



**WORLD BANK GROUP**



**ECREEE**  
TOWARDS SUSTAINABLE ENERGY

REGIONAL OFF-GRID ELECTRIFICATION PROJECT

**Off-Grid Solar Market Assessment & Private Sector Support Facility Design**

BURKINA FASO REPORT

JULY 2019



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## ABBREVIATIONS & ACRONYMS

AECF	African Enterprise Challenge Fund
ABER	Agence Burkinabè de l'Électrification Rurale (Burkinabe Rural Electrification Agency)
AFD	Agence Française de Développement (French Development Agency)
AfDB	African Development Bank
ANEREE	Agence Nationale des Énergies Renouvelables et de l'Efficacité Énergétique (National Agency for Renewable Energies and Energy Efficiency)
ARSE	Autorité de Régulation du Secteur de l'Électricité (Regulatory Authority of the Electricity Sector)
ASD	African Solar Designs
ASE	Accès Services Énergétiques (Access to Energy Services)
BABF	Banque Atlantique du Burkina Faso (Atlantic Bank of Burkina Faso)
BCEAO	Banque Centrale des États de l'Afrique de l'Ouest (Central Bank of West African States)
BCB	Banque Commerciale Du Burkina (Commercial Bank of Burkina)
BICIAB	La Banque Internationale pour le Commerce et l'Industrie du Burkina Faso (International Bank for Trade and Industry)
BOAD	Banque Ouest Africaine de Développement (West African Development Bank)
BSIC	Banque Sahelo- Saharienne pour l'Investissement et le Commerce
C&I	Commercial and Industrial
CAPEX	Capital Expenditure
CAR	Capital Adequacy Ratio
CBAO	Compagnie Bancaire de l'Afrique de l'Ouest (Banking Company of West Africa)
CFA	Communauté Financière Africaine (African Financial Community)
COD	Cash-on-Delivery
COOPEL	Coopératives d'Électricité (Electricity Cooperatives)
DFI	Development Finance Institution
EBID	ECOWAS Bank for Investment and Development
ECA	Export Credit Agency
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
ECOWREX	ECOWAS Observatory for Renewable Energy and Energy Efficiency
ECREEE	ECOWAS Center for Renewable Energy and Energy Efficiency
EPC	Engineering Procurement and Construction
ESCO	Energy Service Company
ESMAP	Energy Sector Management Assistance Program
EU	European Union
EUR	Euro
EVA	Energio Verda Africa
FAO	Food and Agriculture Organization of the United Nations
FDE	Fonds de Développement de l'Électrification (Electrification Development Fund)
FEI	Facility for Energy Inclusion
FGD	Focus Group Discussion
FI	Financial Institution
FONDEM	Fondation Énergie pour le Monde (Energy Foundation for the World)
FRES	Foundation for Rural Energy Services
FX	Foreign Exchange
GDP	Gross Domestic Product

GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Society for International Cooperation)
GNI	Gross National Income
GoBF	Government of Burkina Faso
GOGLA	Global Off-Grid Lighting Association
GSMA	Groupe Spéciale Mobile Association (Global System for Mobile Communications)
HC	Health Center
HDI	Human Development Index
HH	Household
ICT	Information and Communication System
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
IGB	Institut Géographique du Burkina (Geographic Institute of Burkina Faso)
IMF	International Monetary Fund
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
kW	Kilowatt
kWh	Kilowatt-hour
LTO	Lease-to-Own
MFI	Microfinance Institution
MTF	Multi-Tier Energy Access Framework
MINEE	Ministère de l'Energie et de l'Eau (Ministry of Water Resources and Energy)
MW	Megawatt
NGO	Non-Governmental Organization
NPL	Non-Performing Loans
O&M	Operations and Maintenance
OGS	Off Grid Solar
OHADA	L'Organisation pour l'Harmonisation en Afrique du Droit des Affaires (Organization for the Harmonization of Business Law in Africa)
O&M	Operations and Maintenance
PANEE	Plan d'Action National pour l'Efficacité Énergétique (National Action Plan for Energy Efficiency)
PANER	Plan d'Action National pour les Énergies Renouvelables (National Action Plan for Renewable Energies)
PARMEC	Programme d'Appui à la Réglementation des Mutuelles d'Épargne et de Crédit (Support Program for the Regulation of Savings and Credit)
PASE	Projet d'Accès aux Services Énergétiques (Access to Energy Services Project)
PASEL	Projet d'Appui au Secteur de l'Électricité (Electricity Sector Support Project)
PAYG	Pay-As-You-Go
PNDES	Plan National de Développement Économique et Social (National Economic and Social Development Plan)
POSEN	Politique Sectorielle de l'Énergie (Sectorial Energy Policy)
PPP	Public Private Partnership
PROPARCO	Promotion et Participation pour la Coopération Économique (Promotion and Participation for Economic Cooperation)
PUE	Productive Use of Energy
PV	Photovoltaic
RE	Renewable Energy

RISE	Regulatory Indicators for Sustainable Energy
ROA	Return on Assets
ROE	Return on Equity
ROGEP	Regional Off-Grid Electrification Project
SCADD	Stratégie de Croissance Accélérée et de Développement Durable (Accelerated Growth and Sustainable Development Strategy)
SEFA	Sustainable Energy Fund for Africa
SEforALL	Sustainable Energy for All
SHS	Solar Home System
SME	Small and Medium Enterprise
SONABEL	Société Nationale d'Électricité du Burkina Faso (National Electricity Company of Burkina Faso)
SPV	Special Purpose Vehicle
SSA	Sub-Saharan Africa
SUNREF	Sustainable Use of Natural Resources and Energy Finance
TA	Technical Assistance
UEMOA/WAEMU	Union Économique et Monétaire Ouest Africaine / West African Economic and Monetary Union
UN	United Nations
UNCOOPEL	Union Nationale des Coopératives d'Électricité du Burkina Faso (National Union of Electricity Cooperatives of Burkina Faso)
UNDP	United Nations Development Programme
USD	United States Dollar
VAT	Value Added Tax
WAPP	West African Power Pool
Wh	Watt-hour
Wp	Watt peak

## ACKNOWLEDGEMENTS

The consortium of GreenMax Capital Advisors (GreenMax), African Solar Designs (ASD) and Energio Verda Africa (EVA) would like to thank the ECOWAS Center for Renewable Energy and Energy Efficiency (ECREEE), including Mahama Kappiah, Executive Director, ECREEE; Festus William Larrey Amoyaw, ROGEP Project Coordinator; and the entire ROGEP Expert and Technical Specialist team: Hamadou Tchiemogo, Kwabena Adom-Opare, Nouhou Amadou Seini, Daniel Paco, Ermelinda Tavares Lima, Sire Abdoul Diallo and Collins Osaé for their leadership and guidance. We would also like to thank Nicola Bugatti and Yuri Handem for their support.

In addition, we would like to acknowledge the following individuals and organizations in Burkina Faso for their assistance:

Ministère de l'Énergie; Fonds de Développement de l'Électrification (FDE); Agence Nationale des Énergies Renouvelables et de l'Efficacité Énergétique (ANEREE); Dr. Bachir Ismael Ouedraogo, Minister of Energy; Dr. Korgo, Director General of Renewable Energy; Issaka Nong-Nogo, Director of Solar Energy; Amadou Diallo, Ministry of Energy, Renewable Energy Direction; Hyacinthe Sanou, FDE Control Service, and all focus group and survey participants and other contributors in the country. This report would not have been possible without their support.

We would especially like to thank Prof. Yao Azoumah for his significant contributions to this research effort.

NOTE: The findings, analysis, conclusions and recommendations expressed in this report are those of the authors – they do not necessarily represent the views of ECREEE, the World Bank, or any of the individuals and organizations that contributed to this study.

## KEY DEFINITIONS

### ELECTRICITY ACCESS

For the purpose of this analysis, figures on national, urban and rural electrification rates are from the International Energy Agency (IEA) Energy Access Outlook Report, 2017.<sup>1</sup> Although local government authorities (energy ministries, rural electrification agencies, utilities etc.) may have different or more up-to-date electrification data, one single, uniformly-accepted source was necessary as a baseline to assess electricity access figures across all 19 of the countries analyzed under this regional market assessment.

There is no single internationally-accepted and internationally-adopted definition of modern energy access. The IEA defines energy access as “a household having reliable and affordable access to both clean cooking facilities and to electricity, which is enough to supply a basic bundle of energy services initially, and then an increasing level of electricity over time to reach the regional average.”<sup>2</sup> A “basic bundle of energy services” means, at a minimum, several lightbulbs, task lighting (such as a flashlight or lantern), phone charging and a radio. This definition of energy access serves as a benchmark to measure progress towards UN Sustainable Development Goal 7.<sup>3</sup> The IEA electricity access statistics presented in this report include household connections, either from a grid connection or from a renewable energy-based off-grid source; the approach excludes illegal connections. The data is sourced wherever possible from governments, supplemented by data from multilateral development banks, various international organizations and other publicly available statistics.

The Multi-Tier Energy Access Framework (MTF) is also used as a key reference throughout this report. Rather than measuring electricity access as a household connection to an electricity grid, the MTF views electricity access along a continuum of service levels (tiers) and according to a series of indicators, including capacity, availability/duration of supply, reliability, quality, affordability, legality and health/safety.<sup>4</sup>

### OFF-GRID / STAND-ALONE SOLAR

The term “off-grid” as it is widely used throughout this report (e.g. “off-grid sector”) refers to both mini-grids and stand-alone systems. When “off-grid solar” or its acronym “OGS” are used, this refers *only* to stand-alone solar systems and does not include mini-grids. The main focus of this market assessment is the stand-alone solar sector. While micro/mini-grids typically provide a small community with electricity, stand-alone solar systems are not connected to an electricity distribution system and typically include a battery, but may also be used in conjunction with a diesel generator, wind turbine etc. Stand-alone solar technology broadly includes the following:

- Pico solar/solar lanterns<sup>5</sup>
- Single module solar systems (DC)<sup>6</sup>
- Multiple module solar systems (AC)<sup>7</sup>
- Large solar systems (AC)<sup>8</sup>

In addition to providing electricity access, stand-alone solar products/systems also support a wide range of productive applications (e.g. solar water pumping, agricultural processing, milling equipment, refrigeration etc.).

<sup>1</sup> [https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport\\_EnergyAccessOutlook.pdf](https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport_EnergyAccessOutlook.pdf)

<sup>2</sup> <https://www.iea.org/energyaccess/methodology/>

<sup>3</sup> <https://sustainabledevelopment.un.org/sdg7>

<sup>4</sup> “Multi-Tier Framework for Measuring Energy Access,” World Bank ESMAP: <https://www.esmap.org/node/55526>

<sup>5</sup> Typically less than 10 Wp; all-in-one lighting and/or phone charging; enables partial or full Tier 1 electricity access

<sup>6</sup> Typically 11-100 Wp; capable of powering a few appliances (lights, mobile phone charging, TV, radio, fan etc.); often referred to as a “plug-and-play” solar home system when components are sold as a set; enables full Tier 1 or higher electricity access

<sup>7</sup> Typically 101-500 Wp; capable of powering multiple appliances; requires small inverter

<sup>8</sup> Typically greater than 500 Wp; most often used to power a large home; requires large inverter

Multi-tier Matrix for Measuring Access to Household Electricity Supply

		TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5	
ATTRIBUTES	1. Peak Capacity	Power capacity ratings <sup>28</sup> (in W or daily Wh)	Min 3 W	Min 50 W	Min 200 W	Min 800 W	Min 2 kW	
			Min 12 Wh	Min 200 Wh	Min 1.0 kWh	Min 3.4 kWh	Min 8.2 kWh	
		OR Services	Lighting of 1,000 lmhr/day	Electrical lighting, air circulation, television, and phone charging are possible				
	2. Availability (Duration)	Hours per day	Min 4 hrs	Min 4 hrs	Min 8 hrs	Min 16 hrs	Min 23 hrs	
		Hours per evening	Min 1 hr	Min 2 hrs	Min 3 hrs	Min 4 hrs	Min 4 hrs	
	3. Reliability						Max 14 disruptions per week	Max 3 disruptions per week of total duration <2 hrs
	4. Quality						Voltage problems do not affect the use of desired appliances	
	5. Affordability						Cost of a standard consumption package of 365 kWh/year < 5% of household income	
6. Legality						Bill is paid to the utility, pre-paid card seller, or authorized representative		
7. Health & Safety						Absence of past accidents and perception of high risk in the future		

Source: World Bank Energy Sector Management Assistance Program (ESMAP)

## WEST AFRICA AND THE SAHEL

The term “West Africa and the Sahel” as it is used to throughout this report refers to the 19 countries covered by the first phase of the Regional Off-Grid Electrification Project (ROGEP). The countries include the 15 member states of the Economic Community of West African States (ECOWAS) – Benin, Burkina Faso, Cabo Verde, Côte d’Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Sierra Leone, Senegal and Togo – plus Cameroon, Central African Republic, Chad and Mauritania.

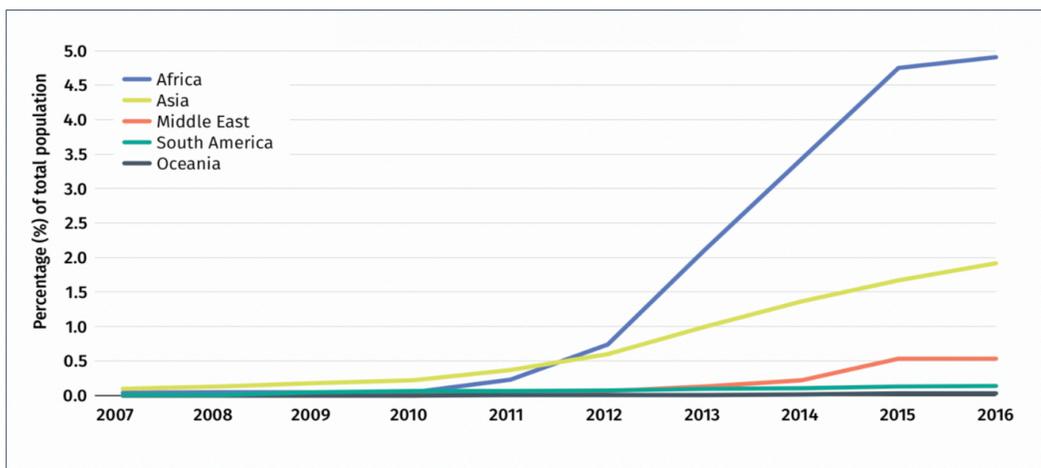


## EXECUTIVE SUMMARY

### I. INTRODUCTION

Access to electricity in Sub-Saharan Africa has improved significantly over the past decade. The number of people without access to electricity in the region stopped increasing for the first time in 2013 and has since declined.<sup>9</sup> Although grid connections continue to be the primary method of electrification, access to electricity through off-grid renewable energy systems has grown considerably. The use of off-grid solar (OGS) power is notably on the rise, with African countries accounting for most of the sector’s growth over the last decade (**Figure ES-1**). The pace of solar electrification has accelerated more rapidly in Sub-Saharan Africa than anywhere in the world.<sup>10</sup> In order to achieve universal electrification by 2030, the International Energy Agency (IEA) estimates that Sub-Saharan Africa will need more than half of new electricity access connections between 2017 and 2030 to be made through decentralized systems (mini-grids and stand-alone systems), with solar technologies representing nearly 60% of these connections.<sup>11</sup>

Figure ES-1: Off-Grid Solar Access Rate by Region



Tier 1 access and above

Source: International Renewable Energy Agency

Despite this progress, government efforts to increase electricity access in Africa have struggled to keep pace with rapid population growth and increasing demand. Many countries across the region must navigate the interrelated challenges of energy poverty, energy security and climate change (among other sociopolitical, economic and development challenges), which collectively slow the adoption of renewable energy and the pace of off-grid market growth. Rates of energy access remain particularly low in rural areas, where the electrification rate is less than 25% across Sub-Saharan Africa.<sup>12</sup> In part, this is due to the gap between the power sector’s infrastructure needs and the availability of necessary resources to expand grid electrification. Extending the grid to rural areas can be challenging due to significant transmission distances and low population densities.

<sup>9</sup> “Energy Access Outlook, 2017: From Poverty to Prosperity,” International Energy Agency, (2017):

[https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport\\_EnergyAccessOutlook.pdf](https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport_EnergyAccessOutlook.pdf)

<sup>10</sup> “Tracking SDG7 – The Energy Access Report 2018,” The World Bank, IEA, IRENA, UN Statistics Division and the WHO, (2018): <https://openknowledge.worldbank.org/handle/10986/29812>

<sup>11</sup> Tracking SDG7 – The Energy Access Report, 2018.

<sup>12</sup> IEA Energy Access Outlook, 2017.

As of 2016, over 200 million people in West Africa and the Sahel – more than half of the region’s population – lacked access to electricity. This figure represents nearly one-third of Africa’s total unelectrified population. Rates of urban and rural electrification vary widely across the region, with the average rate of access nearly three times higher in urban areas.<sup>13</sup>

Despite these access deficits, the region is generously endowed with renewable energy resources – including hydropower, solar, wind and bioenergy. These resources are largely untapped, however, as investments in the power sector remain high-risk due to market instability, as well as a variety of political and regulatory risks. Other energy sector challenges include *inter alia* limited institutional capacity, poor utility financial performance, a shortage of local technical expertise and a lack of support from local financial institutions (FIs).

Until recently, diesel generators largely served as the expensive alternative both for rural electrification and for urban and peri-urban “bad grid” areas, where electricity was unreliable or only available for part of the day. However, the advent of decentralized renewable energy technologies, particularly stand-alone solar and mini-grid systems, offers opportunities to deliver clean and cost-effective off-grid solutions. Accordingly, policymakers are increasingly utilizing these options in electrification planning as they offer a reliable, flexible and relatively affordable complement to grid extension initiatives.

Solar energy is the most promising technology in the off-grid space, with three key trends converging to drive the industry’s growth: first, continued reductions in hardware and balance of system costs (solar modules, batteries, inverters, appliances etc.); second, a digital revolution, with mobile communication technology facilitating payments and monitoring; and third, innovation in private sector business models, such as pay-as-you go (PAYG) and third-party ownership of solar home systems (SHS), which offer energy as a service and remove previously prohibitive up-front costs for households.<sup>14</sup> As a result of these developments, the off-grid solar market is rapidly evolving and expanding.

In 2016, the OGS market reported global revenues of approximately USD 1 billion. This figure is expected to increase to USD 8 billion by 2022, with SHS representing the majority of this revenue growth and an increasing share of unit sales (**Figure ES-2**). Investments in the off-grid solar sector doubled annually between 2012 and 2016, increasing by 98% over this period. Between 2013 and 2017, East Africa represented 86% of the global PAYG market in terms of cumulative unit sales, followed by West Africa at 12% and Asia at 2%.<sup>15</sup> As the East African market becomes more crowded and solar companies expand their operations into West Africa, the region will account for a larger geographic share of the burgeoning global OGS market. Although the sector’s investment trends remain volatile, there is some preliminary evidence to suggest that this transition is already underway: in 2016, West Africa accounted for 34% of total funds raised, up from 9% in 2015, while East Africa’s share of funding decreased from 77% to 47% over the same period.<sup>16</sup>

<sup>13</sup> IEA Energy Access Outlook, 2017.

<sup>14</sup> “Derisking Renewable Energy Investment: Off-Grid Electrification,” United Nations Development Programme (UNDP) and ETH Zurich, (December 2018):

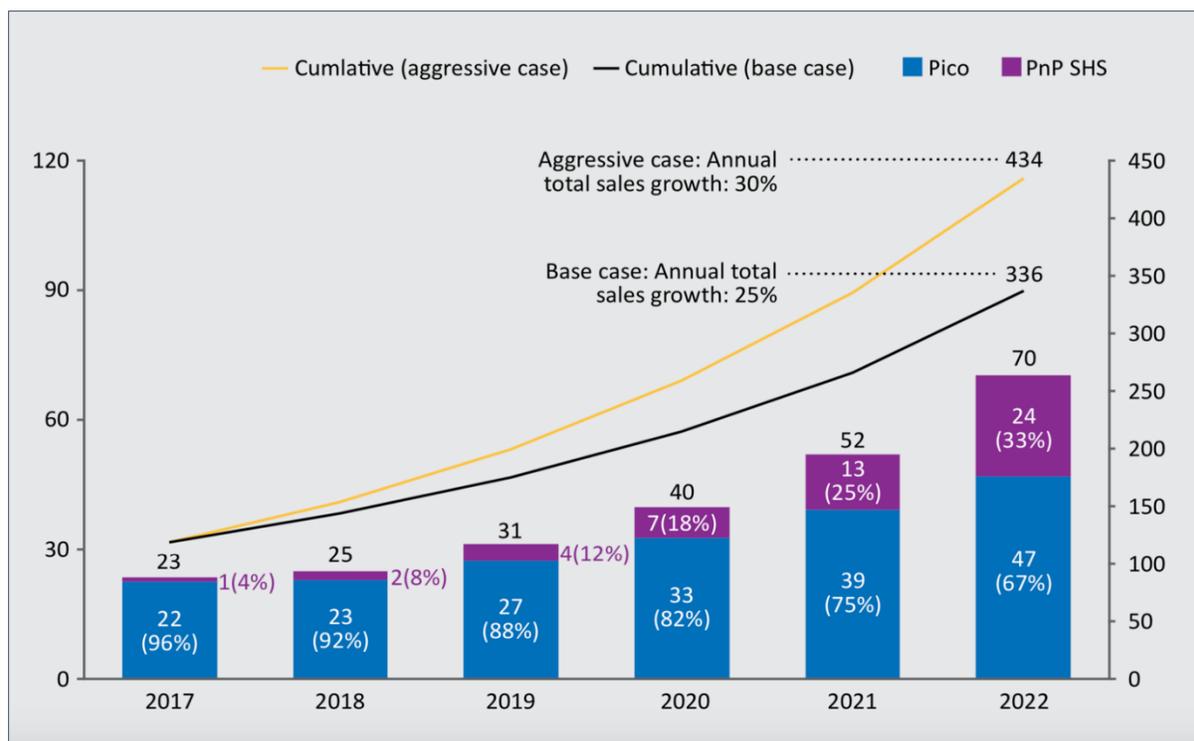
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<sup>15</sup> “Off-Grid Solar Market Trends Report 2018,” Dahlberg Advisors, Lighting Global, GOGLA and World Bank ESMAP, (January 2018):

[https://www.lightingafrica.org/wp-content/uploads/2018/02/2018\\_Off\\_Grid\\_Solar\\_Market\\_Trends\\_Report\\_Full.pdf](https://www.lightingafrica.org/wp-content/uploads/2018/02/2018_Off_Grid_Solar_Market_Trends_Report_Full.pdf)

<sup>16</sup> Ibid.

