cover the remainder of the funding. The project could lead to an increase of 240,000 tons of plantains; 216,000 tons of palm nuts; 17,500 tons of palm oil; and 10,000 tons of pineapples.

5.2 AGRICULTURE AND PRODUCTIVE-USE RELEVANT REGULATIONS

Regarding productive uses, Circular 001/CF/MINEFI/CAB dated June 9, 2012 specifies that equipment for the exploitation of solar and wind energy benefits from an exemption of the VAT. The types of solar radiation energy equipment and wind energy equipment are discussed as follows:

- › Solar radiation energy equipment includes PV modules, generators, systems transformers, inverters, controllers, cables, accumulators, switches, batteries, battery chargers, solar torches, generator mills, control panels for PV pumps, solar dryer equipment, and solar devices for water filtering.
- › Wind energy equipment includes the turbine system, blades, generators, pumps, transformers, inverters, and controllers.

5.3 AGRICULTURAL AND PRODUCTIVE-USE FINANCING OVERVIEW

ACEP Cameroon is an MFI and local partner of Kiva. ACEP Cameroon and Kiva began activities in 2012. Since 2016, the activities have focused on agriculture, livestock, and trade. According to the partnership between Kiva and ACEP Cameroon, the maximum loan amount is \$1,000. ACEP Cameroon assesses the project submitted, proposes projects for Kiva funding, pre-finances projects with a 1.5 percent interest rate per month (tax not included) for 12 months, recovers funds, and reimburses only the capital to Kiva. Kiva receives the projects from ACEP Cameroon and provides approval according to the terms of their partnership.

ACEP Cameroon has not yet provided credit for a renewable energy project, either through Kiva or through ACEP Cameroon directly. However, ACEP Cameroon and Kiva will introduce the energy sector into their portfolio to finance agriculture and energy-integrated projects.

Credit Sahel is an MFI that started commercializing solar lanterns and SHS (Sun King) in January 2019. Credit Sahel is actively involved in the cotton market and finances cotton producers in the northern Cameroon, in partnership with SODECOTON. Cotton producers are grouped together within the National Confederation of Cotton Producers (NCCP), which has more than 250,000 producers. Through the NCCP, Credit Sahel provides loans for fertilizers and for seeds, and the MFI pre-finances harvest. Many cotton producers are living in off-grid areas and expressed the following needs: lighting, telephone charging, and tools for harvesting cotton.

AGRO-PME specializes in the agricultural, agro-pastoral, and agro-food sector. AGRO-PME has a diversified portfolio and is a service provider of many types in business creation and development. However, AGRO-PME has not yet begun specializing renewable energy, solar energy, and solar kit sales. AGRO-PME has planned a project to establish a biogas plant in the city of Djombé. The goal is to raise funds (approximately \$1.2 million) and create companies that will form a holding company, all of which will be fueled by the generated energy.

Private early-stage funds could be leveraged to support new projects and lead them into bankability. InfraCo Africa has conducted its first transaction in a solar farm in Cameroon and may look to support solar water pumping projects and mini-grids in the future.

5.4 PRODUCTIVE USE AND GENDER INCLUSION

One of the most active, rural groups in Cameroon is the Ladies Business Network, which consists of 120 rural female entrepreneurs. The Network's activities focus on agriculture, livestock, livestock breeding, apiculture, and small agro-processing. The women's needs depend on the regions where they are located and include energy for a range of agro-processing needs. Some of the agro-processing needs include heating poultry houses, milling machines for various grains (corn or cassava, millet, sorghum), water irrigation, drying for fish, coffee and cocoa beans, and lighting for various business purposes.

ANNEX A: GEOSPATIAL ANALYSIS DATA SOURCES

Table A-I outlines the terminology and definitions used as part of the geospatial analysis in this report.