Figure ES-2: Global Off-Grid Solar Market Forecast (million units sold)



NOTE: Left axis = annual sales volume; Right axis = cumulative sales volume; PnP SHS = Plug-and-Play Solar Home System

Source: Dahlberg Advisors, Lighting Global, GOGLA and World Bank ESMAP

Many international off-grid solar companies, including most of the industry’s leading players – BBOXX, Greenlight Planet, Azuri, d.light, Off-Grid Electric, M-KOPA Solar, Fenix International, and French utilities EDF and Engie among others – have recently entered markets in West Africa, joining international pioneers such as PEG and Lumos, which launched originally in Ghana and Nigeria, respectively, and both expanded into Côte d’Ivoire and Togo.<sup>17</sup> While these large international companies are well capitalized, there is a dearth of financing for smaller, early-stage companies that operate in nascent markets across West Africa and the Sahel. In fact, the top 10 global off-grid solar companies have received nearly 90% of investment capital since 2012, while early-stage companies often struggle to raise the necessary capital to accelerate growth.<sup>18</sup>

In order to scale off-grid electrification, OGS companies will need to access large volumes of commercial debt financing. In the longer term, partnerships with local commercial banks and microfinance institutions (MFIs) will also be necessary in order to develop domestic, local-currency sources of financing and reduce foreign exchange risk.<sup>19</sup> Partnerships with local FIs, whose understanding of the credit risk of local populations, may also reduce financing costs more rapidly compared to other methods (e.g. using debt from securitized receivables).<sup>20</sup> Although most financing currently comes from non-commercial sources (i.e. the

<sup>17</sup> Bavier, J., “Off-grid power pioneers pour into West Africa,” Reuters, (February 20, 2018):

<https://www.reuters.com/article/us-africa-power-insight/off-grid-power-pioneers-pour-into-west-africa-idUSKCN1G41PE>

<sup>18</sup> “Accelerating Energy Access: The Role of Patient Capital,” Acumen, (2018): <https://acumen.org/wp-content/uploads/Accelerating-Access-Role-of-Patient-Capital-Report.pdf>

<sup>19</sup> UNDP and ETH Zurich, 2018.

<sup>20</sup> “How can Pay-As-You-Go Solar Be Financed?” Bloomberg New Energy Finance, (7 October 2016):

[https://www.bbhuh.io/bnef/sites/4/2016/10/BNEF\\_WP\\_2016\\_10\\_07-Pay-as-you-go-solar.pdf](https://www.bbhuh.io/bnef/sites/4/2016/10/BNEF_WP_2016_10_07-Pay-as-you-go-solar.pdf)

international development community), global capital markets have the size and depth necessary to meet this investment challenge. Nevertheless, small investment sizes and other early-stage market investment risks are currently holding back abundant and low-cost private capital flows to the off-grid sector.<sup>21</sup>

In order to mitigate risks and spur investment, the OGS sector requires substantial policy and regulatory support. It is therefore important that governments send a clear signal to the private sector by integrating off-grid technologies into national development programs, electrification plans and electricity access targets. Governments should also adopt favorable policies, laws and regulations to boost private sector participation, including procurement and tax incentives, grants and subsidies, concession schemes, streamlined licensing and permitting procedures, and quality standards for equipment. Additional measures include public awareness raising, encouraging inclusive gender participation, and building local capacity at all levels (e.g. solar PV vocational training and technical certification programs, training for FIs to address unfamiliarity of lenders with off-grid solar sector, corporate and consumer financing needs etc.).

In addition, solar companies increasingly rely on mobile money platforms to scale their business, as mobile payments allow them to offer low-income customers new ways to access and pay for electricity through innovative business models such as PAYG. Mobile money services, however, are only just beginning to be deployed in West Africa and the Sahel. Solar companies are therefore limited by low levels of penetration and in some cases by country-specific regulatory restrictions.<sup>22</sup> Governments can take action to foster linkages between the off-grid solar, telecommunications and mobile money sectors to expedite the uptake of market-transforming technology platforms and business models.

Governments across West Africa and the Sahel have implemented a range of policies and approaches to support off-grid market development, including private concessions, Public Private Partnerships (PPPs), Rural Electrification Agencies (REAs) and Rural Electrification Funds (REFs), among other measures. Some countries like Senegal and Mali have adopted private concessions to scale up mini-grids in rural areas, while others, such as Nigeria and Ghana, have improved rural electrification largely through public investment.

To support these initiatives, the Economic Community of West African States (ECOWAS) adopted the ECOWAS Renewable Energy Policy (EREP) in 2013, which intends to achieve universal electricity access in the region by 2030. The EREP also aims to increase the share of the region's rural population served by decentralized renewable energy services (mini-grids and stand-alone systems) to 25% by 2030. The ECOWAS Center for Renewable Energy and Energy Efficiency (ECREEE) is working with member states to develop and implement national policies and strategies with electrification targets through 2030 in line with the EREP, including Sustainable Energy for All (SEforALL) Action Agendas and National Renewable Energy Action Plans (NREAP), among other programs in support of renewable energy and off-grid market development.<sup>23</sup>

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<sup>21</sup> UNDP and ETH Zurich, 2018.

<sup>22</sup> "Scaling Access to Energy in Africa: 20 Million Off-Grid Connections by 2030," Scaling Off-Grid Energy: A Grand Challenge for Development, USAID, UK DFID, Shell Foundation, (2018): [https://static.globalinnovationexchange.org/s3fs-public/asset/document/SOGE%20YIR\\_FINAL.pdf?uwUDTyB3ghxOrV2gqvsO\\_r0L5OhWPZZb](https://static.globalinnovationexchange.org/s3fs-public/asset/document/SOGE%20YIR_FINAL.pdf?uwUDTyB3ghxOrV2gqvsO_r0L5OhWPZZb)

<sup>23</sup> ECOWAS Renewable Energy Policy, 2013:

[http://www.ecreee.org/sites/default/files/documents/ecowas\\_renewable\\_energy\\_policy.pdf](http://www.ecreee.org/sites/default/files/documents/ecowas_renewable_energy_policy.pdf)

## II. BACKGROUND AND CONTEXT OF THE ASSIGNMENT

In this context, with funding from the World Bank, ECREEE launched the Regional Off-Grid Electrification Project (ROGEP) in 19 countries in West Africa and the Sahel. The project aims to enhance shared capacity, institutions and knowledge in order to increase electricity access of households, businesses and public institutions using modern stand-alone solar systems through a harmonized regional approach. ROGEP has two main components/objectives:

✓ **Component 1: Accelerate development of a regional off-grid solar market:**

- (1A) Foster regional collaboration and promote a supportive enabling environment for the OGS sector;
- (1B) Provide entrepreneurship technical support to OGS companies at various stages of development (training to accelerate business growth and/or facilitate market entry);
- (1C) Provide entrepreneurship financial support to OGS companies at various stages of development (matching grants);
- (1D) Provide financing to remove barriers in challenging markets (market entry grants and performance grants to OGS companies operating in challenging markets)

✓ **Component 2: Facilitate access to financing for off-grid solar businesses:**

- (2A) Provide line of credit for OGS businesses via the West African Development Bank (Banque Ouest Africaine de Développement, BOAD) to be extended to local FIs for on-lending to local entrepreneurs (working capital for companies to finance equipment imports, receivables from PAYG schemes etc.)
- (2B) Implement contingent grant facility via BOAD to share risks with local FIs and encourage lending to OGS businesses.

In addition, the project intends to support a range of capacity building activities targeting public and private sector stakeholders to address existing policy, regulatory, institutional, financial, economic, business, technology and capacity related barriers. ECREEE will also assist each country with development and implementation of national programs and initiatives in the areas of renewable energy, rural electrification and energy access in line with the regional focus of the assignment.

Under the first phase of the project, an initial assessment of the off-grid solar market was undertaken in each of the 19 countries. The study focused exclusively on the stand-alone solar PV market and did not assess mini-grids (see **Key Definitions**). The scope of work was broadly divided into the following tasks:

- (1) Review the current enabling policy and market environment for the off-grid solar sector
- (2) Analyze the market for off-grid solar products and systems, including an estimate of demand from the household, institutional and productive use market segments and analysis of the supply chain;
- (3) Assess the willingness and capacity of national and regional financial institutions to provide commercial and/or consumer financing to the off-grid solar sector; and
- (4) Propose models to incentivize the private sector and financial institutions to support off-grid solar market development and to harmonize a regional market to achieve universal access.

Available geographic information system (GIS) data for each country supported the Task 1 and Task 2 analyses. A least-cost electrification analysis was undertaken utilizing geospatial mapping to assess the potential development of electricity access and grid coverage in each country through 2023 and 2030. The study estimated the total number of potential settlements, people and households electrified by on-grid, mini-grid or off-grid stand-alone solutions under each timeframe based on a series of indicators, including national electricity grid proximity, population density and nodes of economic growth. The assessment was also performed for health facilities and education centers (although the analysis was limited by the

availability and/or quality of GIS data for these market segments). The results of the analysis were used to estimate the share of the population suitable for off-grid stand-alone solar solutions over the analyzed periods and to assess corresponding potential demand from the household sector under the Task 2 market sizing.

Within the context of this assignment, a gender-focused analysis was also implemented in order to assess the level of female participation in each country’s off-grid energy sector. Each stage of the market study therefore analyzed inclusive participation and gender implications. A comprehensive gender profile is presented in **Annex 4**, including a summary of findings, as well as recommendations to improve gender equality and enhance women’s engagement in development of the off-grid sector.

To carry out these tasks, the project team utilized a combination of desk research, input from local country experts and feedback from engagement with a wide range of stakeholders at the country and regional levels. Interviews were conducted with policymakers, industry experts, and representatives from solar companies and financial institutions. Focus group discussions were also held in each country with key stakeholders from the four market segments analyzed under Task 2 (household, institutional, productive use and supplier). Focus group participants included representatives from government, the donor community, NGOs, solar companies, business and industry associations, academia, community groups, and women’s groups. In addition to the focus group meetings, surveys were administered in order to collect additional Task 2 market data, including (i) a survey of international solar companies to gauge their level of interest in the region; (ii) a survey of local solar companies and retail suppliers in each country to inform the supply chain analysis; and (iii) an assessment of an off-grid village in each country to better understand how solar is being utilized for productive uses. Under Task 3, a survey was administered to local and regional FIs to determine their level of capacity and interest in lending to the off-grid solar sector. A detailed description of the methodology used to carry out these tasks is presented in **Annexes 1-3**.

This report is organized into three sections that correspond to Tasks 1-3 described in the scope of work above (Task 4 was prepared in a separate report). **Section 1** covers the enabling policy and market environment for the OGS sector. This includes an overview of the status of the on-grid and off-grid markets, an analysis of off-grid energy policy and regulation and gaps in the existing framework, and a summary of off-grid development initiatives. The results of the least-cost electrification analysis are also included in this section.

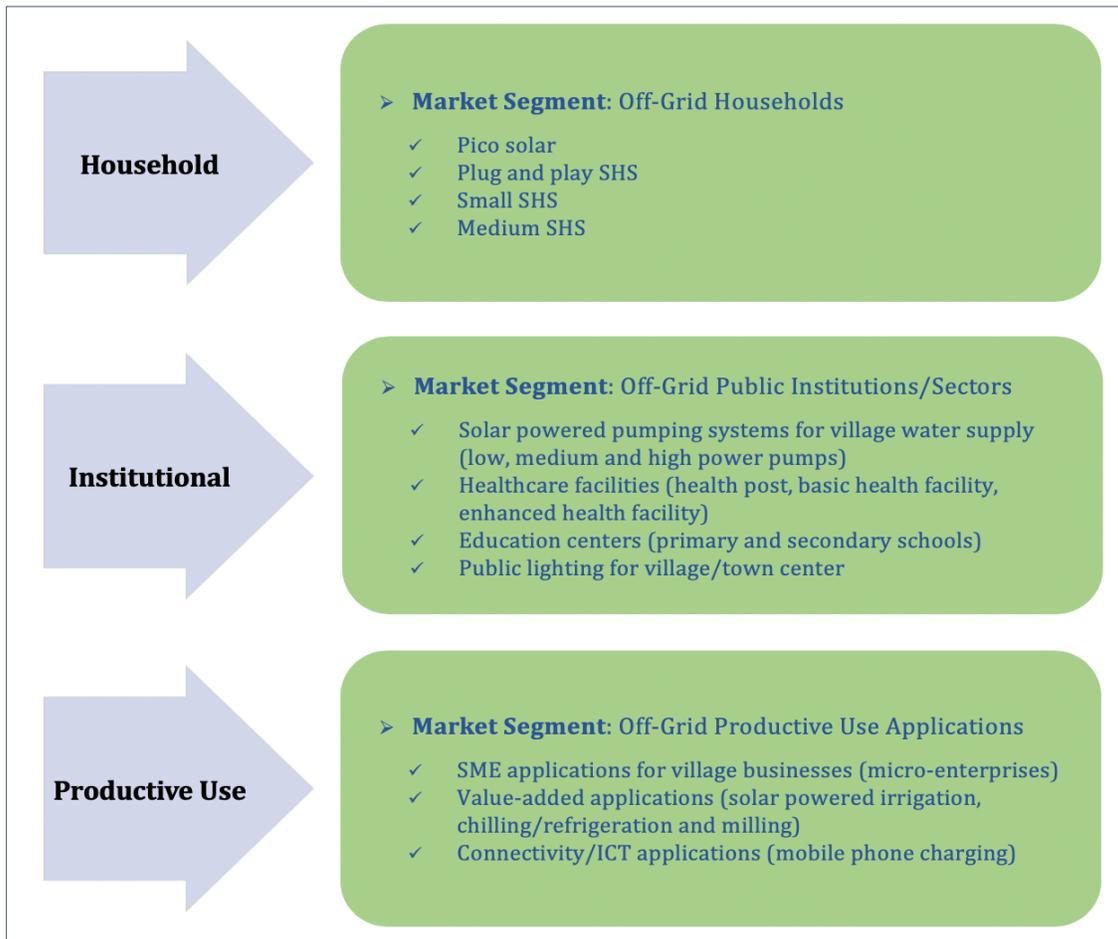
**Section 2** estimates the potential market for off-grid solar products and systems by assessing potential demand from the household, institutional and productive use market segments (**Figure ES-3**), followed by an analysis of the supply chain. The household market sizing utilizes results from the least-cost electrification analysis, along with data on household income and energy expenditure, in order to estimate potential demand based on the number of households able to afford various OGS systems. Both the cash and financed market potential were estimated for 2018, 2023 and 2030.

The institutional sector analysis combines available GIS data with secondary research to estimate potential demand based on assumptions about the electricity needs, usage patterns and associated costs of solar electrification of four public/institutional markets – water supply for off-grid communities, healthcare facilities, education centers (primary and secondary schools) and public lighting. Where GIS data was unavailable, per capita comparisons were made using data from similar countries to estimate off-grid solar demand by market segment (see **Annex 2** for country categorization). The productive use of energy (PUE) market sizing estimates potential off-grid solar demand for SME, value-added and connectivity applications. Feedback from stakeholder interviews and focus group discussions informed the analysis and helped characterize each market segment’s consumer perceptions, interest, awareness, ability to pay and access to finance.

The Task 2 supply chain analysis presents an overview of key market actors, solar products and services, sales figures and business models, and includes a discussion of the role of informal market players and the impact of uncertified products. The analysis also addresses the capacity needs of the supply chain and describes specific areas of support where technical assistance is needed to accelerate market growth.

**Section 3** assesses the willingness and capability of national and regional financial institutions (FIs) to provide commercial and/or consumer financing to the off-grid solar sector in each country. This section includes a summary of financial products for the off-grid sector, a comprehensive overview of each country’s financial market and commercial lending environment (including analysis of commercial banks, microfinance institutions and other non-bank financial institutions) and any programs supporting off-grid solar lending. This section also examines the scope of financial inclusion in each country and the impact of digital financial services and mobile money on access to finance. It concludes with the results of surveys that were administered to financial institutions in each country across the region.

Figure ES-3: Analyzed Off-Grid Market Segments



NOTE: SHS = Solar Home System; ICT = Information Communication Technology

### III. EXECUTIVE SUMMARY

Burkina Faso is a landlocked nation in West Africa with a young, rapidly-growing population that relies heavily on subsistence farming. The country has promising rates of economic growth, bolstered by increased public investment and higher prices for gold and cotton, which are the country's two key exports.<sup>24</sup> Macroeconomic gains have not translated into improvements for the majority of the population, as rates of poverty and unemployment are high, particularly in rural areas where a majority of the population lives.

Access to electricity remains an ongoing challenge. In 2016, an estimated 80% of the population – about 15 million people – did not have access to electricity, with a significant disparity in rates of access between urban (58%) and rural (1%) areas.<sup>25</sup> Even where grid connections exist, power supply is often unreliable, with fewer than one-third of households reporting reliable access to electricity when surveyed.<sup>26</sup> Off-grid electrification is a policy priority for the Government of Burkina Faso (GoBF), which is committed to achieving a national electrification rate to 45% by 2020 and 65% by 2030. Currently, the Government's efforts to establish a supportive policy and regulatory framework for the off-grid sector are progressing well, as evidenced by the country's 22-point improvement in its World Bank Regulatory Indicators for Sustainable Energy (RISE) energy access score between 2015 and 2017.<sup>27</sup>

Several off-grid programs are in various stages of implementation by the GoBF, with funding and support from development partners. With support from ECREEE, the Government has outlined its commitments and initiatives to develop renewable energy and meet its electrification targets in its SEforALL National Renewable Energy Action Plan (Plan d'Action National pour les Énergies Renouvelables, PANER). Under PANER, the GoBF is pursuing grid extensions as well as solar-powered mini-grids to support rural electrification. With support from the World Bank, the Government is also implementing the Access to Electricity Services Program (Projet d'Accès aux Services Electriques, PASEL), which aims to electrify over 200 localities distributed across the 13 regions of the country through connections to the national grid, solar PV/diesel hybrid projects, and stand-alone solar systems. The rural electrification fund (Fonds de Développement de l'Électrification, FDE) also promotes electricity access in rural areas through grid extensions (low-voltage distribution lines) and solar and/or hybrid mini-grids.

This report assesses the market opportunity for off-grid solar products and systems by estimating demand from the household, institutional, and productive use sectors in Burkina Faso (**Figure ES-4**). According to the assessment, there is a significant OGS market opportunity, with the annualized cash market potential in 2018 estimated to be USD 79.7 million. The household sector (USD 48.8M) makes up the majority of estimated demand, followed by the productive use (USD 28.4M) and institutional (USD 2.4M) sectors.

<sup>24</sup> "Burkina Faso Economic Outlook," African Development Bank, (2018): <https://www.afdb.org/en/countries/west-africa/burkina-faso/burkina-faso-economic-outlook/>

<sup>25</sup> IEA Energy Access Outlook, 2017.

<sup>26</sup> Blimpo, M., and Cosgrove-Davies, M., "Electricity Access in Sub-Saharan Africa: Uptake, Reliability, and Complementary Factors for Economic Impact," AFD and World Bank, Africa Development Forum, (2019):

<https://openknowledge.worldbank.org/bitstream/handle/10986/31333/9781464813610.pdf?sequence=6&isAllowed=y>

<sup>27</sup> "Policy Matters: Regulatory Indicators for Sustainable Energy," World Bank ESMAP, (2018):

<http://documents.worldbank.org/curated/en/553071544206394642/pdf/132782-replacement-PUBLIC-RiseReport-HighRes.pdf>

Figure ES-4: Indicative Total Cash Market Potential for Off-Grid Solar Products in Burkina Faso, 2018

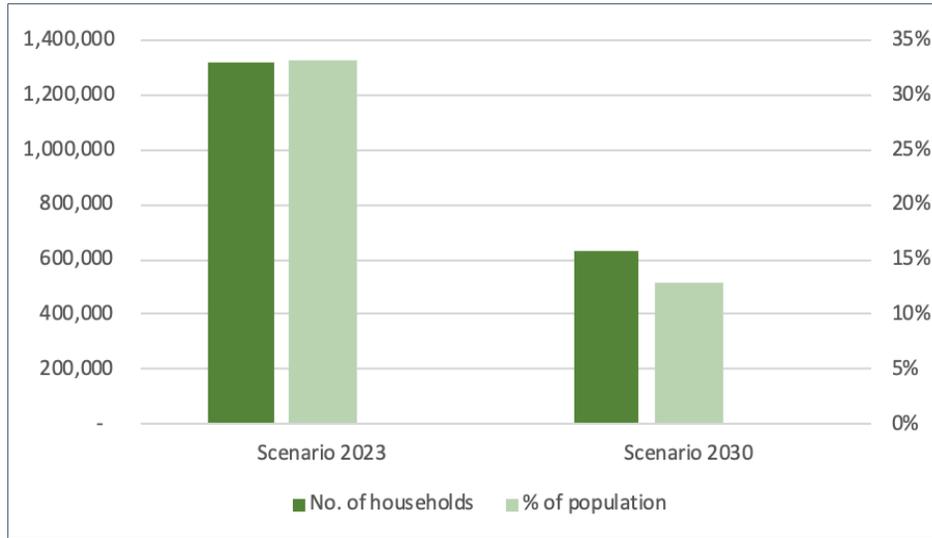


Source: African Solar Designs analysis

According to the geospatial analysis, by 2023, 1,639 settlements across Burkina Faso (1,744,319 households) will be connected to the main grid, representing 43.8% of the population. By 2030, this figure will increase to 5,391 settlements (3,879,488 households), equivalent to 79.7% of the population. These estimates are based on the assumption that all planned grid extensions will be completed by 2030.

In the off-grid sector, the analysis identified 3,896 settlements (1,318,256 households) and 33.1% of the population in 2023 are suitable for off-grid stand-alone solutions, decreasing to 1,518 settlements (631,258 households) and 13.0% of the population in 2030 (**Figure ES-5**). While the total size of the OGS market for households will decrease over time, it will also become somewhat more concentrated in the country’s relatively remote eastern regions. This trend has implications for long-term business models of the solar product market, which will need to consider broader distribution areas as the total number of off-grid households declines and becomes concentrated in areas far from urban centers.

Figure ES-5: Estimated Number of Households and Share of Population Suitable for OGS Systems in Burkina Faso, 2023 and 2030

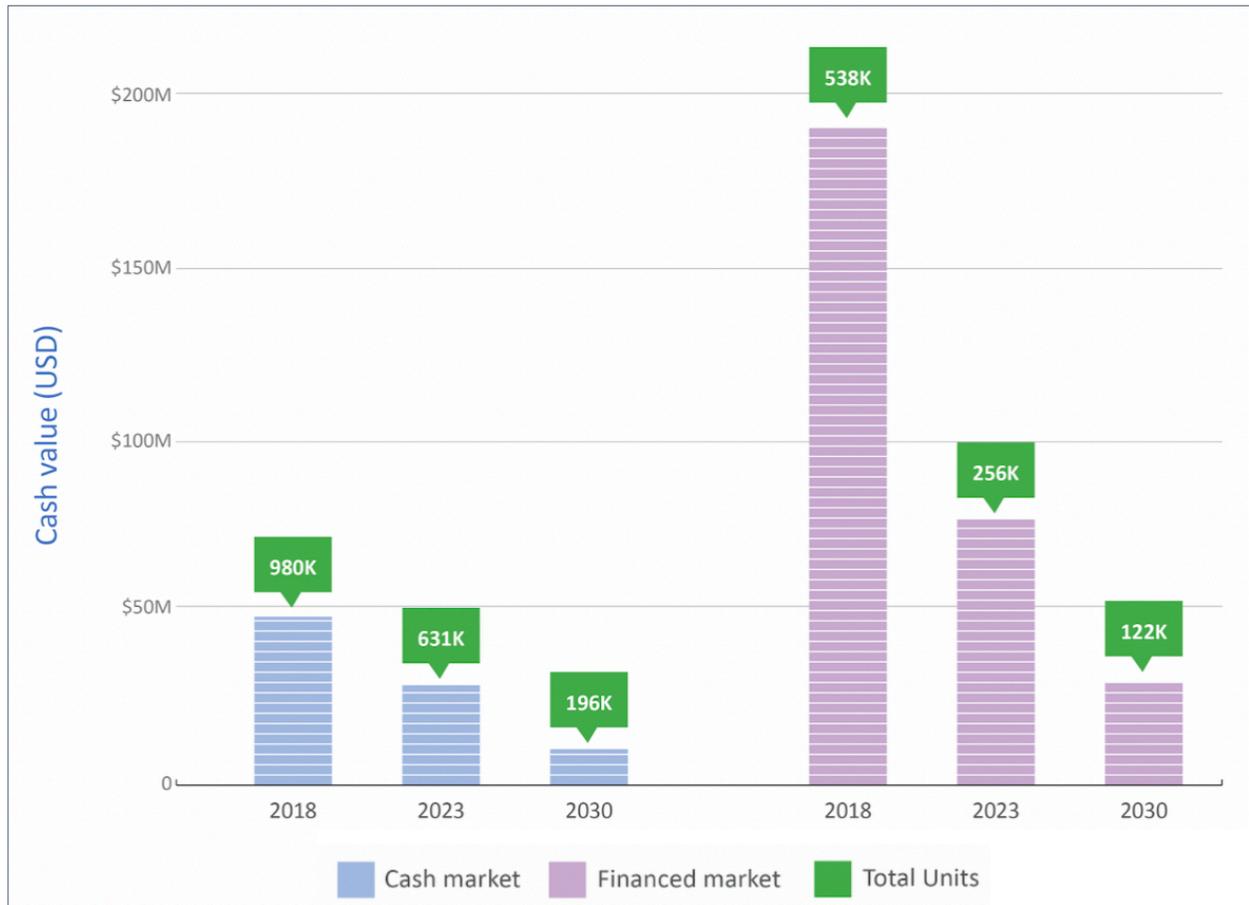


Source: Energio Verda Africa GIS analysis

According to the analysis, the annualized off-grid solar cash market potential for the household sector in 2018 is USD 48.8 million, with the estimated market value more than tripling in size to USD 190.7 million with the addition of consumer financing (**Figure ES-6**). Consumer financing allows the poorest households to enter the market and those already in the market to afford larger systems.

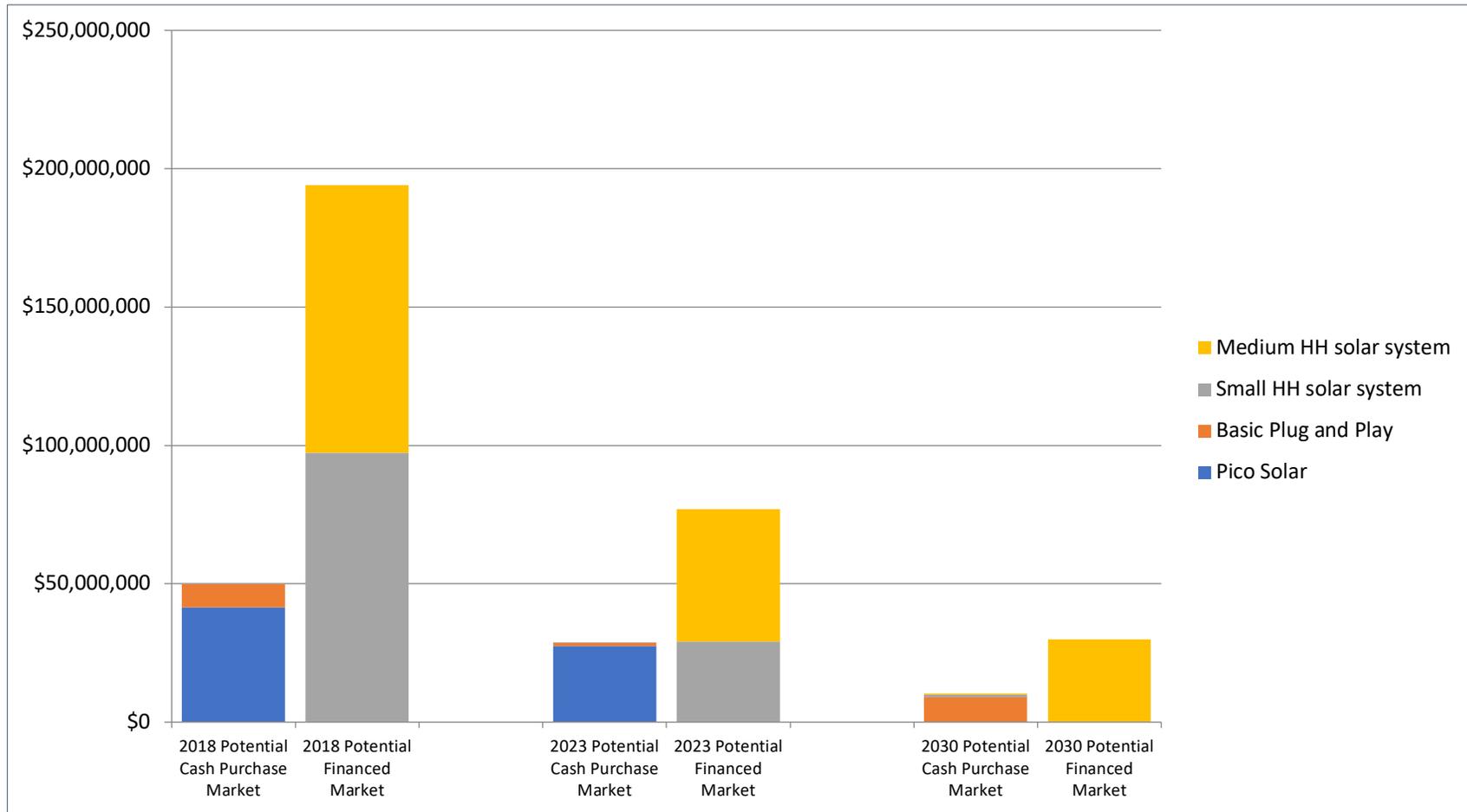
According to the assessment, the most common types of systems the market can afford on a cash basis are pico solar and small plug and play systems; however, this changes significantly with the introduction of financing (**Figure ES-7**). While affordability improves over time, households in the lowest income quintiles cannot afford any off-grid solar products without financing. Consumer financing will therefore prove critical for accelerating off-grid solar market growth and meeting electrification targets through 2030.

Figure ES-6: Estimated Off-Grid Solar Cash and Financed Market Potential for Household Sector



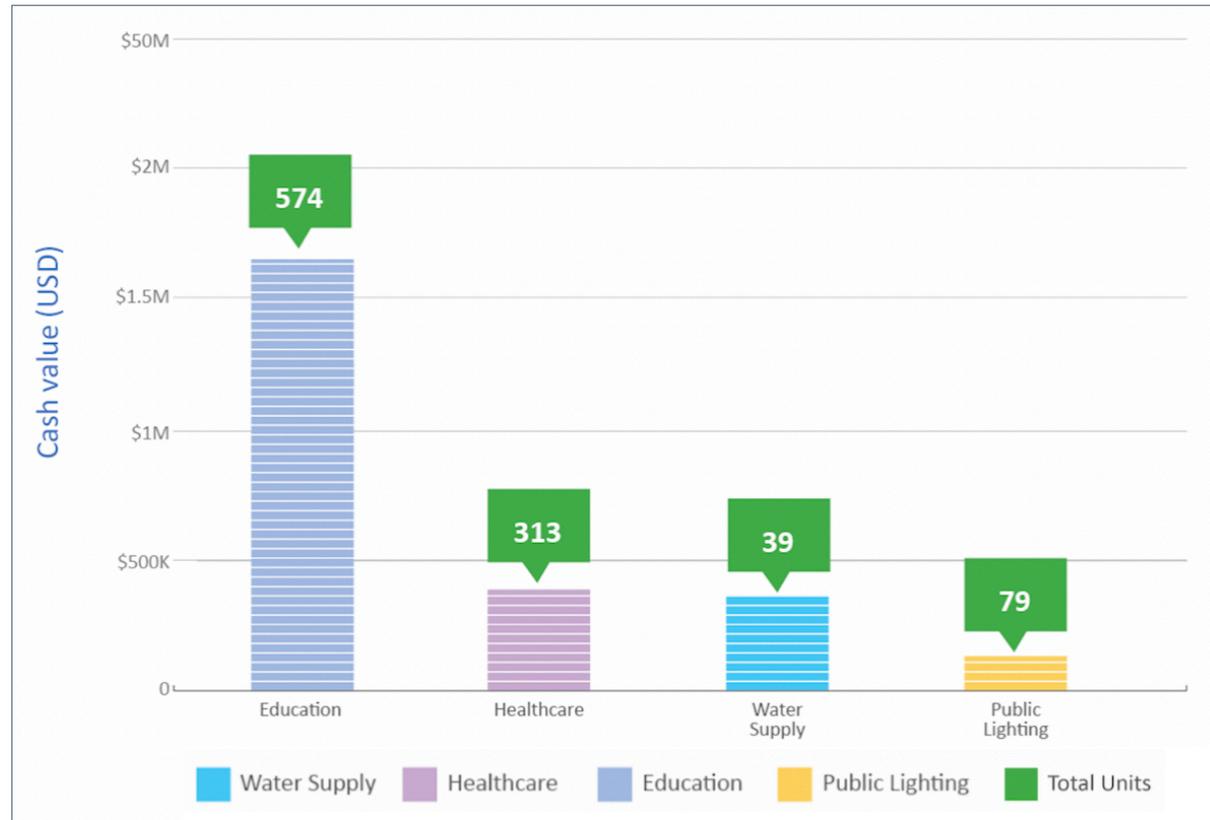
Source: African Solar Designs analysis

Figure ES-7: Estimated Off-Grid Solar Cash and Financed Market Potential for Household Sector by System Type



Source: African Solar Designs analysis

Figure ES-8: Estimated Off-Grid Solar Cash Market Potential for Institutional Sector



Source: African Solar Designs analysis

The estimated annualized cash market potential for Burkina Faso’s public/institutional sector in 2018 is USD 2.5 million (**Figure ES-8**). The institutional market segments with the largest potential are education (USD 1.6M), followed by healthcare (USD 376K), water supply (USD 352K), and public lighting (USD 119K). The water supply sector analysis identified off-grid water points such as boreholes and wells that could benefit from solar technology for water pumping. The healthcare sector analysis identified off-grid health facilities categorized by their size (from basic clinics to enhanced health facilities) that could be electrified by stand-alone systems. The education sector analysis identified primary and secondary schools that could be electrified by stand-alone systems. The public lighting analysis assessed the lighting needs for off-grid villages and market centers (excluding street lighting).

According to the analysis, the annualized off-grid solar cash market potential for the productive use sector in 2018 is USD 28.3 million (Figure ES-9). The estimated demand from value-added applications represents most of the PUE market potential (USD 18.3M), followed by applications for connectivity (USD 9.2M) and SMEs (USD 861K).

Figure ES-9: Estimated Off-Grid Solar Cash Market Potential for Productive Use Sector



Source: African Solar Designs analysis

The value-added applications that were analyzed include solar pumping for agricultural irrigation, solar powered milling and solar powered refrigeration. The assessment utilized a series of inputs, including data from the UN’s Food and Agriculture Organization on national agricultural production, as well as applicable solar technologies to support income generation for small shareholder farmers (i.e. solar pumps, mills, and refrigeration systems). Access to energy for agriculture is critical for the country’s economic development, particularly given the sector’s importance to GDP.

Off-grid solar power supports a wide range of connectivity applications, including mobile phone charging, wi-fi servers, banks, mobile money kiosks, and telecommunications towers. Mobile phone and internet connectivity are also necessary pre-cursors to mobile money and PAYG solutions in the off-grid solar sector. The market sizing examined mobile phone network coverage as well as rates of mobile phone ownership and mobile internet penetration to estimate the market potential for mobile phone charging enterprises (stations/kiosks).

The calculation of the estimated off-grid solar market for SMEs focused only on barbering and tailoring appliances, which comprises a small portion of overall SME sector demand. These two microenterprises are indicative of the service-based SME off-grid solar market, as they benefit significantly from extended working hours and the use of modern appliances/machinery. The estimated demand for this market segment is therefore intended to provide a baseline for future research, as a more robust analysis would be necessary to assess realistic demand from all SMEs.

It should be noted that the Task 2 market sizing assesses the total *potential* demand for off-grid solar, as well as variables that affect demand, such as changes in population density, household income, expansion of national grids and access to finance, among other factors. This data will support policymakers and practitioners as they assess market potential over time. However, the quantitative demand estimate has not been revised to reflect *realistic* market potential. Many other factors and market failures will prevent the full realization of this total market potential, and these will vary by market segment.

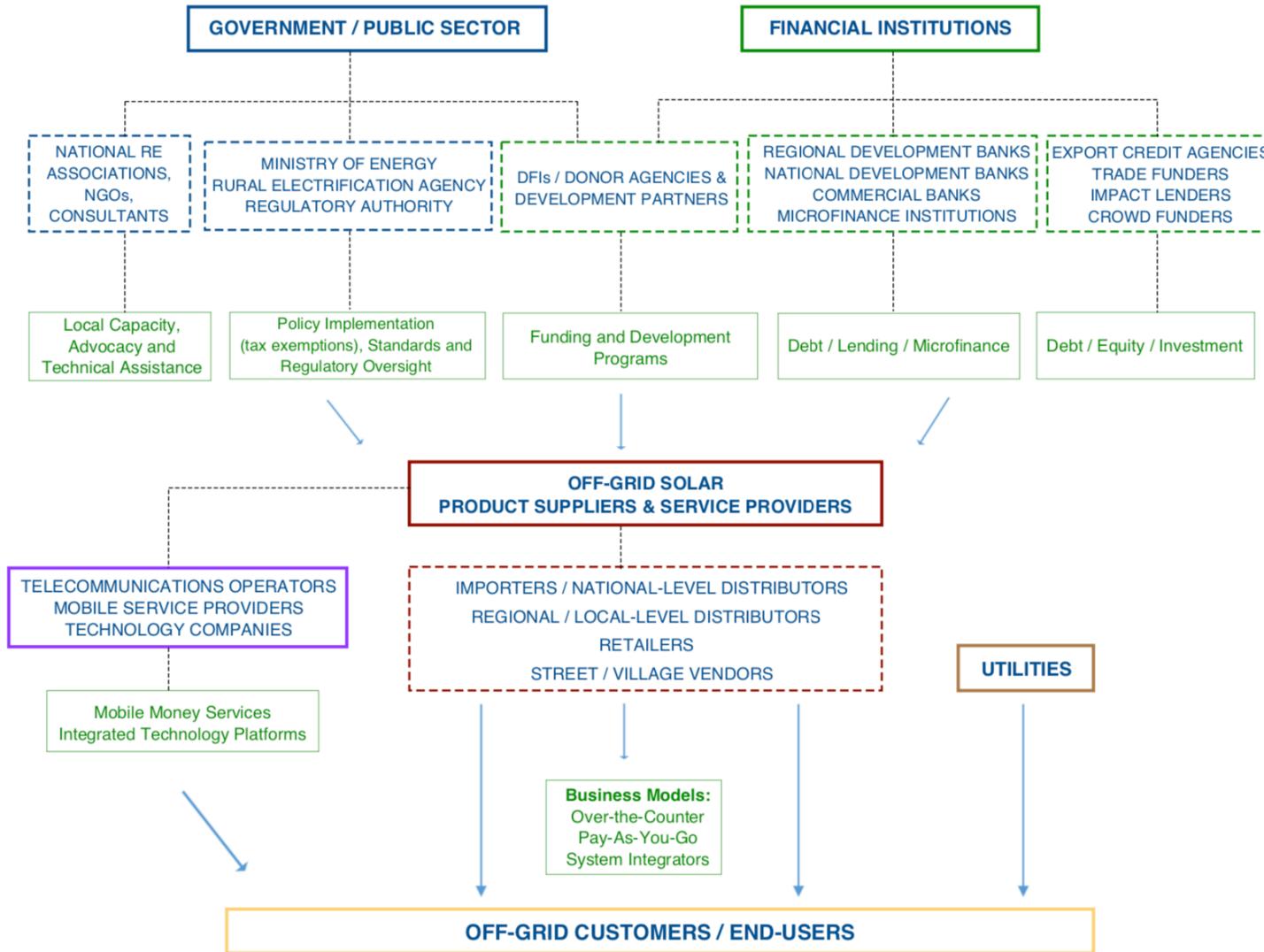
For household demand, the off-grid solar market is already tangible. Still, many factors will affect household demand for solar products, such as distribution realities, consumer education, competing economic priorities for households, financial shocks, etc. The institutional market will be affected largely by government and donor budget allocations along with the potential for community-based finance. The productive use market is perhaps the least concrete. Considered a relatively new market segment for the off-grid solar industry, productive use market dynamics are not yet well understood. The ability to realize potential productive use market demand will also be affected by many of the factors that commonly determine enterprise prospects in the country, including infrastructure, rural distribution, marketing, access to finance, insecurity, regulation, etc. The data presented in this report is intended to provide a baseline for future research.

Following the estimates of market demand, this report analyzes the supply chain for off-grid solar products and services in Burkina Faso, which includes a wide range of stakeholders, including importers, distributors, wholesalers, retailers and end-users (**Figure ES-10**). The solar supply chain is made up of both formal and informal companies that offer a variety of solar products and systems and deploy several business models. Rural households make up the main market for OGS products in the country, as the demand for lighting products and household electrical appliances is growing. Nevertheless, urban households, both electrified and non-electrified, are also a key consumer market, as they may have greater ability to afford solar products and systems. The country's solar market, although still in its nascent stages, is in a period of rapid growth. In fact, GOGLA sales figures from 2016-2017 indicate that Burkina Faso experienced the second highest sales volume and revenue in West Africa behind only Nigeria during this period.

The off-grid solar supply chain faces several barriers, including competition from the informal market. The widespread sale of low-quality, uncertified products undermines consumer confidence in solar equipment, undercuts the prices of sellers of quality-verified products and hinders overall OGS market growth. There are also a number of interrelated challenges and capacity building needs of the supply chain, including financial, capacity, awareness and regulatory challenges.

Burkina Faso's nascent solar market is poised to grow if requisite technical assistance is provided to the supply chain. To operate effectively, companies need a significant amount of both local and international technical and financial expertise, as well as an ability to make practical decisions about their operations. Companies must manage a number of technical competency requirements, including the selection of business models, importation and distribution channels, solar PV technologies, as well as the design and implementation of associated marketing instruments and related initiatives.

Figure ES-10: Off-Grid Solar Market and Supply Chain Overview



Source: GreenMax Capital Advisors

Local industry and supply-chain stakeholders who participated in the Task 2 focus group discussions and surveys identified the following key barriers to and drivers of OGS market growth in Burkina Faso:

Key Barriers to Off-Grid Solar Market Growth
• Low consumer purchasing power and lack of consumer financing options
• Low levels of consumer awareness of solar solutions, particularly in rural areas
• Lack of financing for solar companies
• Informal sector competition and market spoilage
• Lack of local capacity/qualified technicians to maintain systems
• High transaction costs associated with equipment inventory, distribution, importation, taxation etc.
• Insufficient or fragmented market data on consumer electricity needs, usage or experience
Key Drivers of Off-Grid Solar Market Growth
• Strong off-grid electricity demand
• Government policy and action is supportive of the industry, which helps attract substantial/sustained investment to the market
• Growing penetration of mobile money services allows OGS companies to increasingly utilize integrated technology platforms and innovative business models to offer PAYG consumer financing solutions to the market
• Extensive private sector engagement in development of the off-grid sector, with companies adopting new business models and strategies to attract external investment and expand their operations
• Strong donor presence and support from the international development community provides confidence that the market will continue to receive financial, policy and technical support necessary to develop

Source: Focus Group Discussions; Stakeholder interviews; African Solar Designs analysis

Access to financing is critical for off-grid solar market growth. Solar companies need financing for working capital needs, while off-grid solar consumers need financing for the purchase of systems. This report analyzes the willingness and capacity of national and regional financial institutions to provide financing to businesses and consumers in Burkina Faso and throughout the region to support development of the OGS sector. In addition to commercial banks and microfinance institutions, impact investors and crowd funders are also active in several markets across the region.

In Burkina Faso, access to banking and financial services through formal institutions remains limited, particularly in rural areas of the country. While microfinance institutions have helped fill this void, informal sources of financing also serve a significant portion of the population. There are wide disparities in rates of access to financial services between urban and rural populations. In 2016, the average rate of access to bank financial services was 9.2% in rural areas compared to 44.1% in urban areas.<sup>28</sup>

Although access to banking and financial services through formal institutions remains limited, Burkina Faso is experiencing a sharp increase in the availability and usage of digital financial services and mobile banking, driven by widespread mobile phone ownership, rapidly growing mobile internet usage and network coverage. This dynamic is driving greater financial inclusion; in 2017, 43% of Burkina Faso’s adult population had an account at a financial institution or with a mobile money service provider, up from 13% in 2011 and 10% above the regional average in West Africa and the Sahel. Despite the country’s overall improvement with regard to financial inclusion, there is still a significant gender gap in rates of access to financial services, as women in Burkina Faso are 17% less likely than men to have an account at a financial institution or with a mobile money service provider.<sup>29</sup>

<sup>28</sup> “FinScope Consumer Survey Highlights: Burkina Faso 2016,” Finmark Trust and the UN Capital Development Fund, (2017): <http://www.finmark.org.za/wp-content/uploads/2017/04/finscope-pocket-guide-burkina-faso-en.pdf>

<sup>29</sup> Demirguc-Kunt, A., Klapper, L., Singer, D., Ansar, S., and Hess, J., “The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution,” World Bank, (2017): <http://documents.worldbank.org/curated/en/332881525873182837/pdf/126033-PUB-PUBLIC-pubdate-4-19-2018.pdf>

Expanding digital financial services, especially mobile money, can create new opportunities to better serve women, the lower-income population, and other groups that are traditionally excluded from the formal financial system. Moreover, mobile money technology also plays a critical role in the application of off-grid solar solutions, particularly for PAYG systems that rely on the interoperability between digital financial services and stand-alone solar devices.

While there are several donor and DFI-funded programs and initiatives that provide financing to support development of the off-grid solar market (e.g. PASEL), these funds have not been channeled through local commercial banks or MFIs. ROGEP is therefore a pioneering initiative in the country, as it endeavors to boost OGS lending via engagement with local financial partners. Local FIs are increasingly becoming more aware of the opportunities in the off-grid space, thanks in part to the efforts of AFD’s Sustainable Use of Natural Resources and Energy Finance (SUNREF) program. In 2014, Orabank, Société Générale and AFD signed a partnership agreement to launch SUNREF’s West Africa program, which makes a EUR 30 million credit line available to banks in the West African Economic and Monetary Union. The SUNREF West Africa program has been active in Burkina Faso since 2016, with several projects being assessed for financing in the agriculture, construction and services industries – most of which will utilize stand-alone solar technology.<sup>30</sup>

Apart from these promising developments, there are still areas where improvement is needed. Access to financing with affordable terms remains a significant barrier for Burkinabe companies. Furthermore, despite the country’s overall improvement with regard to financial inclusion, there is still a significant gender gap in rates of access to financial services. According to the World Bank’s Global Findex survey, women in Burkina Faso are about less likely than men to have an account at a financial institution or with a mobile money provider.<sup>31</sup> There are also challenges surrounding low levels of financial literacy, and there is no system/registry in place with borrower information for lenders to conduct credit assessments.