TABLE A-I. DATA DICTIONARY	
VARIABLE	DESCRIPTION
Households without electricity	Households that responded “no” to the survey question: “Does your household have access to electricity?”
Total off-grid market potential (not counting back-up use)	At the national level, the number of households without electricity.
Clients that are more than 10 kilometers (km) from the grid	Households without electricity that are located farther than 10 km from the high-voltage network lines.
Medium-voltage network (MVN)	MVN lines across Cameroon identified by the World Bank through its “Electricity Transmission and Reform” project. In its documentation, the World Bank identified these electricity transmission lines as high-voltage lines; however, these more closely align with the MVN lines identified by the Rural Electrification Master Plan (Plan Directeur d’Électrification Rurale [PDER]) prepared by the Rural Electrification Agency (Agence d’Électrification Rurale [AER]). This report, therefore, refers to these lines as medium-voltage lines.
Note: consumer groups are mutually exclusive; each household is classified into the highest tier for which it is eligible.	
Large power consumption households	Households without electricity that have at least one of the following high-cost assets: car, computer, television, or refrigerator.
Medium power consumption households	Households without electricity that own a mobile telephone and live in a dwelling with at least one type of high-quality housing material for the roof, floor, or walls.
Modest power consumption households	Households without electricity that own at least a radio or mobile telephone and do not fall into the large- or medium-consumption household category.
HOUSEHOLD ASSET OWNERSHIP	
Computer	Household reports owning a computer.
Television	Household reports owning a television.
Refrigerator	Household reports owning a refrigerator.
Mobile telephone	Household reports owning a mobile telephone.
Car	Household reports owning a car.
Radio	Household reports owning a radio.
Agricultural land	Household reports owning land used for agriculture.
Livestock	Household reports owning at least one livestock, including sheep, goats, cows, horses, pigs, or chickens.
Bank account	Household reports having at least one bank account without specifying how they use it.

TABLE A-1. DATA DICTIONARY CONTINUED

VARIABLE	DESCRIPTION
HOUSEHOLD CHARACTERISTICS	
Household size	Household reports the number of people living in the household.
Advanced finished floor	Household floors are made out of cement, vinyl, tile, or carpet.
Advanced finished walls	Household walls are made out of cement, brick, cinderblocks, tiles, covered adobe, or limestone.
Advanced finished roof	Household roof is made out of cement or metal.
Advanced finished house	Housing floor, walls, and roof are all made of advanced finished materials.
Advanced cooking fuel	Household uses electricity or gas for cooking.
Flush toilet	Household reports having any type of flush toilet.
MEDIA CONSUMPTION	
Regular television watcher	An individual is defined as a regular watcher of television if he or she watches television at least once per week. Only individuals aged 15–49 years are included.
Regular radio listener	An individual is defined as a regular radio listener if they listen to the radio at least once per week. Only includes individuals aged 15–49 years.
HEAD OF HOUSEHOLD EDUCATION	
Did not finish primary school	Head of household has received no schooling or has not finished primary school.
Finished primary school	Head of household has completed primary school and may have attended, but not completed, secondary school.
Finished secondary school	Head of household has completed secondary school and may have had some higher education.

AER's Buffer Analysis

In its PDER, the AER analyzed the number of electrified localities within ten, 20, and 30 kilometers (km) of high-voltage lines, as shown in Table A-2. Please note that this analysis differs from this report's geospatial analysis. PDER's analysis focused on non-electrified localities, whereas this report's analysis focused on estimates of households that reported not having electricity. The latter captures households that might be located in electrified localities but reported not having electricity.

TABLE A - 2. INFORMATION ON ELECTRIFIED LOCALITIES

INDICATOR	BUFFER 10 KM	BUFFER 20 KM	BUFFER 30 KM
Non-electrified localities	5,918	7,406	8,678
Non-electrified localities (percentage remaining to electrify)	60%	76%	88%
Non-electrified population	3,607,000	4,471,000	5,168,997
Non-electrified population (percentage remaining to electrify)	62%	77%	88%

TABLE A - 3. CHARACTERISTICS OF HOUSEHOLDS WITH AND WITHOUT ELECTRICITY

INDICATOR	HOUSEHOLDS WITHOUT ELECTRICITY	HOUSEHOLDS WITH ELECTRICITY
HOUSING QUALITY AND CHARACTERISTICS		
Average household size	4.9	4.2
Advanced finished floor	20%	86%
Advanced finished walls	35%	85%
Advanced finished roof	56%	99%
Advanced finished house	15%	80%
Flush toilet	<1%	24%
Main cooking fuel is gas	<1%	38%
Main cooking fuel is electricity	<1%	<1%
ASSET OWNERSHIP		
Mobile telephone	61%	97%
Radio	32%	58%
MEDIA CONSUMPTION		
Watches television at least once per week	28%	90%
Listens to the radio at least once per week	38%	55%
INVOLVEMENT IN AGRICULTURE		
Rural	83%	14%
Owens agricultural land	87%	54%
Owens livestock	67%	25%
HIGHEST LEVEL OF EDUCATION ACHIEVED BY HEAD OF HOUSEHOLD		
No education	41%	9%
Primary school	40%	29%
Secondary school	17%	45%
ACCESS TO FINANCIAL TOOLS		
Bank account access	2%	23%

Source:⁶⁷

N.B. Media consumption values were recorded for all people aged 15 to 49 years.