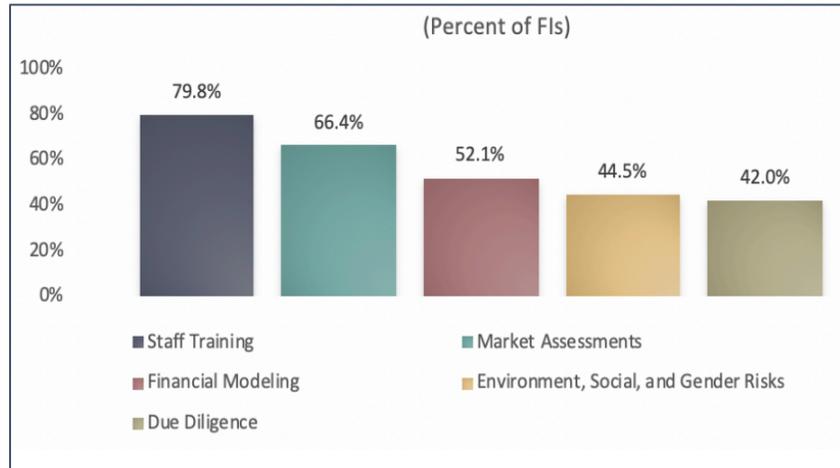
According to the Task 3 survey of financial institutions in Burkina Faso and across the region,<sup>32</sup> there is strong interest to provide financing to the off-grid solar sector. Respondents identified loan guarantees and credit lines as the most important measures to reduce market entry risks for lenders and stimulate FI engagement in the sector. Surveyed FIs also identified several areas of internal capacity that require improvement in order to lend (or increase lending) to the OGS sector (**Figure ES-11**). The most common need among FIs was training for bank staff, which includes *inter alia* assistance to originate deals and appropriately assess the credit risk of off-grid solar firms and projects, due diligence support to qualify products and approve vendors, and targeted support for new lenders to the sector with product structuring and development as well as building deal-flow. Technical assistance for solar enterprises (as is envisioned under Component 1B of ROGEP) will also be necessary, as entrepreneurs often do not have proper financial management and accounting systems in place, are unable to present quality financial models and lack the expertise required to structure their companies to take on debt obligations.

<sup>30</sup> “Burkina Faso’s Solar Ambitions,” Sunref, (5 May 2017): <https://www.sunref.org/en/les-ambitions-solaires-du-burkina-faso/>

<sup>31</sup> Demirguc-Kunt et al., 2017.

<sup>32</sup> The results are based on feedback from a total of 121 FIs (including commercial banks, microfinance institutions and other non-bank FIs) that were interviewed across the 19 countries.

Figure ES-11: Financial Institution Needs to Increase Off-Grid Solar Lending



Source: Financial Institution survey; Stakeholder interviews; GreenMax Capital Advisors analysis

Gender inclusiveness is also a key component of this market assessment, and the key findings of the gender analysis are presented throughout this report. Given that the off-grid market is only beginning to emerge in Burkina Faso, women are not yet highly engaged in the sector. The overall lack of inclusive participation in the off-grid space is attributable to a wide range of factors. A 2018 survey conducted by IRENA found that nearly three-quarters of respondents cited cultural and social norms as the most common barrier to women’s participation in expanding energy access, which reflects the need for gender mainstreaming (**Figure ES-12**). More than half of the women surveyed in Africa identified a lack of skills and training as the most critical barrier, compared to just one-third of respondents globally.<sup>33</sup>

The same survey found that access to necessary technical, business or leadership skills development programs was the single most important measure that could be taken to improve women’s engagement in energy access. Over half of survey respondents also highlighted the need to integrate gender perspectives in energy access programs, mainstream gender in energy policies and to enhance access to financing for women (**Figure ES-13**).<sup>34</sup>

<sup>33</sup> “Renewable Energy: A Gender Perspective,” International Renewable Energy Agency, (2019): [https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA\\_Gender\\_perspective\\_2019.pdf](https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA_Gender_perspective_2019.pdf)

<sup>34</sup> Ibid.

Figure ES-12: Key Barriers to Women’s Participation in Energy Access

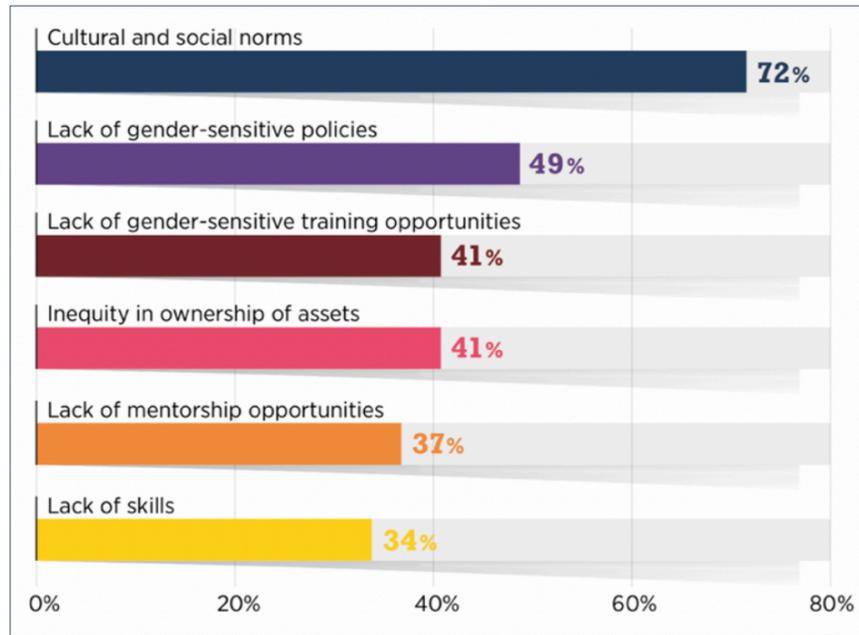
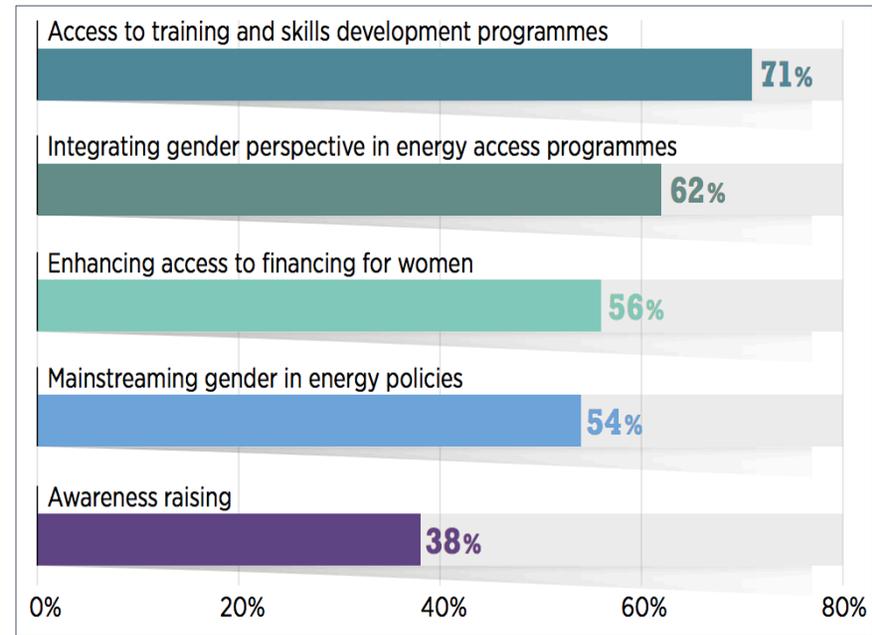


Figure ES-13: Measures to Improve Women’s Engagement in Energy Access



Source: International Renewable Energy Agency

The gender analysis undertaken in corroborated many of these findings and revealed several interrelated challenges that women face in the off-grid sector, including lack of Burkina Faso access to skills development, technical capacity building, and education/training; lack of access to capital, asset ownership, collateral and credit (e.g. to start a business); and low rates of financial literacy due to a lack of education and information available to women on access to financial resources.

A number of initiatives exist that seek to address some of these challenges and help improve gender inclusion in the country’s energy and off-grid sectors. For example, in 2018, ECREEE partnered with AfDB to launch a regional workshop to advance the participation of women in the renewable energy sector. The program intends to address the lack of female inclusion in the energy value chain, as women represent only 2% of energy sector entrepreneurs in West Africa. The joint initiative ultimately seeks to develop a pipeline of investment-ready, women-owned energy businesses across the region, including in Burkina Faso.<sup>35</sup>

<sup>35</sup> “Feasibility study promotes women’s participation in energy transition,” ESI Africa, (7 May 2018): <https://www.esi-africa.com/feasibility-study-promotes-womens-participation-in-energy-transition/>

## I. STATE OF ENERGY ACCESS AND ENABLING MARKET ENVIRONMENT

This section begins with a brief introduction of key macroeconomic and social indicators in Burkina Faso (Section 1.1). This is followed by an overview of the country’s existing energy sector (Section 1.2), with a focus on the status of energy access, including an assessment of both the on-grid and off-grid markets, a least-cost electrification analysis and a review of gender policies. Section 1.3 examines national energy policy and regulation vis-à-vis the off-grid solar market, including detailed analysis of the existing framework for off-grid stand-alone systems<sup>36</sup> in Burkina Faso as well as gaps in the framework. Section 1.4 is a summary of all relevant national and donor-funded development initiatives in the off-grid sector. Annex 1 provides an overview of the Task 1 methodology.

### 1.1 Country Overview

Burkina Faso is a landlocked nation in West Africa with a young, rapidly-growing population that relies heavily on subsistence farming. Real GDP growth was estimated at 6.7% in 2017 and is expected to continue along this trajectory in 2018 bolstered by increased public investment and higher prices for gold and cotton, which are the country’s two key exports.<sup>37</sup> The country’s macroeconomic gains have not translated into improvements for the majority of the population, rates of poverty and unemployment are very high, particularly in rural areas where a large majority of the population lives.

Table 1: Macroeconomic and Social Indicators

Population	19.2 million <sup>38</sup>
Urban Population	31% of total
GDP	USD 12.3 billion
GDP growth rate	6.7%
GNI per capita*	USD 590
Unemployment rate	6.3%
Poverty rate	40.1% (2014)
Urban	13.7%
Rural	47.5%
Currency	West African CFA franc (CFA)
Official language	French
Natural resources	Agricultural (cotton); ores (gold, zinc, copper, manganese, phosphate and limestone)



\* World Bank Atlas method (current USD)<sup>39</sup>

All figures from 2017 unless otherwise indicated

Source: AfDB and World Bank and IMF<sup>40</sup>

<sup>36</sup> NOTE: The term “off-grid” as it is widely used throughout this report (e.g. “off-grid sector”) refers to both mini-grids and stand-alone systems. When “off-grid solar” or its acronym “OGS” are used, this refers *only* to stand-alone systems and does not include mini-grids

<sup>37</sup> “Burkina Faso Economic Outlook,” African Development Bank, (2018): <https://www.afdb.org/en/countries/west-africa/burkina-faso/burkina-faso-economic-outlook/>

<sup>38</sup> 50.3% female/49.7% male

<sup>39</sup> “World Bank Open Data: Burkina Faso,” World Bank, (2017): <https://data.worldbank.org/country/burkina-faso>

<sup>40</sup> “Seventh Review Under the Extended Credit Facility, Burkina Faso,” IMF, (2017): <https://www.imf.org/~media/Files/Publications/CR/2017/cr17222.ashx>

## 1.2 Energy Market

### 1.2.1 Energy Sector Overview

The state-owned utility, Société Nationale d'Électricité du Burkina (SONABEL), has a monopoly on the transmission and distribution segments for urban areas.<sup>41</sup> The utility also oversees electricity production, sales, and imports. Since liberalization of the production segment in 2007, two private sector players entered the market: APR Energy, operating the Kossodo thermal plant (30 MW) and GPS, operating the Ouaga 2000 thermal plant (31 MW). The Burkinabé Rural Electrification Agency (Agence Burkinabè de l'Électrification Rurale, ABER) is responsible for promoting rural electrification and off-grid development. Since 2013, the Government of Burkina Faso (GoBF) has initiated various projects to support electrification within rural communities through ABER. The agency presently works with rural cooperatives (COOPELS) to coordinate development efforts towards rural and off-grid electrification in the country. To properly structure the renewable energy sector, the National Agency for Renewable Energy and Energy Efficiency (Agence Nationale des Énergies Renouvelables et de l'Efficacité Énergétique, ANEREE) was created in 2017 to organize policy, promote private sector participation through Independent Power Producers (IPPs) and mobilize funding.

Table 2: Institutional and Market Actors in the Energy Sector

Institution / Company	Role in the Energy Sector
Ministry of Energy (MOE)	The Ministry of Energy is responsible for defining and implementing national energy policies, development of the energy sector, strategic planning of electrification and regulation and control of electrical infrastructures
Société Nationale d'Électricité du Burkina Faso (SONABEL)	Public utility company that responds to the MoE and is responsible for electricity production, transmission, distribution, sales and imports
Autorité de Régulation du Secteur de l'Électricité (ARSE)	Independent regulatory authority that responds to the Office of the Prime Minister and is responsible for ensuring proper implementation of electricity regulation and laws, protecting electricity consumer interests, licensing IPPs and setting tariffs
Agence du Burkinabè de l'Électrification Rurale (ABER)	National agency under the MoE that is responsible for the implementation of national rural electrification policy
Agence Nationale des Énergies Renouvelables et de l'Efficacité Énergétique (ANEREE)	National agency under the MoE that is responsible for (i) structuring the renewable energy and energy efficiency sectors; (ii) mobilizing funding; (iii) supporting developers and private sector investments; (iv) and facilitating access to technology
Electricity Co-operatives (Coopératives d'Électricité, COOPELS), under the National Union of Electricity Co-operatives (UNCOOPEL)	<ul style="list-style-type: none"> <li>The COOPELS are created by ABER or by private initiatives and include community members of the beneficiary population;</li> <li>UNCOOPEL is the Union that lobbies for financing of the COOPELS, conducts training and supports rural development initiatives</li> </ul>
Local authorities (Collectivités Territoriales)	<p>Per the 2017 Energy Law, local authorities are responsible:</p> <ul style="list-style-type: none"> <li>Giving an opinion on municipalities and regions' electrification plans</li> <li>Participating in the elaboration of the municipalities and regions' rural electrification master plan</li> <li>Preparing and implementing local plans on production, distribution and energy efficiency</li> <li>Creating and managing energy infrastructures</li> <li>Carrying out and managing street lighting</li> <li>Granting concessions</li> </ul>

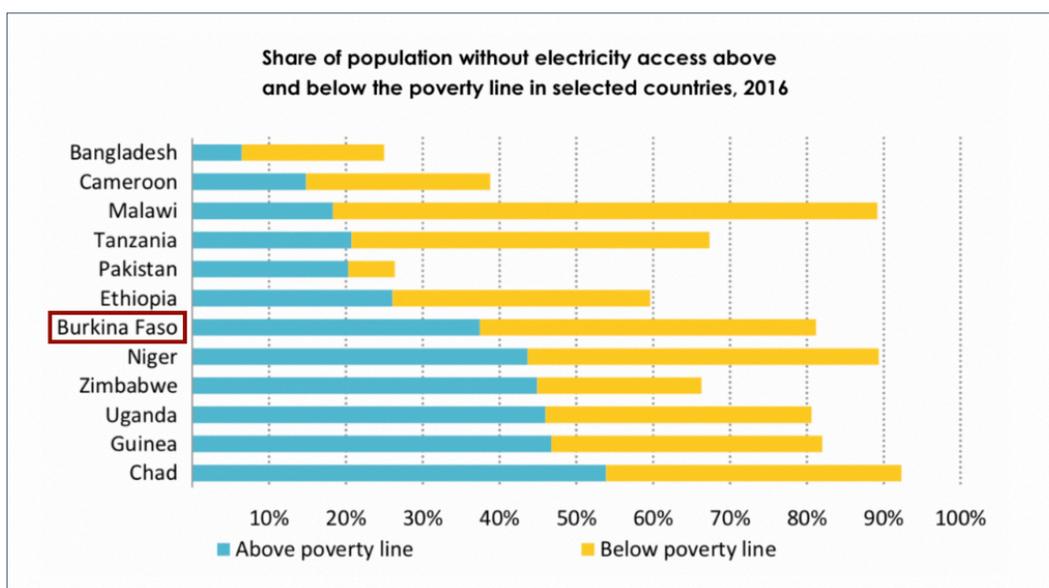
Source: ECOWAS Center for Renewable Energy and Energy Efficiency

<sup>41</sup> "Rôle et responsabilités des institutions publiques au Burkina Faso," ECREEE, (2018).

1.2.2 Electricity Access: *Grid and Off-grid*

Electricity access rates in Burkina Faso remain among the lowest in Africa. In 2016, an estimated 80% of the population – about 15 million people – did not have access to electricity, with a significant disparity in rates of access between urban (58%) and rural (1%) areas.<sup>42</sup> A similar urban-rural electrification gap can be observed in public health and education facilities across the country. An estimated 47% of the rural population has access to health centers with electricity, while 3% have access to electrified schools.<sup>43</sup> Despite widespread poverty, a significant portion of the population lives above the poverty line, but without electricity access, signaling that the lack of access is due in part to systemic issues related to grid infrastructure and the high cost of connection (**Figure 1**). The Government has set a target of increasing the national electrification rate to 45% by 2020 and 65% by 2030 (**Table 3**).

Figure 1: Rates of Electricity Access and Poverty



Source: International Energy Agency

Table 3: Electricity Access Targets<sup>44</sup>

Indicator	2016 (IEA)	2020 target	2030 target
Electricity coverage rate <sup>45</sup>	39%	80%	100%
Electricity access rate	20%	45%	65%
Urban areas	58%	75%	95%
Rural areas	1%	19%	50%

Source: International Energy Agency and European Commission

<sup>42</sup> “Energy Access Outlook, 2017: From Poverty to Prosperity,” International Energy Agency, (2017): [https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport\\_EnergyAccessOutlook.pdf](https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport_EnergyAccessOutlook.pdf)

<sup>43</sup> “Plan d’Action National des Energies Renouvelables (PANER),” ECREEE / SEforALL, (2015): [http://se4all.ecreee.org/sites/default/files/paner\\_bfa\\_juillet\\_15\\_final.pdf](http://se4all.ecreee.org/sites/default/files/paner_bfa_juillet_15_final.pdf)

<sup>44</sup> Moner-Girona, M., “Mapping the least-cost option for rural electrification in Burkina Faso: Scaling-up Renewable Energies,” European Commission – Joint Research Center, (2017):

[http://publications.jrc.ec.europa.eu/repository/bitstream/JRC102198/102198\\_online\\_2017\\_2517\\_src\\_en\\_fr\\_final.pdf](http://publications.jrc.ec.europa.eu/repository/bitstream/JRC102198/102198_online_2017_2517_src_en_fr_final.pdf)

<sup>45</sup> Coverage rate: share of the population that lives in electrified localities out of the total population in the country

### 1.2.2.1 Off-Grid Market Overview

Off-grid development remains limited among the rural population, as less than 1% of the total off-grid population has access to renewable energy off-grid services.<sup>46</sup> Thus far, GoBF electrification efforts have largely focused on prioritizing grid extension. Since 2008, SONABEL has been targeting grid extension for communities of more than 1,500 inhabitants located within 25 km from the closest distribution line. Only 3% of rural communities, most of which have fewer than 6,000 inhabitants, are located further than 25 km from the grid. The National Renewable Energy Action Plan (Plan d'Action National pour les Énergies Renouvelables, PANER) targets solar mini-grids to support rural electrification. Mini-grid electrification is expected to cover 12.8% of the rural population by 2020, with a focus on population centers with less than 1,500 people and located far from the main grid. Moreover, 62.5% of rural mini-grids are expected to be run on renewable energy (RE) technologies.

In addition to the activities carried out by the rural electrification agency, ABER, the rural electrification fund (Fonds de Développement de l'Électrification, FDE) also promotes electricity access in rural areas, mainly through grid extension (low voltage distribution lines) or through the development of solar and/or hybrid mini-grids. The FDE has also developed a model of electrification based on electricity cooperatives, the COOPELS. Under the Electricity for All Program, 60 COOPELS are partnering with ABER to generate diesel electricity in off-grid rural areas. These cooperatives, organized under the UNCOOPEL, are responsible for the generation and distribution of electricity in rural areas that are not connected to the grid. COOPELS receive investment subsidies, VAT exemptions, and discounts on fuel. A 2015 legal decree refers to specific terms and conditions for concession, licensing, authorization and submission contracts for electricity installations and allows for the licensing of off-grid projects to private developers rather than only to cooperatives.

The Access to Energy Services Program (Projet d'Acces aux Services Énergétiques, PASE) is the main rural electrification program for the GoBF. Between 2004 and 2017, the program received support from the World Bank through the PASEL project (Projet d'Accès aux Services Électriques) and has directly supported the electrification of 210 localities, including 21 with solar kits.<sup>47</sup> The PASEL has several components. It consists of the electrification of these localities distributed in the 13 regions of the country through (i) connection to the national grid, (ii) solar PV/diesel hybrid projects, and (iii) standalone solar systems.

Under Component 3: Improving efficient use of energy in target areas, PASEL is implementing Lighting Africa activities including, *inter alia*:

- Provision of capacity training on off-grid lighting in rural electrification strategies;
- Development of public service announcements and awareness campaigns to inform consumers of the benefits of solar lanterns and other good quality products; and
- Deployment of approximately 25,000 solar lanterns in public schools focusing on those in off-grid communities.

Several development partners also support off-grid development in the country (see **Section 1.4**). With financing from the United Nations Development Programme (UNDP), multi-functional community-based platforms have developed and implemented rural electrification initiatives, including solar PV projects,

<sup>46</sup> Ibid.

<sup>47</sup> "Burkina Faso Electricity Sector Support Proposed Additional Credit," World Bank, (2017):

<http://documents.worldbank.org/curated/en/275641497146431923/pdf/BF-PP-05152017.pdf> and "Burkina Faso - Second Energy and Fiscal Management Development Policy Financing Project," World Bank, (2017):

<http://documents.worldbank.org/curated/en/970061513479640534/pdf/BURKINA-FASO-PAD-11212017.pdf>

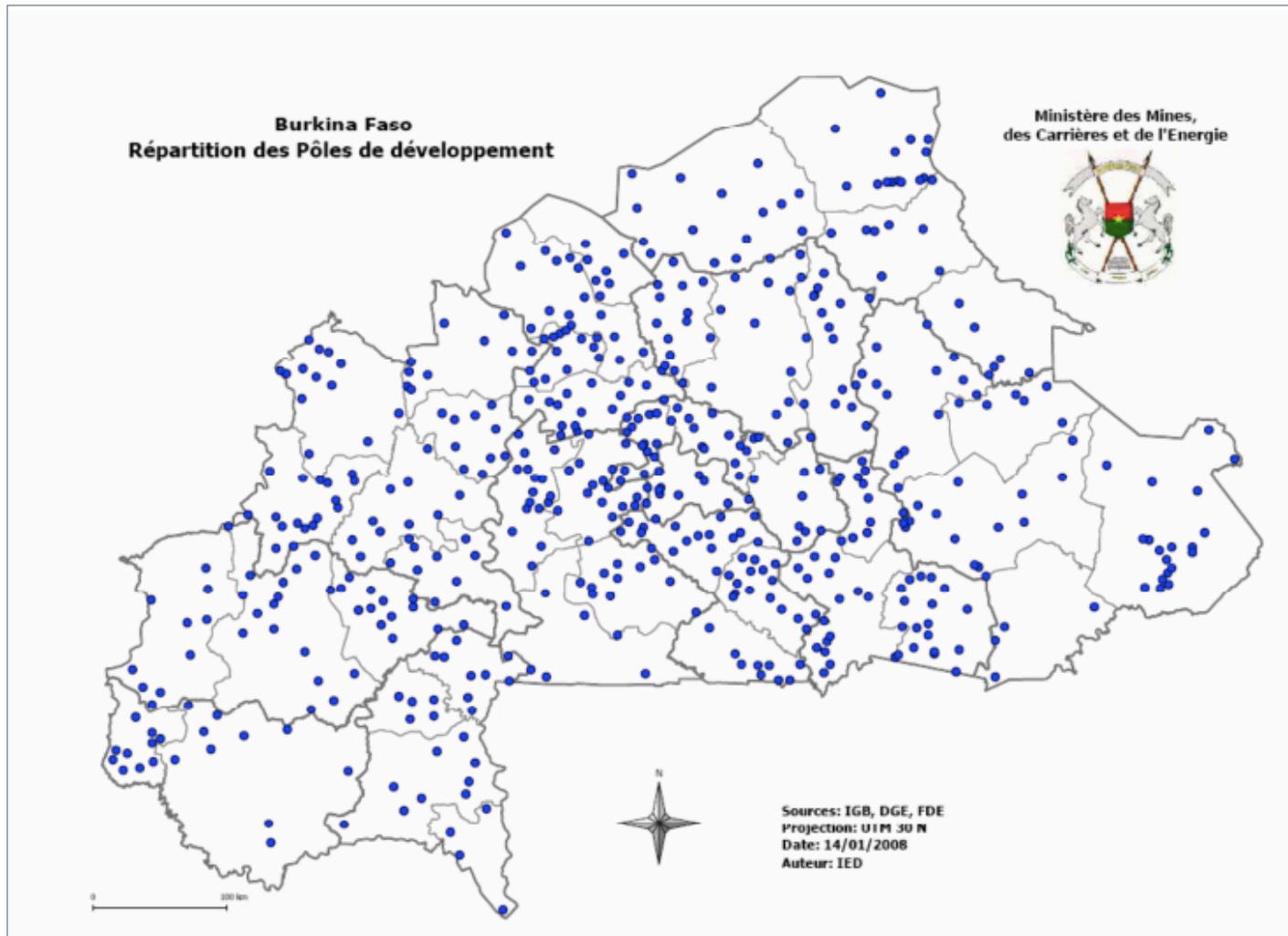
diesel generation, battery charging and water pumping. Women's groups have played an important role in running these platforms. The GoBF has already identified 619 priority off-grid communities that could benefit from these platforms (**Figure 2**). The Dutch foundation, Foundation for Rural Energy Services (FRES), is also actively engaged in the country's off-grid market. FRES partners with private solar companies to support deployment of solar electricity to rural households and microenterprises (see **Section 2.4.3** for more details).

Despite relatively limited activity in the off-grid sector to date, there is significant potential for this market to grow in Burkina Faso. According to the AfDB, 37% of the population (6.6 million people) would have improved electricity access using off-grid solutions, representing an estimated market size of USD 117.1 million in 2017.<sup>48</sup> Current off-grid households located further than 15km away from the existing grid include villages of 1,000 to 5,000 inhabitants. Based on the 2025 planned network coverage, 1.2 million people can benefit from improved electricity access using off-grid solutions. The future off-grid market is estimated to be USD 20.9 million and includes several regions with high potential such as East, Saheland and Boucle du Mouhon.

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<sup>48</sup> "Green Mini-grid Market Development Programme," SEforALL Africa Hub and African Development Bank, (2017): <https://greenminigrd.SEforALL-africa.org/sites/default/files/GMG%20Burkina%20Faso%20report%20final.pdf>

Figure 2: Priority Off-Grid Centers<sup>49</sup>



Source: European Commission

<sup>49</sup> “Mapping the least cost option for rural electrification in Burkina Faso: Scaling up renewable energy,” European Commission, (2017): <https://ec.europa.eu/jrc/en/publication/euro-scientific-and-technical-research-reports/mapping-least-cost-option-rural-electrification-burkina-faso-scaling-renewable-energies>

1.2.2.2 Demand and Supply/Generation Mix

Table 4: Electricity Sector Indicators, 2017<sup>50</sup>

Burkina Faso has an installed capacity of 355 MW, with about 80% of this provided by thermal generation and the remaining balance coming from large hydropower and solar power (Table 4 and Table 5).<sup>51</sup> Major thermal plants are located in Ouagadougou, Bobo-Dioulasso and Koudougou, while primary hydropower plants are located in Bagré, Komienga, Niofila and Touni. In 2017, a 33 MW solar power plant began operation in Zagtouli on the outskirts of Ouagadougou.<sup>52</sup>

Installed Capacity	355 MW
Thermal	288 MW
Hydropower	32.5 MW
Renewable (non-hydro)	36.1 MW
National electrification rate (2016)	20%
Urban electrification rate	58%
Rural electrification rate	1%
Population without access	15 million
Households without access	2.7 million
Electrification target	45% access by 2020; 65% by 2030

Source: IEA, Ministry of Energy and World Bank

Growth in the electricity supply has not kept up with demand as the country’s power deficit was estimated to be between 80-110 MW in 2017.<sup>53</sup> As demand has increased, Burkina Faso has had to steadily import more electricity to compensate (Figure 3). With a 10% expected annual growth rate in electricity demand through 2020, the Government aims to allocate additional public investment in installed capacity and grid maintenance. To meet growing demand, the GoBF intends to expand existing thermal power plant capacity and increase new thermal, hydro, and solar power capacity, as well as imports from neighboring countries.

Due to the high cost of power generation, electricity tariffs do not reflect the full cost of production. Average prices (USD 0.22/kWh) are lower than electricity generation costs (USD 0.26/kWh), with the difference subsidized by the Government. The majority of customers are low-voltage consumers (55% of electricity sold), while 40% of all sales come from the small fraction of high-voltage consumers. Fuel costs for thermal plants (diesel and heavy fuel oil) represent more than 40% of total electricity costs.<sup>54</sup>

Table 5: Current and Planned Installed Capacity

Installed Capacity (MW)	2017	2025
Thermal	288	459
Hydropower	32.5	84
Solar <sup>55</sup>	34.8	279
Biogas <sup>56</sup>	1.3	-
<b>Total</b>	<b>356.6</b>	<b>822</b>
Total thermal	288	459
Total renewable energy	68.6	363

Source: Ministry of Energy and World Bank

<sup>50</sup> See Section 2.1 for more details on households/population without access to electricity.

<sup>51</sup> “Direction Générale des Énergies Renouvelables,” ROGEP National Workshop, ECREEE / Ministry of Energy, (22 November 2017); and “Burkina Faso Power Africa Fact Sheet,” USAID, (2018): <https://www.usaid.gov/powerafrica/burkina-faso>

<sup>52</sup> “Burkina Faso unveils Zagtouli solar power plant,” ESI Africa, (November 29, 2017): <https://www.esi-africa.com/industry-sectors/renewable-energy/burkina-faso-unveil-zagtouli-solar-power-plant/>

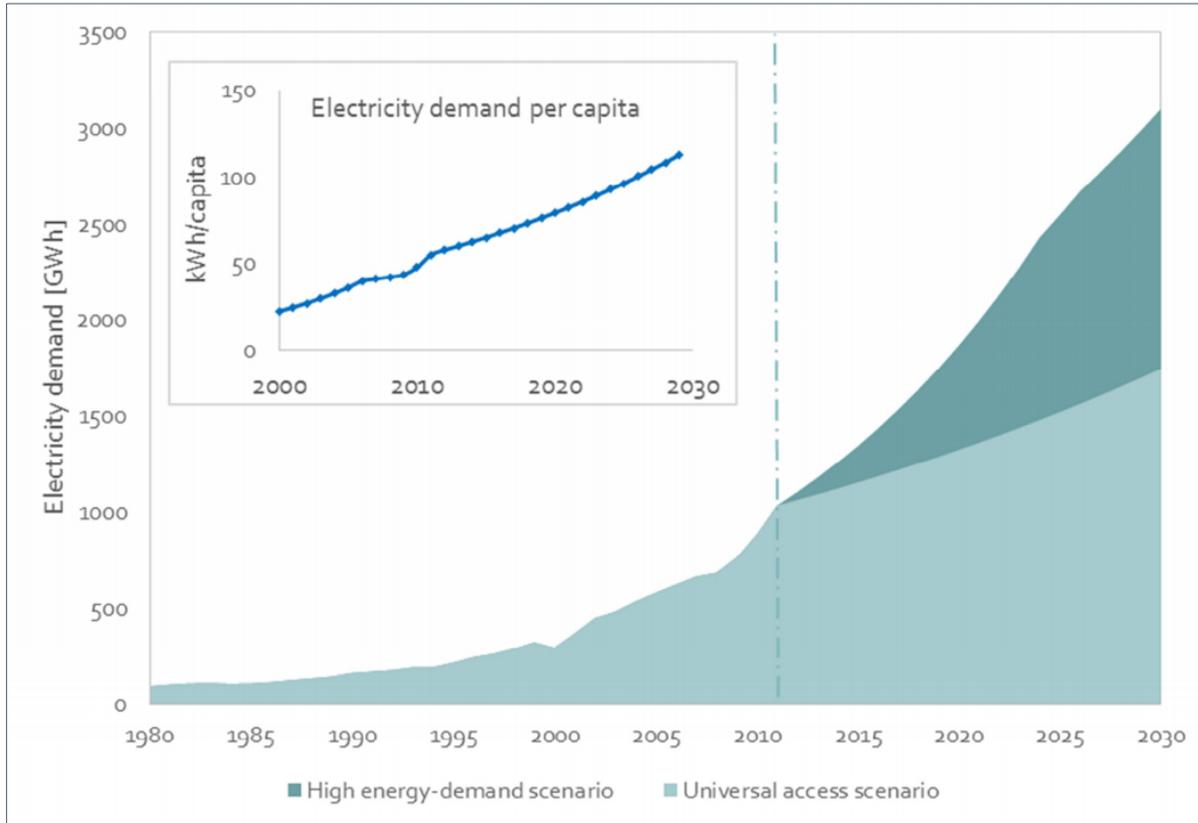
<sup>53</sup> “Mapping the least cost option for rural electrification in Burkina Faso: Scaling up renewable energy,” European Commission, (2017): <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/mapping-least-cost-option-rural-electrification-burkina-faso-scaling-renewable-energies>

<sup>54</sup> Stakeholder interviews, 2018.

<sup>55</sup> Zagtouli: 33.7MW; Ziga: 1.1MW

<sup>56</sup> FasoBiogaz IPP

Figure 3: Electricity Demand Projections<sup>57</sup>



Source: European Commission

Increasing demand for electricity in Burkina Faso is driven in part by the need for off-grid electricity in the mining and agriculture sectors. While the mining sector is one of the largest consumers of electricity in the country, demand for large irrigation systems is also significant, with more than 100 locations identified by the EU. The consistent demand for irrigation pumps makes these locations highly suitable for off-grid solar installations.

### 1.2.2.3 Transmission and Distribution Network

Burkina Faso has an extensive transmission and distribution network (**Figure 4**). Overall, a significant gap exists between the infrastructure needs of the country’s power sector and the availability of resources to invest in grid maintenance and extension to rural areas; as a result, the country’s electricity network is overloaded, unreliable and badly in need of investment (**Figure 5** and **Figure 6**). Total network losses were 16.6% in 2017, driven by distribution losses (14.5%); this figure is relatively low compared to other countries in the region.<sup>58</sup> An estimated 63% of the population lives within 15 km of the power grid.

<sup>57</sup> “Mapping the least cost option for rural electrification in Burkina Faso: Scaling up renewable energy,” European Commission, (2017): <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/mapping-least-cost-option-rural-electrification-burkina-faso-scaling-renewable-energies>

<sup>58</sup> “Burkina Faso Electricity Sector Support Proposed Additional Credit,” World Bank, (2017): <http://documents.worldbank.org/curated/en/275641497146431923/pdf/BF-PP-05152017.pdf> and “Burkina Faso - Second Energy and Fiscal Management Development Policy Financing Project,” World Bank, (2017): <http://documents.worldbank.org/curated/en/970061513479640534/pdf/BURKINA-FASO-PAD-11212017.pdf>

The country is part of the West Africa Power Pool (WAPP) and imports power exclusively from Côte d'Ivoire (the Government had previously imported electricity from Togo and Ghana as well). In 2016, the country imported 50 MW (225-kV line) of electricity from Côte d'Ivoire, representing one-quarter of the country's available capacity.<sup>59</sup> The country aims to increase its import capacity from the existing Ivoirian interconnection, while a second interconnection with Ghana (225 kV Boltanga-Ouagadougou) is under construction and is scheduled to be commissioned in 2018. In the medium term, two additional regional interconnections are planned: (i) Nigeria-Niger-Burkina Faso-Benin (330 kV) and (ii) Ghana-Burkina Faso-Mali (225 kV). In the long-term, the country could also be connected to Niger and Nigeria through the North Core Interconnector Project.<sup>60</sup>

SONABEL plans to strengthen the transmission grid prior to expanding the distribution network. The Government is also working with Lighting Africa to provide off-grid lighting and energy solutions for the country's off-grid population.<sup>61</sup>

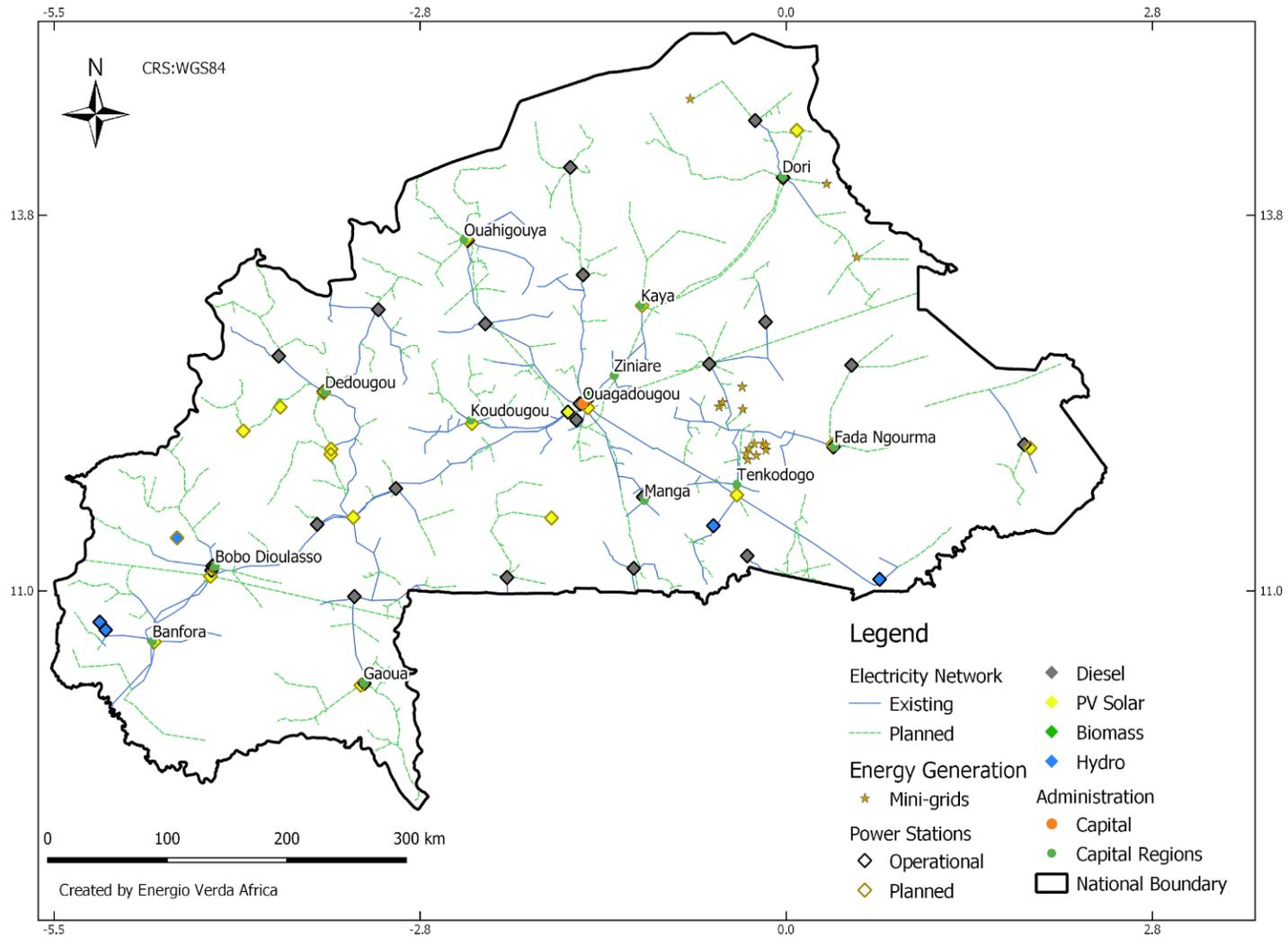
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<sup>59</sup> "West African Power Pool," ECOWAS, (2016): <http://www.ecowas.int/specialized-agencies/the-west-african-power-pool-wapp/>

<sup>60</sup> "Nigeria-Niger-Benin-Burkina Faso Power Interconnection Project", African Development Fund, (2017): <https://www.gtai.de/GTAI/Content/DE/Trade/Fachdaten/PRO/2018/04/Anlagen/PRO201804115013.pdf?v=1>

<sup>61</sup> "A focus on rural areas," Lighting Africa, (2018): <https://www.lightingafrica.org/country/burkina-faso/>

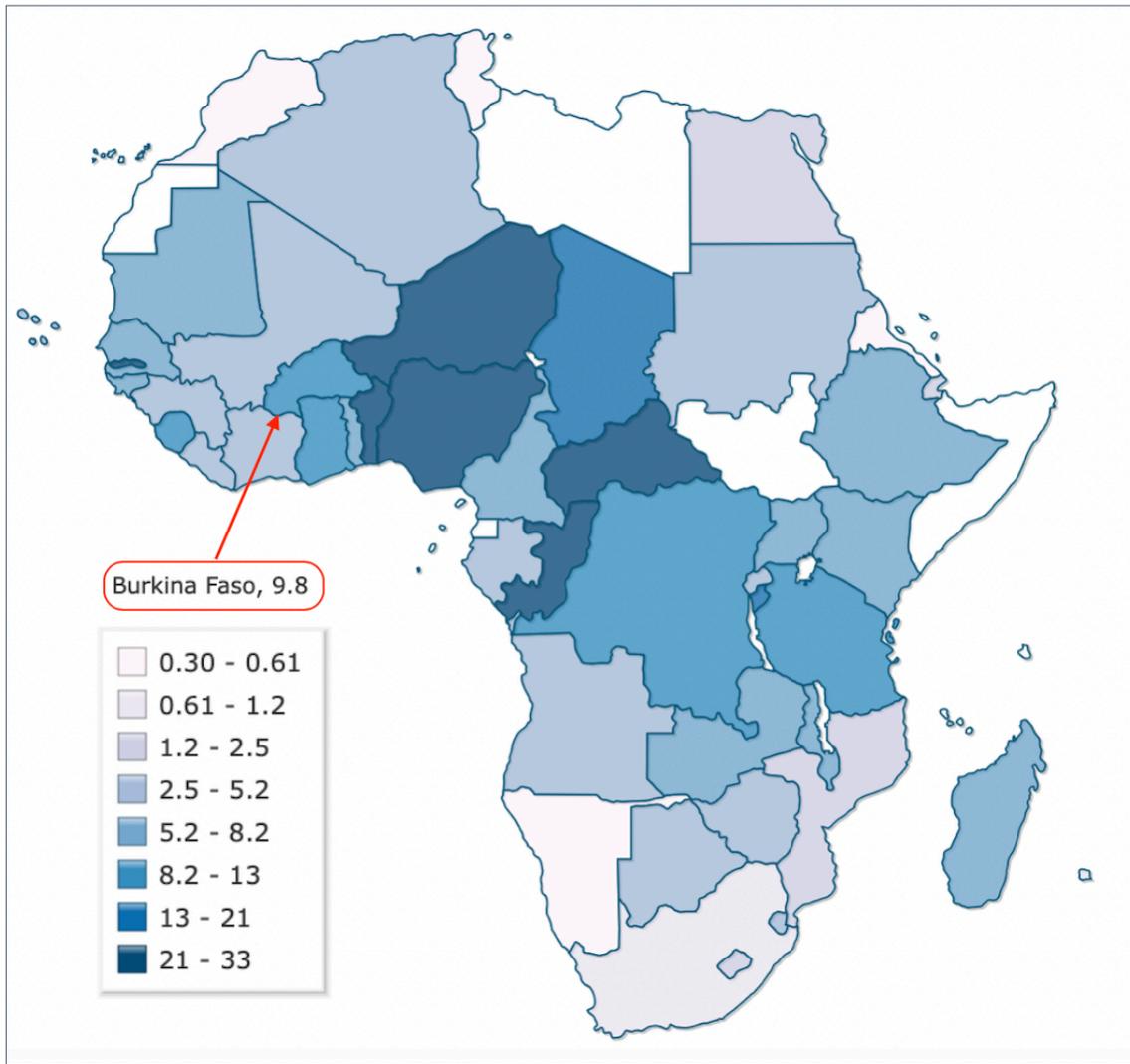
Figure 4: Electricity Transmission and Distribution Network<sup>62</sup>



Source: Energio Verda Africa GIS Analysis

<sup>62</sup> See Annex 1 for more details, including data sources.