⁶⁷ National Institute of Statistics, "Multiple Indicator Cluster Survey (MICS5): Cameroon."

TABLE A - 4. HOUSEHOLD CHARACTERISTICS BY CONSUMPTION POWER GROUP

INDICATOR	MODEST- CONSUMPTION POWER HOUSEHOLDS	MEDIUM- CONSUMPTION POWER HOUSEHOLDS	LARGE- CONSUMPTION POWER HOUSEHOLDS
HOUSING QUALITY AND CHARACTERISTICS			
Average household size	5.5	5.1	5.5
Advanced finished floor	2%	33%	52%
Advanced finished walls	8%	54%	57%
Advanced finished roof	12%	88%	94%
Advanced finished house	2%	26%	39%
Flush toilet	0%	0%	2%
Main cooking fuel is gas	0%	1%	5%
Main cooking fuel is electricity	0%	0%	0%
ASSET OWNERSHIP			
Mobile telephone	73%	100%	93%
Radio	55%	39%	75%
MEDIA CONSUMPTION			
Watches television at least once per week	14%	24%	50%
Listens to the radio at least once per week	32%	33%	40%
INVOLVEMENT IN AGRICULTURE			
Rural	90%	81%	75%
Owns agricultural land	93%	83%	83%
Owns livestock	77%	64%	63%
HIGHEST LEVEL OF EDUCATION ACHIEVED BY HEAD OF HOUSEHOLD			
No education	38%	33%	15%
Primary school	42%	44%	47%
Secondary school	20%	22%	34%
ACCESS TO FINANCIAL TOOLS			
Bank account access	1%	2%	10%

Source:⁶⁸

N.B. Media consumption values were recorded for all people aged 15 to 49 years.

⁶⁸ National Institute of Statistics; Fraym, "Fraym."

TABLE A - 5. HOUSEHOLD CHARACTERISTICS USED TO ANALYZE LATENT DEMAND

INDICATOR	LARGE-CONSUMPTION POWER HOUSEHOLDS WITHOUT ELECTRICITY	SIMILAR HOUSEHOLDS WITH ELECTRICITY
HOUSING QUALITY AND CHARACTERISTICS		
Average household size	5.5	5.5
Advanced finished floor	52%	55%
Advanced finished walls	57%	60%
Advanced finished roof	94%	98%
Advanced finished house	39%	43%
Flush toilet	2%	1%
Main cooking fuel is gas	5%	1%
Main cooking fuel is electricity	<1%	<1%
ASSET OWNERSHIP		
Mobile telephone	93%	95%
Radio	75%	55%
Television	90%	99%
Refrigeration	6%	5%
MEDIA CONSUMPTION		
Watches television at least once per week	50%	85%
Listens to the radio at least once per week	40%	45%
INVOLVEMENT IN AGRICULTURE		
Rural	75%	43%
Owns agricultural land	83%	76%
Owns livestock	63%	61%
HIGHEST LEVEL OF EDUCATION ACHIEVED BY HEAD OF HOUSEHOLD		
No education	15%	16%
Primary school	47%	45%
Secondary school	34%	37%

Source: ⁶⁹

N.B. Media consumption values were recorded for all people aged 15 to 49 years.

⁶⁹ National Institute of Statistics, “Multiple Indicator Cluster Survey (MICS5): Cameroon”; Fraym, “Fraym.”

Sources and Methods

The Fraym database used in the geospatial analysis comprises existing household surveys that are harmonized and re-weighted based on population data from third-party sources such as the United Nations and the World Bank, thereby ensuring that indicators are comparable across countries and over time.

For this study, indicators at the individual and household levels were sourced from the 2014 Cameroon Multiple Indicator Cluster Survey (MICS), which was implemented by the National Institute for Statistics in collaboration with the Ministry of Public Health.⁷⁰ The UNICEF provided technical support, and financing was provided by UNICEF, the Ministry of Public Health, and the Public Finance Reform Support Program (Programme d'Appui à la Réforme des Finances Publiques [PARFIP]). The MICS data have a total sample size of 10,213 households. This analysis also used information from the 2011 Demographic and Health Surveys (DHS), which was prepared by the National Institute of Statistics and the Ministry of Economy, Planning, and Regional Development in collaboration with the Ministry of Public Health.⁷¹

Geotagged data is also used and comes from the 2011 DHS to supplement non-geotagged data from the 2014 MICS concerning indicators regarding household access to electricity. Additionally, existing geospatial data produced from the World Bank is used for MVN lines. The Design Unit of the World Bank prepared these 2016 data as part of the Electricity Transmission and Reform project.⁷² The World Bank also contributed to the development of the PDER prepared by the AER. The 2017 Global Findex survey designed by the World Bank is also used.