Figure 5: Average Number of Power Outages in Firms in Africa in a Typical Month<sup>63</sup>

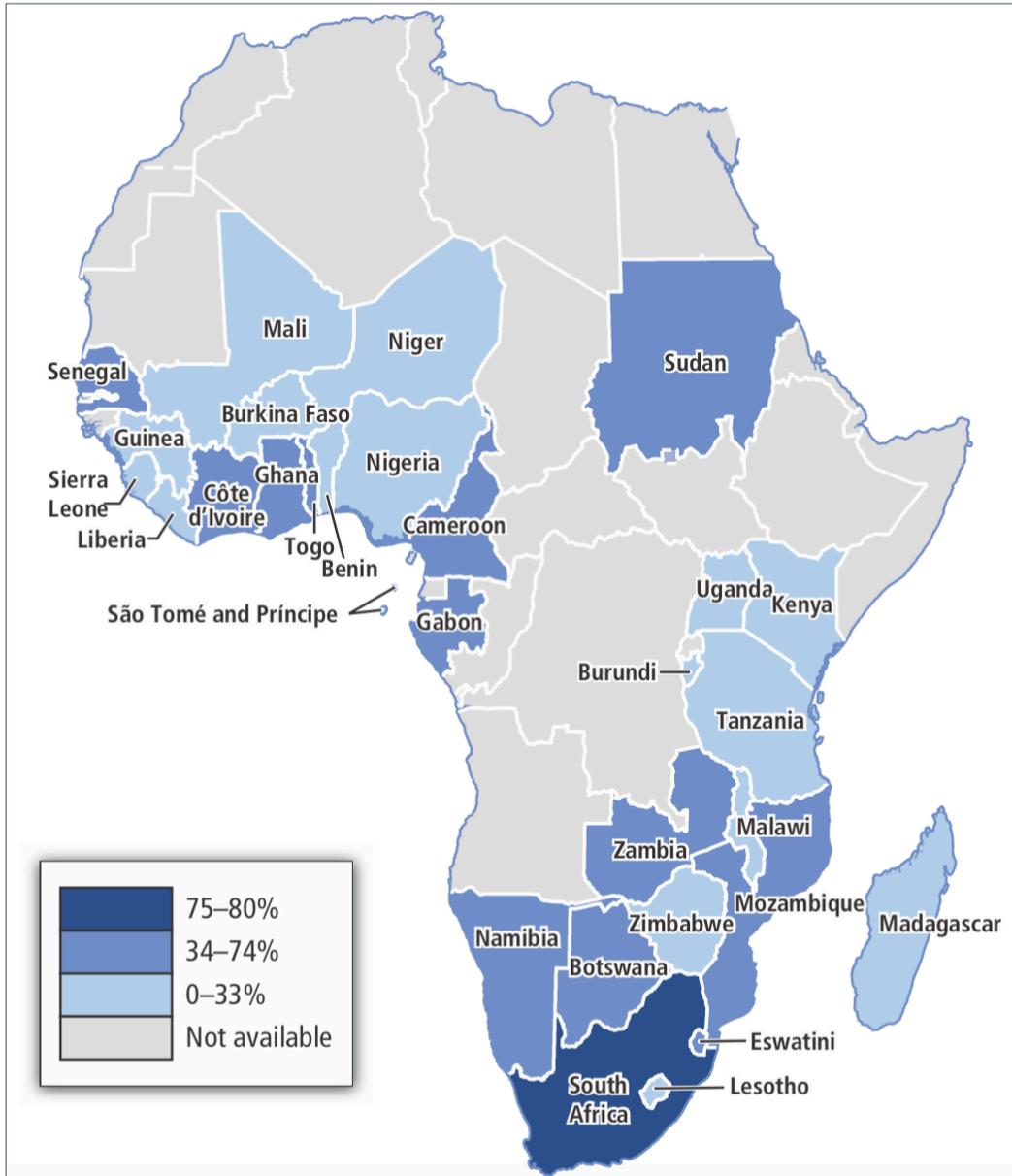


Source: World Bank Enterprise Surveys, 2013-2017

The map in **Figure 5** illustrates how the number of power outages in firms in a given month varies by country in Africa. The shade of the country corresponds to the magnitude of the indicator; the darker the shade, the higher the value. Firms in Burkina Faso reported an average of nearly 10 power outages per month, which is comparable to the West Africa and Sahel region’s average of 12 outages per month.

<sup>63</sup> “Power outages in firms in a typical month (number) – Africa,” IndexMundi / World Bank, <https://www.indexmundi.com/facts/indicators/ic.elc.outg/map/africa>

Figure 6: Share of Households with Reliable Electricity Supply in Africa<sup>64</sup>



Source: Afrobarometer Household Surveys, 2014-2015

The map in **Figure 6** shows the variation in the share of households reporting access to reliable electricity supply in Africa. The shade of the country corresponds to the magnitude of the indicator; the darker the shade, the higher the value. In Burkina Faso, fewer than one-third of surveyed households reported having reliable access to electricity.

<sup>64</sup> Blimpo, M., and Cosgrove-Davies, M., “Electricity Access in Sub-Saharan Africa: Uptake, Reliability, and Complementary Factors for Economic Impact,” AFD and World Bank, Africa Development Forum, (2019): <https://openknowledge.worldbank.org/bitstream/handle/10986/31333/9781464813610.pdf?sequence=6&isAllowed=y>

### 1.2.2.4 Least-Cost Electrification Analysis

A least-cost electrification analysis has been performed to assess the potential development of electricity access in Burkina Faso through 2023 and through 2030 (“Scenario 2023” and “Scenario 2030”).<sup>65</sup> The analysis identifies the scale of market opportunities for off-grid stand-alone solar electrification. A brief summary of the approach and methods used, main assumptions and key results of the analysis in Burkina Faso are outlined below. Additional geographic information system (GIS) information, including categorizations, key definitions, and datasets are included in **Annex 1**.

#### ➤ Methodology

This analysis used geospatial techniques to determine the least-cost electrification options for settlements across Burkina Faso based on their proximity to electrical infrastructure, population density or nodes of economic growth.

For the scenario 2023 analysis, it is assumed that widespread densification of the existing electrical grid will enable settlements within 5 km of existing grid lines to connect to the grid (according to WAPP densification plans).<sup>66</sup> Beyond this area, the likely candidates for electrification by mini-grid systems are settlements that are relatively dense (settlement with a population above 1,000<sup>67</sup>) and have active local economies, evidenced by the presence of social facilities and by their proximity to other settlements already with electricity access (i.e. within 15 km of night-lights areas). All remaining settlements – those in areas of lower population density (settlement with a population below 1,000) or far from the national grid – are considered candidates for off-grid stand-alone systems.

For the scenario 2030 analysis, it is assumed that the grid and the reach of grid densification efforts will extend far beyond the existing network. Hence, settlements that are within 15 km of current lines (average densification distance announced by utilities across West Africa in a 10-year timeline in personal interviews) and 5 km of future planned line extensions are assumed to be connected. For mini-grids, future economic development – which will allow new settlements to grow sufficiently to become candidates for mini-grids – is assumed to occur in settlements within 1 km of mini-grid settlements (average distance of mini-grid coverage of different developers) identified in the scenario 2023 analysis, as well as within 15 km of economic growth centers – airports, mines and urban areas. All other settlements are considered candidates for off-grid stand-alone systems.

Given the lack of low voltage distribution line data, it is necessary to approximate areas where un-electrified settlements in close proximity to the grid exist. The analysis therefore focused on settlements that are within 5 km of the high and medium voltage network, but that are located beyond 15 km of areas with night-time light emissions (indicative of electrification). Settlements in areas of low population density (below 1,000 people) that met the above criteria are identified as both being currently un-electrified and unlikely to be electrified within the scenario 2023.<sup>68</sup> Additional analysis was undertaken to estimate the population within each settlement. The current annual national population growth rate of 2.9%<sup>69</sup> was applied to the geospatial analysis to project population figures for the Scenario 2023 and Scenario 2030 analyses.<sup>70</sup> **Figure 7** shows population density across the country, which served as the basis for this analysis.

<sup>65</sup> NOTE: Rather than presenting a 10-year projection through 2028, the analysis conforms to GoBF electrification targets for 2030

<sup>66</sup> NOTE: Low-voltage distribution lines were not considered in this analysis (data was unavailable)

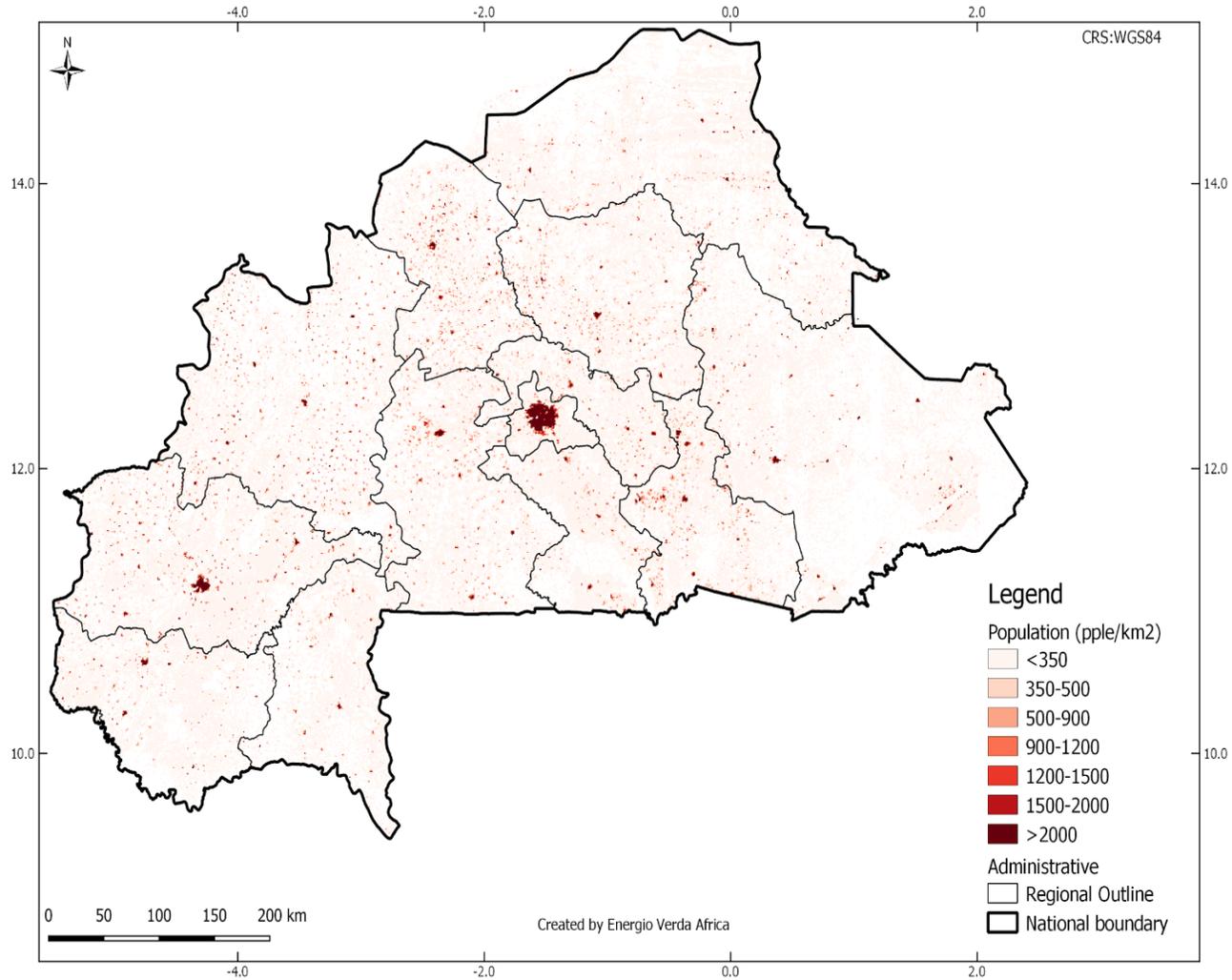
<sup>67</sup> Settlements above a population of 1,500 are targeted for grid extension, whereas below 1,500 are for mini-grid electrification (see Chapter 1.2.2.1). Therefore, a threshold of a population of 1,000 was used to distinguish between mini-grid and off-grid settlements.

<sup>68</sup> Note that this analysis was performed for the scenario 2023 but not for the 30 scenario 2030 due to uncertainties regarding population densities being too high over such a long timeframe

<sup>69</sup> <https://data.worldbank.org/indicator/SP.POP.GROW?locations=BF>

<sup>70</sup> See **Annex 1** for the results of this analysis as well as more details on the approach and methods used

Figure 7: Population Density, 2015<sup>71</sup>



Source: Energio Verda Africa GIS analysis

<sup>71</sup> See Annex 1 for more details, including data sources.

➤ **Results**

**Table 6** summarizes the results of the least cost electrification analysis. **Figure 8** and **Figure 9** illustrate the distribution of settlements according to least-cost electrification options under scenarios 2023 and 2030, respectively. The number of households was estimated by using the average household size for the country (5.7 persons/household).<sup>72</sup>

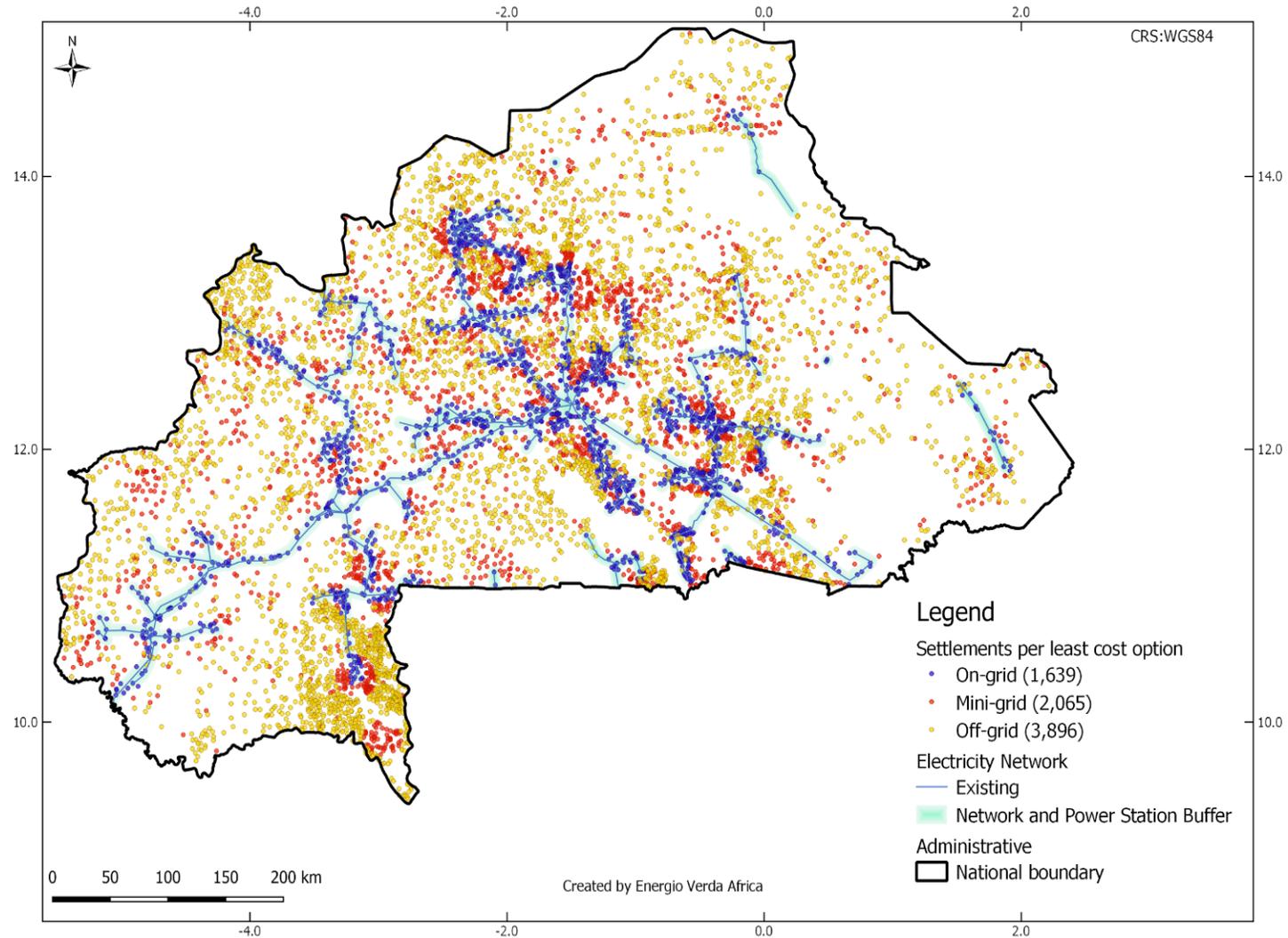
**Table 6: Results of Least-Cost Electrification Analysis**

Scenario	Indicator	Least-Cost Electrification Option			Grid Vicinity		
		Grid extension	Mini-grid	Off-grid stand-alone systems	Under-grid un-served	Total under-grid	Total outside grid vicinity
<b>Scenario 2023</b>	Number of settlements	1,639	2,065	3,896	227	1,866	5,734
	% of settlements	21.6%	27.2%	51.3%	12.2%	24.6%	75.4%
	Total population	9,942,620	5,254,330	7,514,057	311,667	10,254,287	12,456,720
	% of population	43.8%	23.1%	33.1%	3.0%	45.2%	54.8%
	Number of households	1,744,319	921,812	1,318,256	54,678	1,798,998	2,185,389
<b>Scenario 2030</b>	Number of settlements	5,391	691	1,518	Not calculated	5,391	2,209
	% of settlements	70.9%	9.1%	20.0%	Not calculated	70.9%	29.1%
	Total population	22,113,080	2,031,150	3,598,169	Not calculated	22,113,080	5,629,319
	% of population	79.7%	7.3%	13.0%	Not calculated	79.7%	20.3%
	Number of households	3,879,488	356,342	631,258	Not calculated	3,879,488	987,600

Source: Energio Verda Africa GIS analysis

<sup>72</sup> “Household Size and Composition Around the World,” United Nations, (2017): [http://www.un.org/en/development/desa/population/publications/pdf/ageing/household\\_size\\_and\\_composition\\_around\\_the\\_world\\_2017\\_data\\_booklet.pdf](http://www.un.org/en/development/desa/population/publications/pdf/ageing/household_size_and_composition_around_the_world_2017_data_booklet.pdf)

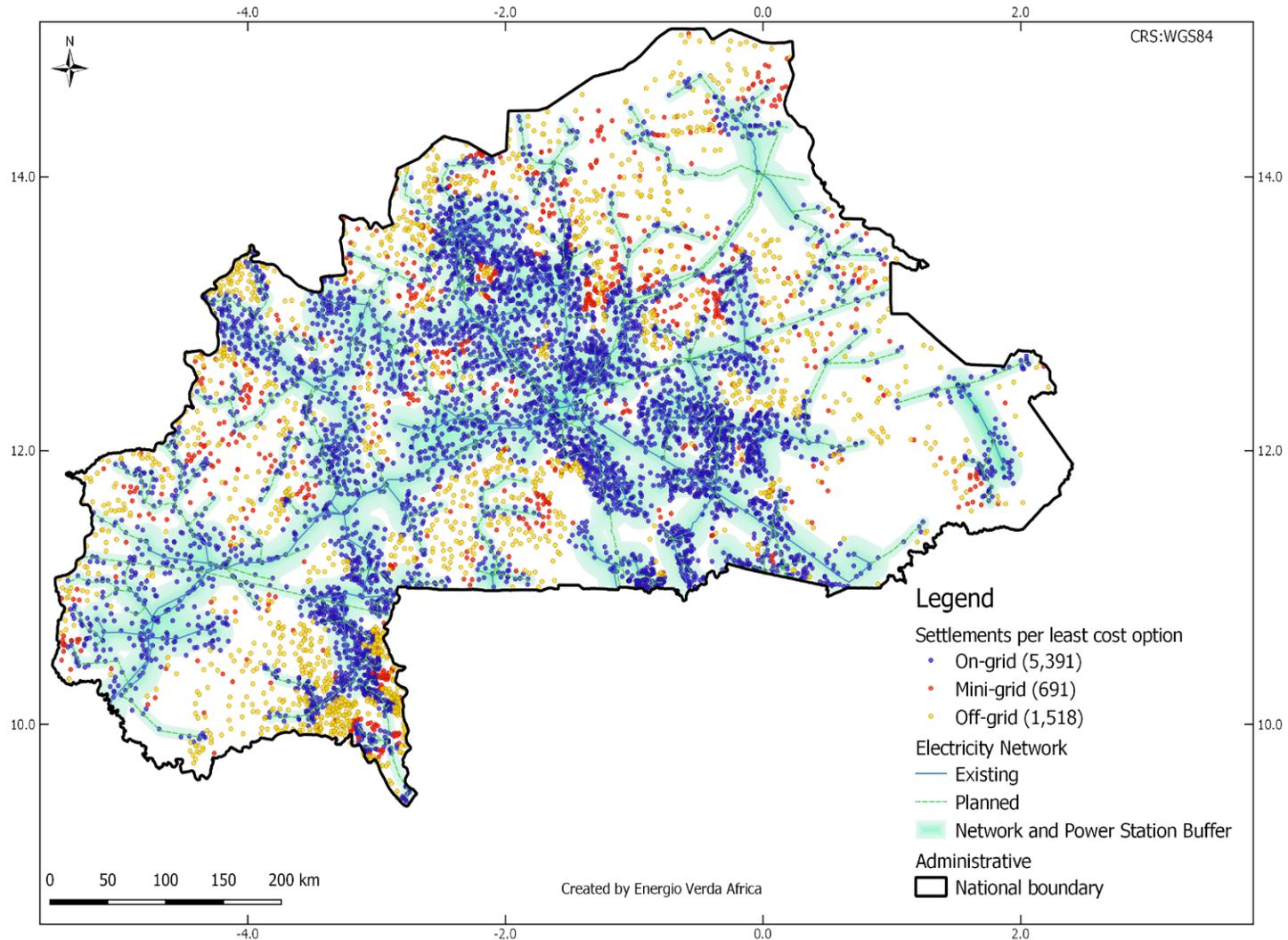
Figure 8: Distribution of Settlements by Least-Cost Electrification Option, 2023<sup>73</sup>



Source: Energio Verda Africa GIS analysis

<sup>73</sup> Displaying identified settlements with known location (given coordinates) only; see **Annex 1** for more details, including data sources.

Figure 9: Distribution of Settlements by Least-Cost Electrification Option, 2030<sup>74</sup>



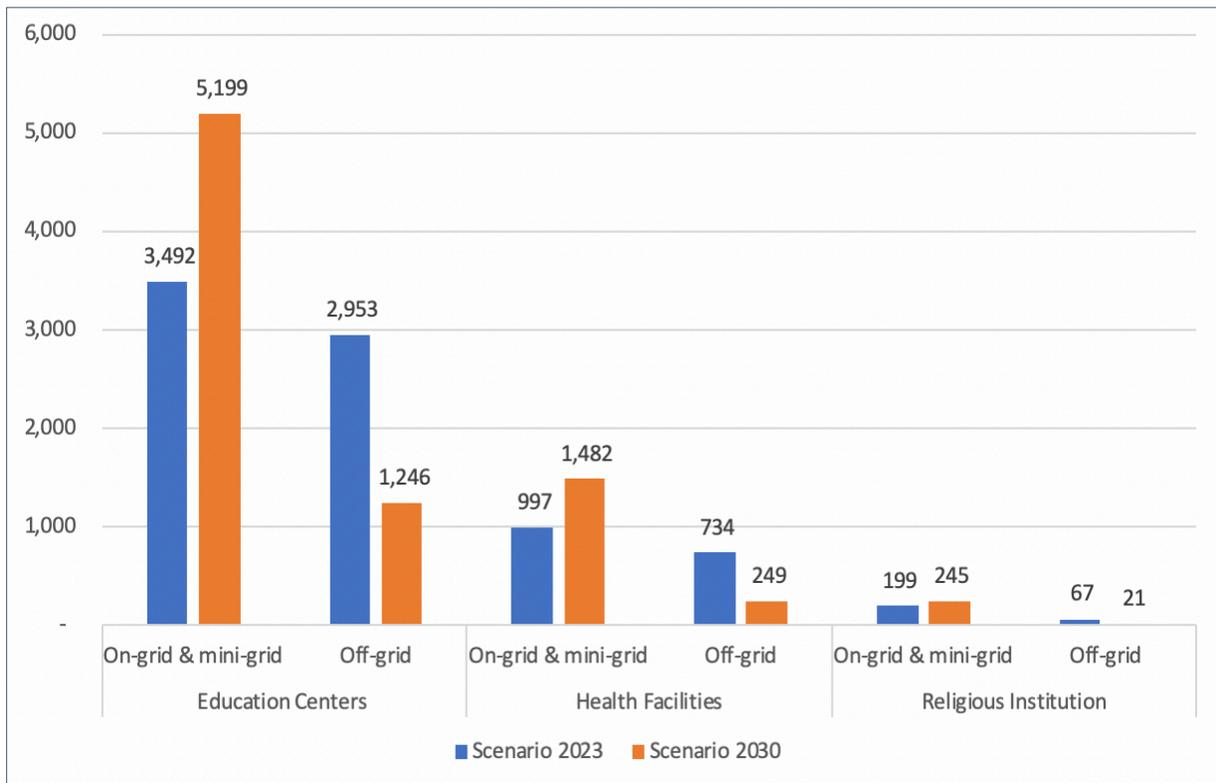
Source: Energio Verda Africa GIS analysis

<sup>74</sup> Displaying identified settlements with known location (given coordinates) only; see **Annex 1** for more details, including data sources.

The analysis also covered the social facilities (education centers and health facilities) and religious institutions (churches and mosques) that could remain off-grid during the analyzed timeframes. The number of social facilities and religious institutions cannot be seen as comprehensive as the data available for the geospatial analysis (i.e. institutions with known coordinates) was collected by the Geographic Institute of Burkina Faso (Institut Géographique du Burkina, IGB) in 2012. A total of 6,445 education centers, 1,731 health facilities, 190 mosques and 76 churches were analyzed.

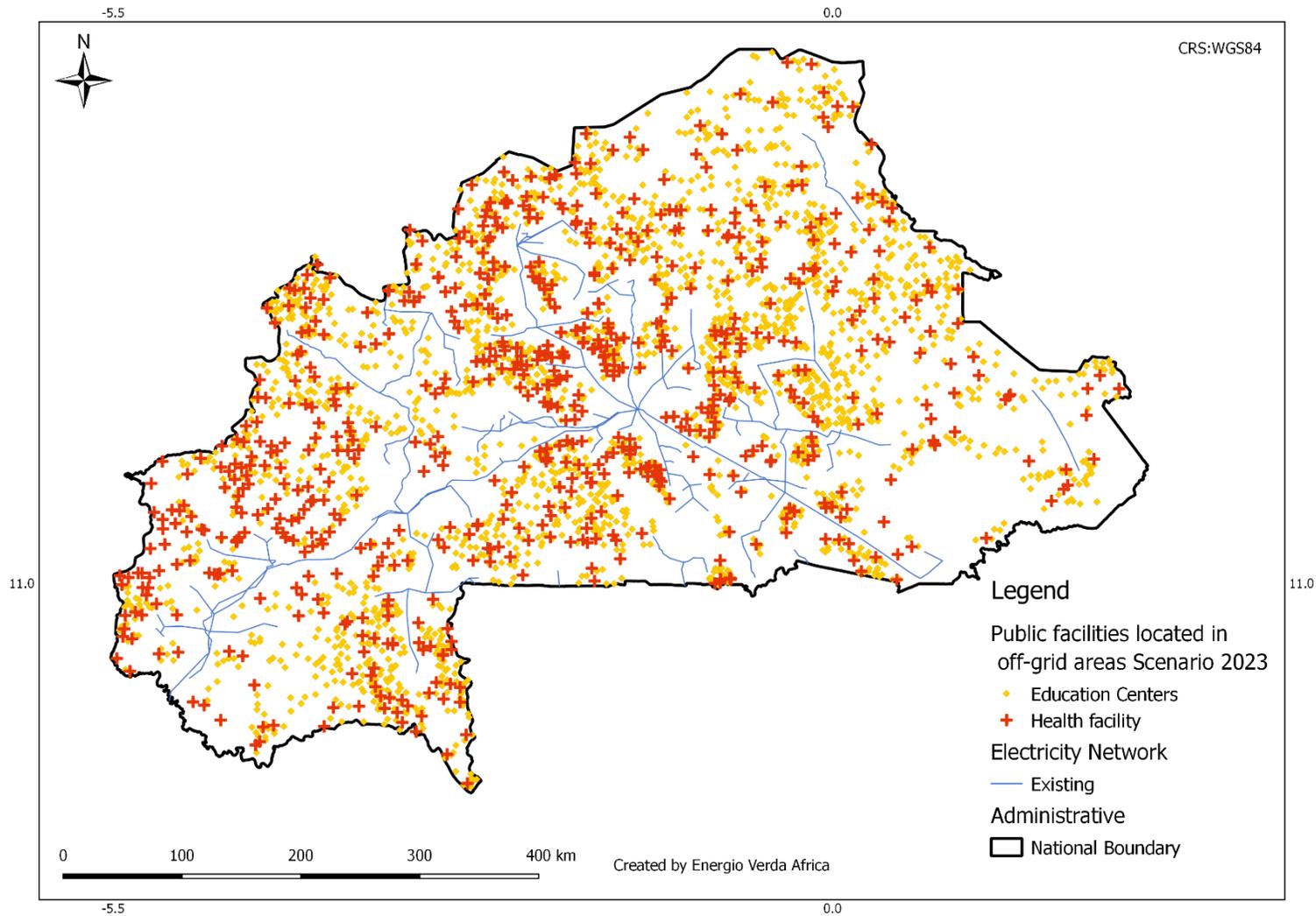
**Figure 10** summarizes the number of education centers, health facilities and religious institutions that may be electrified (on-grid and mini-grid) or suitable for off-grid stand-alone solutions in scenarios 2023 and 2030. **Figure 11** and **Figure 12** illustrate the distribution of potential off-grid social facilities, while **Figure 13** shows the distribution of potential off-grid religious institutions under the two scenarios.

Figure 10: Identified Social Facilities for On-Grid, Mini-Grid and Stand-alone Solutions, 2023 and 2030



Source: Energio Verda Africa GIS analysis

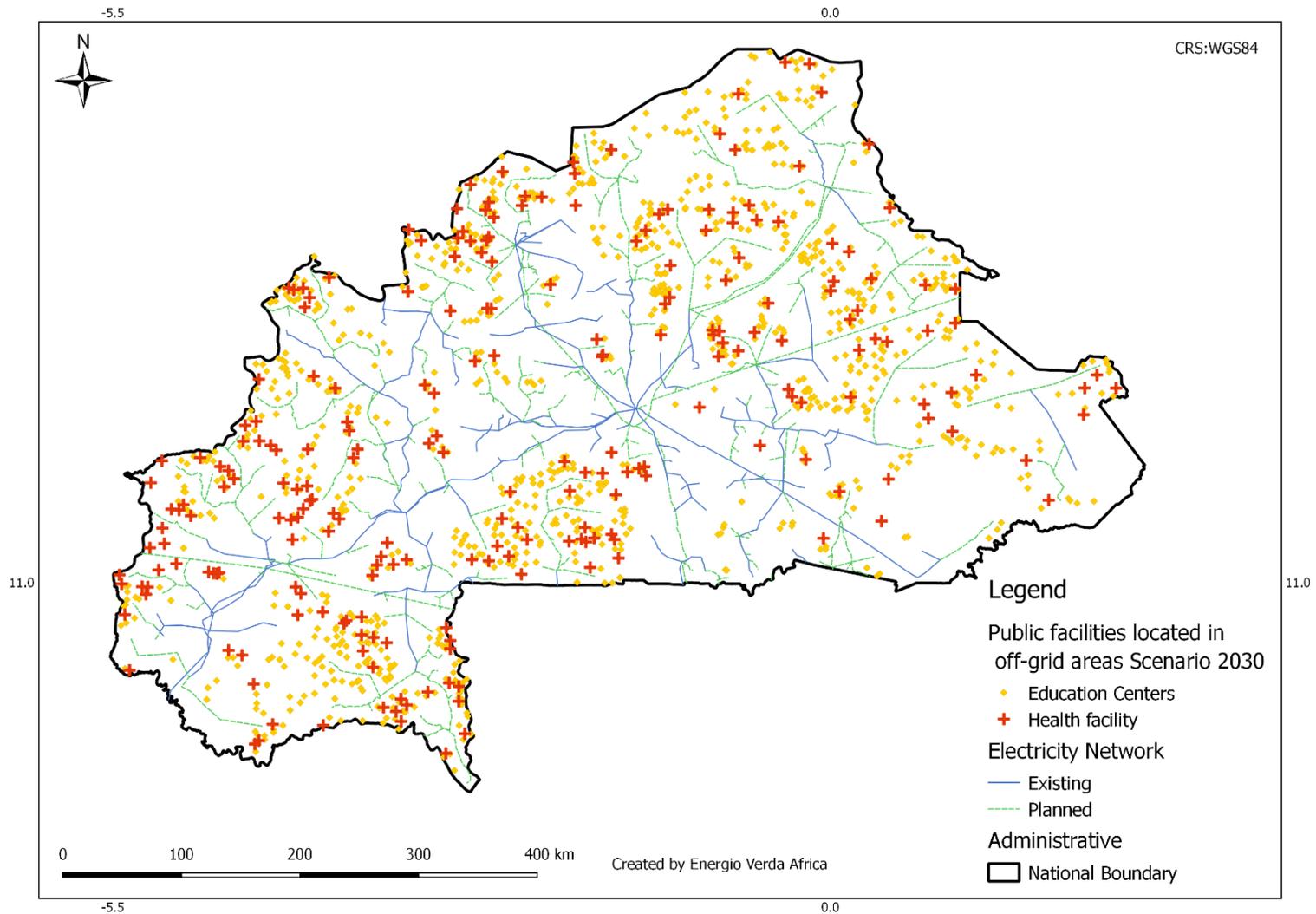
Figure 11: Distribution of Potential Off-Grid Social Facilities, 2023<sup>75</sup>



Source: Energio Verda Africa GIS analysis

<sup>75</sup> Displaying identified facilities with known location (given coordinates) only; see **Annex 1** for more details, including data sources.

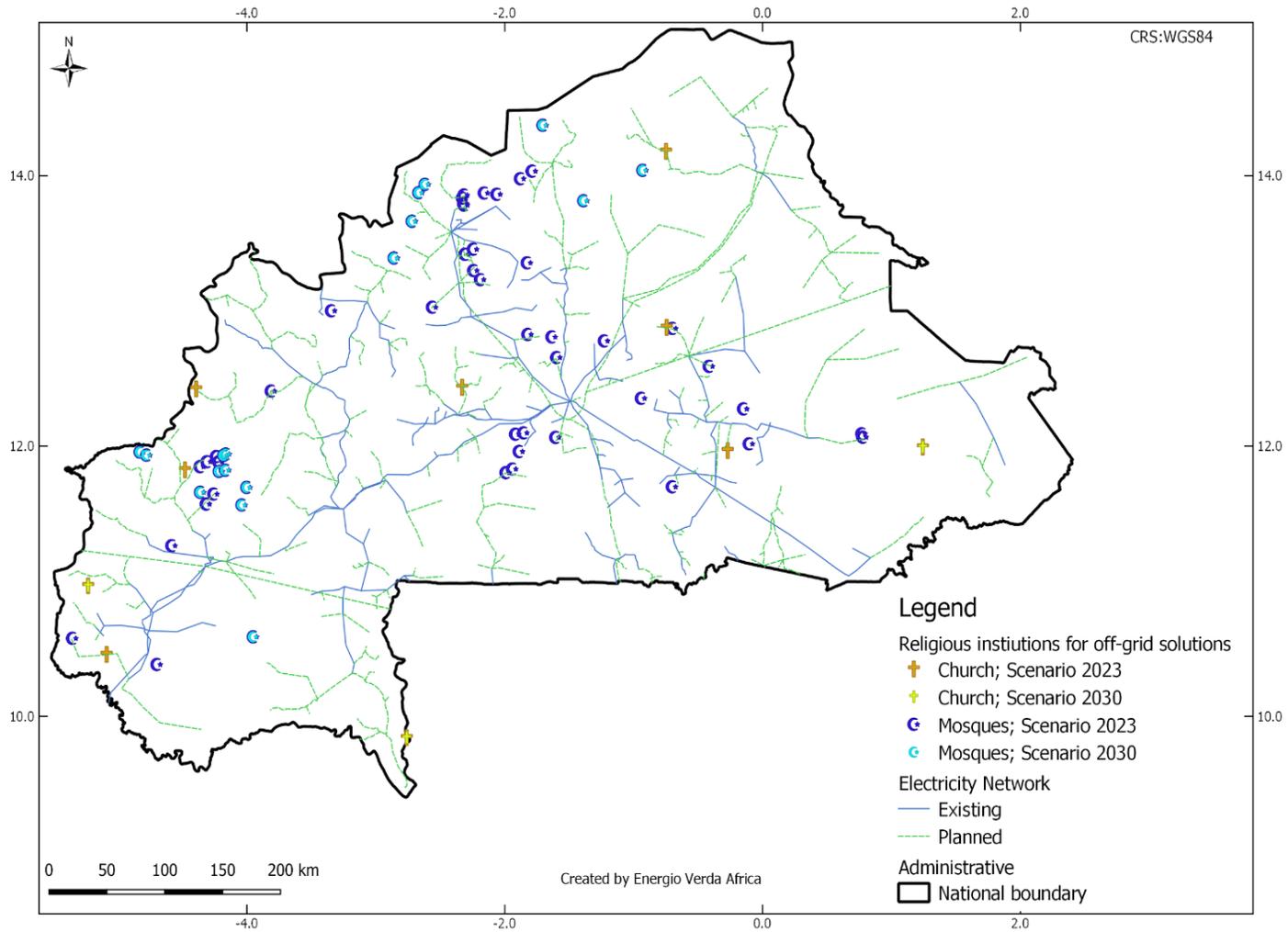
Figure 12: Distribution of Potential Off-Grid Social Facilities, 2030<sup>76</sup>



Source: Energio Verda Africa GIS analysis

<sup>76</sup> Displaying identified facilities with known location (given coordinates) only; see **Annex 1** for more details, including data sources.

Figure 13: Distribution of Potential Off-Grid Religious Institutions, 2023 and 2030<sup>77</sup>



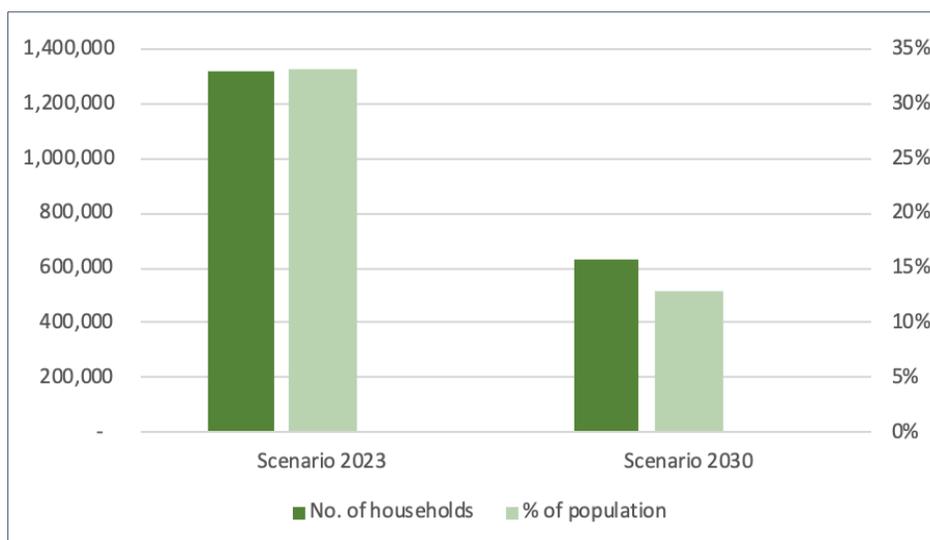
Source: Energio Verda Africa GIS analysis

<sup>77</sup> Displaying identified facilities with known location (given coordinates) only; see **Annex 1** for more details, including data sources.

According to the geospatial analysis, by 2023, 1,639 settlements across Burkina Faso (1,744,319 households) will be connected to the main grid, representing 43.8% of the population. By 2030, this figure will increase to 5,391 settlements (3,879,488 households), equivalent to 79.7% of the population. These estimates are based on the assumption that all planned grid extensions will be completed by 2030. Not all settlements in close proximity to electricity lines will connect to the main grid, largely due to the low density of these areas (dispersed settlements with a density below 350 people/km<sup>2</sup>). By 2023, an estimated 227 settlements located under the grid will meet these criteria (or 12.2 of the settlements located within 5 km of the grid).

Outside of the main grid areas, settlements with higher economic growth potential and higher population density can optimally be electrified by mini-grids. By 2023, this represents an estimated 2,065 settlements (5,254,330 households), or 23.1% of the population, decreasing to 691 settlements (2,031,150 households), or 7.3% of the population by 2030. The remaining more dispersed settlements (further from centers of economic activity) can optimally be served by off-grid stand-alone systems. This comprises 3,896 settlements (1,318,256 households) and 33.1% of the population in 2023, decreasing to 1,518 settlements (631,258 households) and 13.0% of the population in 2030 (**Figure 14**).

Figure 14: Estimated Number of Households and Share of Population Suitable for OGS Systems, 2023 and 2030



Source: Energo Verda Africa GIS analysis

The analysis indicates that the off-grid stand-alone market has the potential to grow significantly. According to figures published by the Global Off-Grid Lighting Association (GOGLA),<sup>78</sup> an estimated 224,532 off-grid stand-alone solar PV products (pico solar and solar home systems) have been sold in Burkina Faso as of the end of 2017 (see **Section 2.4.3**). The least-cost analysis estimates that more than 1.3 million households in 2023 may be suitable for these solutions.

<sup>78</sup> “Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data,” GOGLA, Lighting Global and World Bank, (July – December 2017): [https://www.gogla.org/sites/default/files/resource\\_docs/gogla\\_sales-and-impact-reporth2-2017\\_def20180424\\_web\\_opt.pdf](https://www.gogla.org/sites/default/files/resource_docs/gogla_sales-and-impact-reporth2-2017_def20180424_web_opt.pdf); and

“Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data,” GOGLA, Lighting Global and World Bank, (January – June 2017): [https://www.gogla.org/sites/default/files/resource\\_docs/gogla\\_sales-and-impact-reporth12017\\_def.pdf](https://www.gogla.org/sites/default/files/resource_docs/gogla_sales-and-impact-reporth12017_def.pdf); and

“Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data,” GOGLA, Lighting Global and World Bank, (July – December 2016): [https://www.gogla.org/sites/default/files/recource\\_docs/final\\_sales-and-impact-report\\_h22016\\_full\\_public.pdf](https://www.gogla.org/sites/default/files/recource_docs/final_sales-and-impact-report_h22016_full_public.pdf); and

“Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data,” GOGLA, Lighting Global and World Bank, (January – June 2016): [https://www.gogla.org/sites/default/files/recource\\_docs/global\\_off-grid\\_solar\\_market\\_report\\_jan-june\\_2016\\_public.pdf](https://www.gogla.org/sites/default/files/recource_docs/global_off-grid_solar_market_report_jan-june_2016_public.pdf)

In its SEforALL National Renewable Energy Action Plan, the GoBF envisions a relatively modest share of the population would have electricity access through off-grid systems (**Table 7**), with grid extension as the main focus of its rural electrification policy. The findings of the least-cost analysis suggest that the Government may need to consider increasing the utilization of off-grid solutions (a combination of mini-grids and stand-alone solutions) in electrification planning in order to achieve its energy access targets, particularly in the near-term until planned grid extensions are realized.

**Table 7: Estimated Share of Population Served by Off-Grid Systems<sup>79</sup>**

Share of population with access to off-grid systems powered by renewable energy (%) *	2020 (target)	2030 (target)
	13%	27%

\* Estimate includes both mini-grids and stand-alone systems

Source: SEforALL National Renewable Energy Action Plan

### 1.2.2.5 Inclusive Participation<sup>80</sup>

Inclusive participation in Burkina Faso remains an ongoing challenge. Gender inequality persists, as women are under-educated and generally have a lower socio-economic status, with inadequate access to basic social services and reduced economic opportunities compared to men. Burkina Faso performs poorly in the UNDP Gender Inequality Index, which measures several indicators to assess levels of gender inequality in the areas of health, access to education, economic status and empowerment.<sup>81</sup> Female participation in education, particularly higher education, remains disproportionately low (**Figure 15**).<sup>82</sup> While gender discrimination is widespread, these issues tend to be more pronounced in rural areas of the country.

Burkina Faso has adopted several policies to promote gender equality. In 2009, the Government established a National Gender Policy (Politique nationale genre), a dedicated ministry – the Ministry of Women, National Solidarity and Family – as well as a National Council (Conseil National pour la promotion du Genre) to promote gender equality and develop several action plans and related programs to advocate for gender inclusion. The existing national plan is the Strategy for Accelerated Growth and Sustainable Development (Stratégie de croissance accélérée et de développement durable, “SCADD”), which was adopted in 2010. The SCADD recognizes the importance of gender in the country’s development and promotes gender mainstreaming and inclusive participation for women in the public and private sectors. As a result, FDE/ABER has considered gender aspects in all the projects implemented.

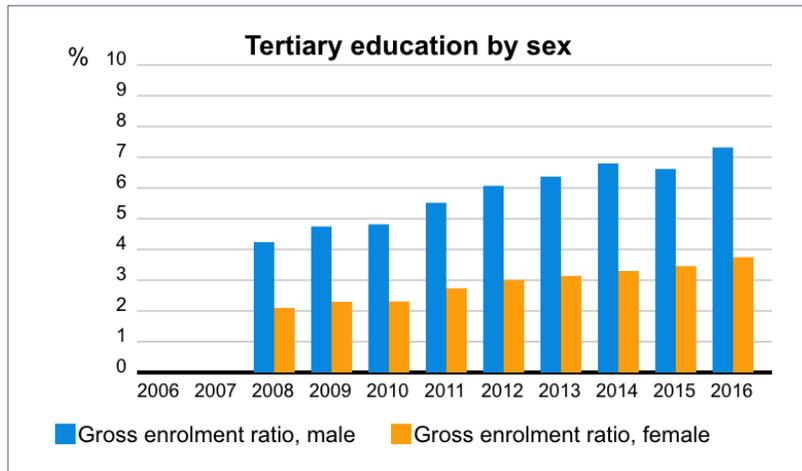
<sup>79</sup> “Plan d’Action National des Energies Renouvelables (PANER),” ECREEE / SEforALL, (2015): [http://se4all.ecreee.org/sites/default/files/paner\\_bfa\\_juillet\\_15\\_final.pdf](http://se4all.ecreee.org/sites/default/files/paner_bfa_juillet_15_final.pdf)

<sup>80</sup> See **Annex 4** for more details

<sup>81</sup> “Gender Inequality Index,” UNDP, (2015): <http://hdr.undp.org/en/composite/GII>

<sup>82</sup> “Burkina Faso Participation in Education,” UNESCO Institute for Statistics, (2018): <http://uis.unesco.org/en/country/bf?theme=education-and-literacy>

Figure 15: Rates of Enrollment in Tertiary Education



Source: UNESCO Institute for Statistics

In the energy sector, efforts have been made to implement measures under the regional framework, ECOWAS Policy for Gender Mainstreaming in Energy Access, as well as additional gender policies at the national level. The Government has included references and linkages to gender in its energy policies and has established a gender focal point at the Ministry of Energy. Despite these efforts, gender mainstreaming in the country’s energy policy remains insufficient and requires capacity building of staff and the implementation of gender management systems at the institutional level to provide guidance on gender responsive leadership and decision making.