After data collection, post-hoc sampling weights were created to account for any oversampling and ensure survey representativeness. The weights and resulting population proportions were triangulated by using independent, third-party sources, such as the United Nations' Population Division and the World Bank's World Development Indicators.

Spatial Prediction

To create spatial layers of off-grid households, machine learning was used to combine survey coverage data at the cluster level with satellite imagery to identify spatial relationships and predict patterns at a hyper-local scale. In particular, the analysis relied on a survey question that asked the following question: Does your household have electricity?

Eight of the 40-plus spatial covariates (satellite images) were used for this process. These covariates were selected because of their availability across time and space and their high predictive power. A combination of raw and modeled satellite data layers were used and provided by respected organizations, including LandScan, the U.S. Geological Survey, the European Space Agency, the Socioeconomic and Applications Center, and the Center for International Earth Science Information Network.

In this market assessment report, all maps and corresponding data tables that show and identify the number of households without access to electricity at the region level and at varying distances from the grid represent estimates obtained from this interpolation model. Other statistics on household asset ownership, household characteristics, media consumption, and the education level of the head of household were extracted directly from the nationally representative 2014 MICS.

⁷⁰ National Institute of Statistics, "Multiple Indicator Cluster Survey (MICS): Cameroon."

⁷¹ National Institute of Statistics and ICF International, "Republic of Cameroon: Demographic and Health Survey and Multiple Indicators (EDS-MICS) 2011."

⁷² The World Bank, "International Bank for Reconstruction and Development Project Appraisal Document on a Proposed Loan in the Amount of 291.1 Million Euros to the Republic of Cameroon for an Electricity Transmission and Reform Project."

Although Power Africa and Fraym’s particular process for creating spatial layers is proprietary, related approaches are detailed in the academic literature.⁷³

The particular process for creating spatial layers is proprietary, related approaches are detailed in the academic literature, including:

- › Gething, Peter, Andy Tatem, Tom Bird, and Clara R. Burgert-Brucker. 2015. Creating Spatial Interpolation Surfaces with DHS Data. DHS Spatial Analysis Reports No. 11. Rockville, Maryland, USA: ICF International. <http://dhsprogram.com/publications/publication-SAR11-Spatial-Analysis-Reports.cfm#sthash.U4CPy69y.dpuf>
- › Engstrom, Ryan, Jonathan Samuel Hersh, and David Locke Newhouse. 2017. Poverty from Space: Using High-Resolution Satellite Imagery for Estimating Economic Well-Being. World Bank Policy Research Working Paper No. WPS 8284. Washington, DC: World Bank. <http://documents.worldbank.org/curated/en/610771513691888412/Poverty-from-space-using-high-resolution-satellite-imagery-for-estimating-economic-well-being>

⁷³ ICF International, “Creating Spatial Interpolation Surfaces with DHS Data”; Engstrom, Hersh, and Newhouse, Poverty from Space.

USAID.GOV/POWERAFRICA

 /POWERAFRICA

 /@POWERAFRICA

 /#POWERAFRICA



IMPORTANT NOTICES:

The information in Off-grid Solar Market Assessment – Cameroon is not official U.S. Government information and does not represent views or positions of USAID or the U.S. Government. The statements in this assessment should not be construed as investment advice on behalf of either particular securities or overall investment strategies, and nothing in Off-grid Solar Market Assessment – Cameroon shall be deemed to constitute an offer or solicitation of an offer for the acquisition of a stake in anything referenced in Off-grid Solar Market Assessment – Cameroon. For the avoidance of doubt, nothing in Off-grid Solar Market Assessment – Cameroon constitutes an offer to sell, a solicitation of, or an invitation to subscribe to or to buy securities in any jurisdiction. Further, the inclusion of any activity or transaction in Off-grid Solar Market Assessment – Cameroon does not constitute an official endorsement, recommendation, sponsorship, or approval by USAID, the Securities and Exchange Commission, any state securities authority, or any other U.S. government agency, their employees, contractors, or agents.

Unless a copyright is indicated, information in Off-grid Solar Market Assessment – Cameroon may be copied and distributed without permission, provided that Off-grid Solar Market Assessment – Cameroon is cited as the source of the information. If a copyright is indicated on a photo, graphic, or other material, unless it has the appropriate permissions, permission to copy these materials must be obtained from the original source.