### 1.2.3 Key Challenges

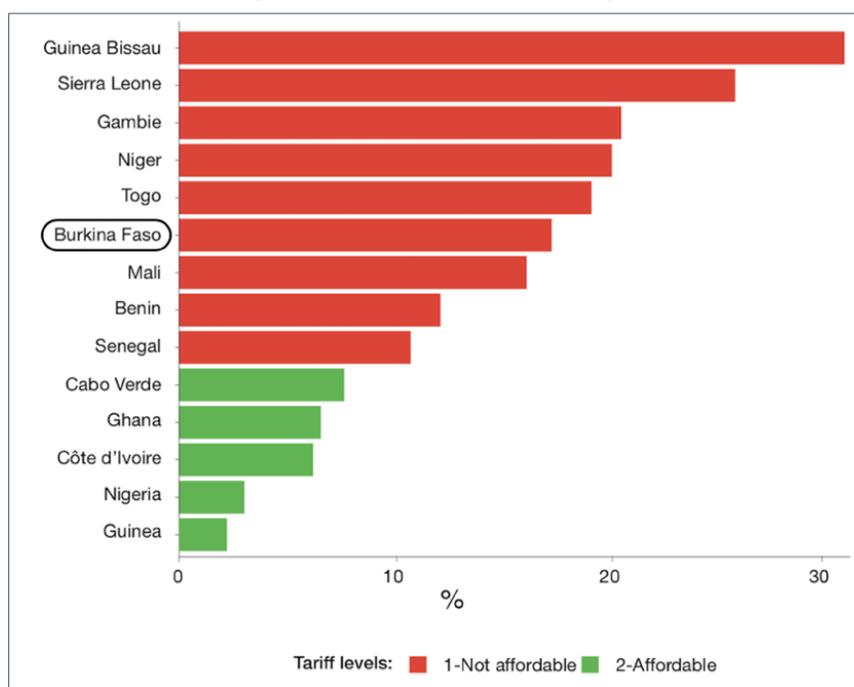
Some of the key energy sector challenges facing Burkina Faso include (but are not limited to) the following:

- Investment in Grid Maintenance:** Rapid growth and corresponding increases in electricity demand will continue to put pressure on the country’s power supply. Burkina Faso has had to increase electricity imports to meet rising demand and experienced a net power deficit in 2016. Demand is expected to continue to grow at an estimated annual growth rate of 10.2%, while installed capacity will need to increase by at least 150-200 MW to meet demand in 2020. The demand-supply mismatch will continue to burden the electricity transmission and distribution network that needs maintenance and investment to reduce losses and expand access.
- Electricity Tariffs:** Average electricity tariffs (USD 0.22/kWh)<sup>83</sup> are slightly above the ECOWAS region’s average tariff of USD 0.20/kWh.<sup>84</sup> Burkina Faso subsidizes electricity tariffs for low-income consumers, providing electricity to poorer households below the cost of supply with funds from the GoBF and the country’s utility (SONABEL) through a range of residential and commercial consumers who pay higher electricity rates. Despite this cross-subsidization scheme, average households in the country still spend a disproportionate amount of their income on electricity (**Figure 16**).

<sup>83</sup> “Regulatory Indicators for Sustainable Energy: Burkina Faso,” World Bank, (2016): <http://rise.worldbank.org/country/burkina-faso>

<sup>84</sup> “Electricity Tariffs in ECOWAS Region,” African Development Bank Group, Energy Policy, Regulation and Statistics Division, (September 2018): [http://www.ecowrex.org/sites/default/files/pesr1\\_-\\_energy\\_statistics\\_bulletin\\_september\\_2018.pdf](http://www.ecowrex.org/sites/default/files/pesr1_-_energy_statistics_bulletin_september_2018.pdf)

Figure 16: Share of Income Spent on Household Electricity in ECOWAS Countries, 2018



NOTE: Liberia is excluded from the analysis; the threshold for what is considered an affordable tariff is 10% of income spent on electricity – a household is considered energy poor if more than 10% of income is spent on energy/fuel to maintain adequate level of comfort; On average, households in the ECOWAS region spend 17% of their income on electricity.

Source: ECOWAS Regional Electricity Regulatory Authority

- **Utility Financial Performance:** Without cost-reflective tariffs in place, SONABEL does not generate enough revenue to invest sufficiently in grid extensions and maintenance. As a result, Burkina Faso's power sector remains largely dependent upon foreign assistance.
- **Imbalanced Energy Mix:** The country's power supply is overly reliant upon thermal and large hydropower, technologies that are susceptible to price volatility and climatic conditions, respectively. There is comparatively very little investment in non-hydro renewable energy, which cannot compete with cheaper baseload power in the country's existing regulatory environment.
- **Electricity Cooperatives:** Although Burkina Faso has historically favored an electricity cooperative model rather than private ownership, the efficiency and effectiveness of this approach when it comes to off-grid solar has been poor. However, the recent 2017 Decree clearly reflects the GoBF's intention to favor private ownership and operates a shift in the development of off-grid, from a model based on cooperatives to a new approach seeking to promote independent private ownership.
- **Rural Electrification:** Energy access is a huge challenge for Burkina Faso, as only 3% of the rural population has access to electricity. While the Government's approach to rural electrification had been largely dominated by grid extensions, it now intends to promote large-scale mini-grid and off-grid solar standalone solutions.

- Local Financial Institutions:**<sup>85</sup> Local financial institutions (FIs) and microfinance institutions (MFIs) lack sufficient internal capacity and credit appetite to invest in the renewable energy/off-grid sectors. This challenge is complicated as it arises mainly from the risk perceptions of FIs, which influence whether efforts should be made to develop strategies and customize financial products to target a nascent market, where there is often limited knowledge of technologies, market characteristics and historical data on portfolio credit performance. There are also likely mis-perceptions about the potential size of these markets as well as doubts about the profitability of offering financial products in rural off-grid areas, where the creditworthiness of potential clients may be an issue. The renewable energy/off-grid space is particularly complicated given relatively high transaction costs and a comparatively unfavorable regulatory environment that exists in the country.<sup>86</sup>
- Other Challenges:** Successful development of the off-grid sector will require more than just a financial support mechanism – the Government and its supporting agencies will also need to develop and implement a range of measures to expedite growth of the market, including a robust technical assistance (TA) platform to supplement ROGEP’s objectives. This platform should address *inter alia* (i) awareness raising, education and training for consumers, including organization of appropriate community management structures; (ii) solar PV system supply chain and operations and maintenance (O&M) services, including training of local technicians to ensure that the cost of maintenance is affordable and sustainable; and (iii) standards for equipment and service providers (i.e. installers, technicians) to guide customers to companies providing the best value for their money. These measures should be part of a national rural electrification sector strategy to inform decision-making of key stakeholders surrounding development and regulation of the country’s stand-alone solar PV market.

<sup>85</sup> The role of FIs is examined in further detail in **Section 3**.

<sup>86</sup> One notable exception to this is the commercial and industrial (C&I) market segment, where systems are larger, and off-takers are often companies with large enough balance sheets to borrow. This has been one of the stand-alone market segments where there has been some lending to date in Africa (e.g. AFD’s Sunref program)

## 1.3 National Policy and Regulation

### 1.3.1 National Electricity/Electrification Policy

Energy access, increased generation capacity and RE development are three key components of the Government’s plan aimed at reducing poverty. These priorities are defined in the national government strategy “Vision 2020” and its corresponding national Policy for Sustainable Economic and Social Development (PNDES), 2016-2020, which establishes an institutional framework for PPPs. The “Sectoral Energy Policy Letter 2014-2025” (POSEN)<sup>87</sup> proposes a policy shift emphasizing clean energy development through institutional and sector reforms to increase energy access through renewables alongside conventional sources of energy.<sup>88</sup>

Additional targets for renewable energy are defined in the 2017 General Energy Regulation Law as well as in Burkina Faso’s SEforALL PANER and Action Agenda.<sup>89</sup> The overall objective of these policies is to increase the share of RE in the electricity mix to 24% by 2020. As a member state of ECOWAS, The GoBF is also committed to the ECOWAS Regional Renewable Energy Policy for the period of 2015-2030, which seeks to (i) set national RE targets, (ii) create a harmonized regulatory framework with common tax policies and standards, (iii) develop technology knowledge and capacity building, and (iv) promote a regional RE market. For the electricity sector, the objective is to increase the share of RE generation in the power mix by 2030 as well as the share of the off-grid population served by mini-grid and off-grid stand-alone systems.<sup>90</sup>

### 1.3.2 Integrated National Electrification Plan

Despite having a rural electrification agency (ABER) that aims to work with electricity cooperatives groups (COOPEL) and install PV and hybrid systems, the GoBF does not currently have an integrated national electrification master plan in place.

### 1.3.3 Energy and Electricity Law

The General Energy Regulation Law passed in 2017 includes provisions to support RE development and liberalize the supply side of the energy market.<sup>91</sup> Under the new legal framework, competition is allowed in the wholesale electricity sector, effectively ending SONABEL’s monopoly and allowing private IPPs to sell electricity directly to customers. While the transmission segment remains controlled by SONABEL, production, distribution and imports are open to competition. A decree was also released in 2017 to provide further details on granting licenses to produce electricity by IPPs in both the on-grid and off-grid sectors.

<sup>87</sup> “Politique sectorielle de l’énergie (2014-2025),” Ministère des Mines et de l’Energie du Burkina Faso, (2013)

<sup>88</sup> “Green Mini-grid Market Development Programme”, SEforALL, (2017): <https://greenminigrid.SEforALL-africa.org/sites/default/files/GMG%20Burkina%20Faso%20report%20final.pdf>

<sup>89</sup> “Plan d’Action National d’Efficacité Énergétique and Plan d’Action National des Énergies Renouvelables,” SEforALL and the Ministry of Energy, (2015): <http://SEforALL.ecreee.org/content/country-documents>

<sup>90</sup> “ECOWAS Renewable Energy Policy,” ECOWAS, (2015): [http://www.ecreee.org/sites/default/files/documents/ecowas\\_renewable\\_energy\\_policy.pdf](http://www.ecreee.org/sites/default/files/documents/ecowas_renewable_energy_policy.pdf)

<sup>91</sup> Loi n°014-2017/AN du 20 avril 2017 portant sur la réglementation générale du secteur de l’énergie, The Government of Burkina Faso, (2017)

1.3.4 Framework for Stand-alone Systems

Figure 17 is an overview of the key national policies, programs, laws and regulations pertaining to Burkina Faso’s framework for stand-alone systems. The gaps in this framework are addressed in Section 1.3.5.

To date, the Government’s efforts to establish a comprehensive off-grid policy and regulatory framework are progressing well, as evidenced by the country’s 22-point improvement in its World Bank Regulatory Indicators for Sustainable Energy (RISE) energy access score between 2015 and 2017. In the 2017 RISE evaluation, Burkina Faso ranked sixth in West Africa and the Sahel and was among the highest scoring countries in Africa (Figure 18).<sup>92</sup>

Figure 17: Policy and Regulatory Framework for Stand-alone Systems

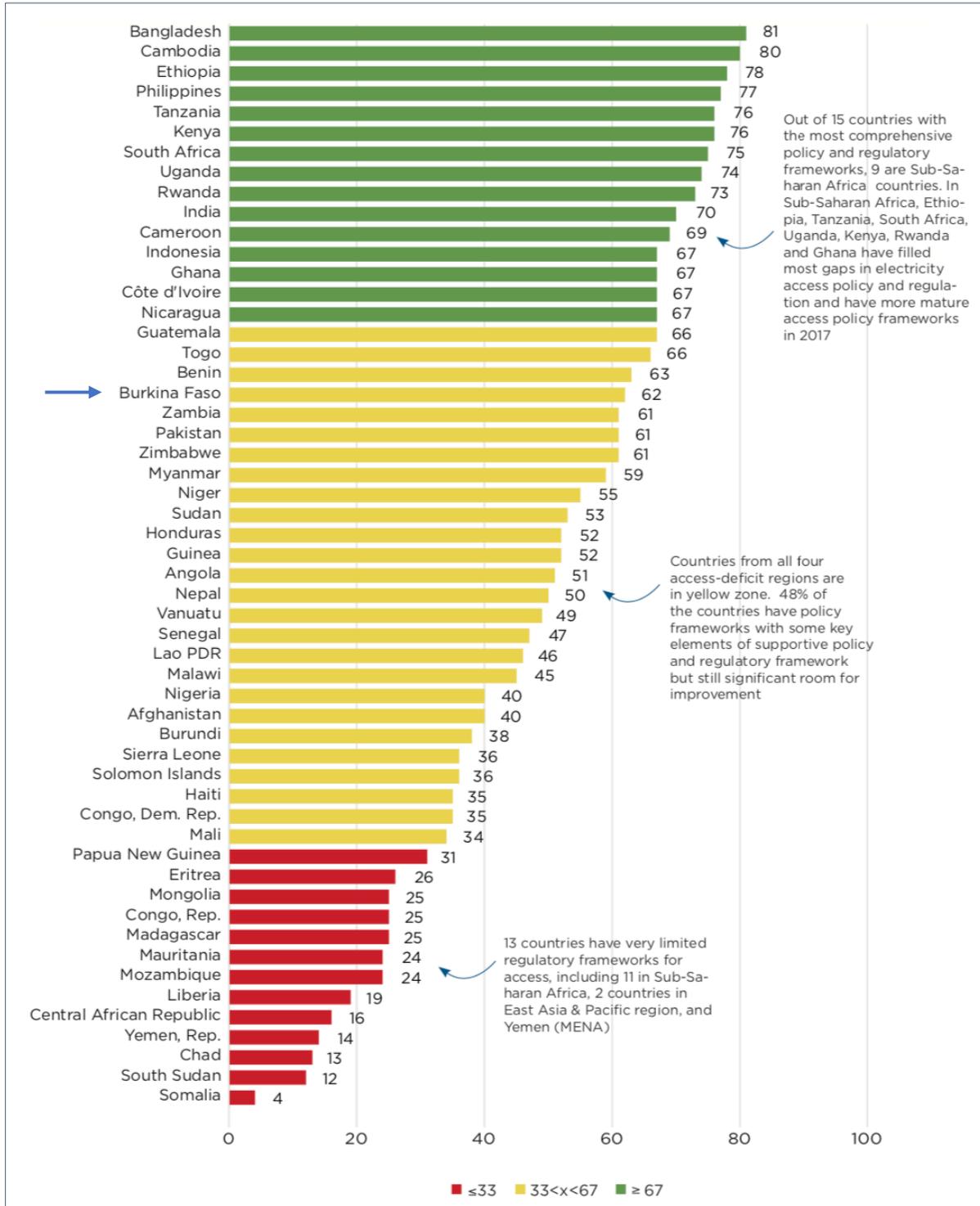
BURKINA FASO			
World Bank RISE 2017 Energy Access Score: 62		2017 ranking among West Africa and the Sahel (ROGEP) countries: 6 <sup>th</sup>	
World Bank RISE 2015 Energy Access Score: 40			
Policy/Regulatory Support and Financial Incentives	<b>Specific national policies, laws and programs</b>		
	National electrification policy with off-grid provisions	√	POSEN
	Integrated national electrification plan	x	
	Energy/electricity law with off-grid provisions	√	General Energy Regulation Law, 2017
	National programs promoting off-grid market development	√	PASE, PNDES, PASEL (Lighting Africa)
	Specific target for rural electrification	√	45% access by 2020; 65% by 2030
	<b>Financial incentives</b>		
	Subsidies, tax exemptions or related incentives for solar equipment/stand-alone systems	√	Tax exemptions for solar equipment
	<b>Standards and quality</b>		
	Government-adopted international quality standards for stand-alone systems	√	General Energy Regulation Law, 2017
	Government-certified program for solar equipment installers	x	
	Consumer awareness/education programs	√	PASEL (Lighting Africa) includes public awareness component
	<b>Concession Contracts and Schemes</b>		
		√	General Energy Regulation Law, 2017
<b>Business Model Regulation</b>			
	x		

√ = existing/implemented provisions in the current regulatory framework  
 X = no existing provisions

Source: World Bank RISE, Stakeholder interviews and GreenMax Capital Advisors analysis

<sup>92</sup> “Policy Matters: Regulatory Indicators for Sustainable Energy,” World Bank ESMAP, (2018): <http://documents.worldbank.org/curated/en/553071544206394642/pdf/132782-replacement-PUBLIC-RiseReport-HighRes.pdf>

Figure 18: Distribution of RISE Electricity Access Scores in Access-Deficit Countries, 2017<sup>93</sup>



Source: World Bank Regulatory Indicators for Sustainable Energy

<sup>93</sup> "Policy Matters: Regulatory Indicators for Sustainable Energy," World Bank ESMAP, (2018): <http://documents.worldbank.org/curated/en/553071544206394642/pdf/132782-replacement-PUBLIC-RiseReport-HighRes.pdf>

#### 1.3.4.1 Existence of Specific National Programs

While there is no specific national program for development of the off-grid sector, there are several overlapping government and donor-funded initiatives supporting rural electrification, including the Access to Energy Services Program (PASE), which committed to electrifying 600 settlements; (ii) the PNDES Structural Reforms and Investment Plan, providing off-grid solar systems to 300 localities through 2020; and (iii) the World Bank Lighting Africa rural electrification program, PASEL, implemented by the Ministry of Energy between 2004 and 2017 and subsequently by ANEREE. Moreover, the GoBF is prioritizing development of the RE sector, as the MoE created a new dedicated agency – ANEREE – to coordinate government, donor and private sector initiatives and to support research and innovation. A roadmap for development of the solar sector was approved in 2017.

#### 1.3.4.2 Financial Incentives

An Electrification Development Tax and value added tax (VAT) incentives have been adopted to prioritize stand-alone systems. In 2013, VAT, customs, and tax exemption on solar equipment were adopted through the law of finance/budget which is renewed each year by the National Assembly. The Electrification Development Tax is used to finance electricity infrastructure in rural areas and totals FCFA/kWh 2 (EUR 0.03/kWh). The government has also established a Rural Electrification Fund (FDE) to support financing and implementation of rural electrification policy in Burkina Faso. ABER provides loan guarantees and subsidies to rural electrification studies and investments.

#### 1.3.4.3 Standards and Quality

For the quality of off-grid solar products and systems to meet the expectations of end-users, a set of standards need to be in place to ensure equipment is reliable, adequately covered by warranties and post-sale O&M. The GoBF has addressed quality standards through the General Energy Regulation Law of 2017 by ensuring development of renewable energy sources follow the standards of protection of public health, the environment and the demands of competitiveness of the economy. More specifically, equipment for the production of renewable energy, in particular solar and hydroelectric equipment, must adhere to the quality standards developed by Lighting Global and meet the requirements imposed by ANEREE.

#### 1.3.4.4 Concession Contracts and Schemes

The 2017 regulatory reform has initiated a more favorable mini-grid and off-grid licensing and concession framework for rural electrification, as it allows for the licensing of off-grid projects to both private developers and rural cooperatives. Burkina Faso is also one of the few African countries with detailed procedures to guide consumers interested in the mini-grid market.<sup>94</sup> Under the new regulation, a new approach was adopted to select small grid-connected solar PV projects totaling 100 MW (PPP contracts through a competitive bidding process).<sup>95</sup> Prior to 2017, the regulation in place favored projects managed by cooperatives but restricted the development of private solar companies. For solar PV power producers to operate above 10 kW, the regulation previously required an authorization from the Ministry of Energy.

<sup>94</sup> “Green Mini-grid Market Development Programme,” SEforALL, (2017): <https://greenminigrid.SEforALL-africa.org/sites/default/files/GMG%20Burkina%20Faso%20report%20final.pdf>

<sup>95</sup> “Burkina Faso Electricity Sector Support Proposed Additional Credit,” World Bank, (2017):

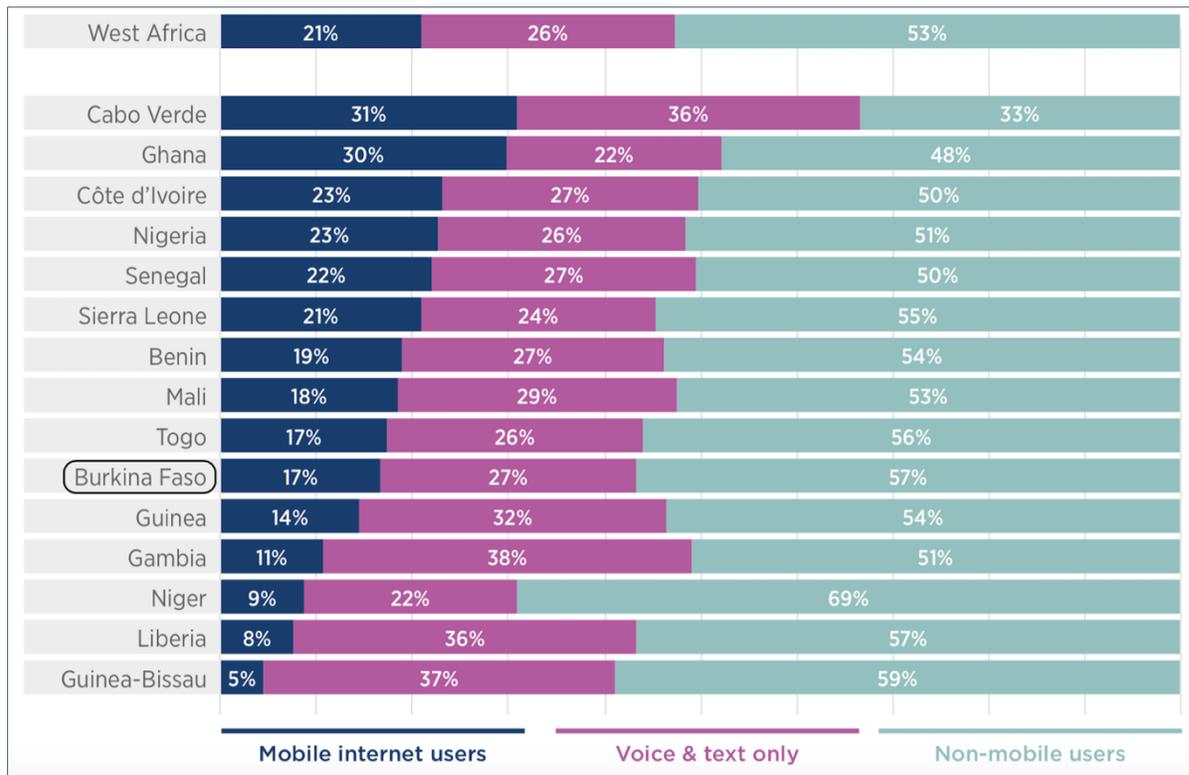
<http://documents.worldbank.org/curated/en/275641497146431923/pdf/BF-PP-05152017.pdf> and “Burkina Faso - Second Energy and Fiscal Management Development Policy Financing Project,” World Bank, (2017):

<http://documents.worldbank.org/curated/en/970061513479640534/pdf/BURKINA-FASO-PAD-11212017.pdf>

1.3.4.5 Specific Business Model Regulation

No specific business model regulations exist for the off-grid sector in Burkina Faso, although the Government can take measures to support pay-as-you-go (PAYG) business models that have already been deployed by private solar companies engaged in the market. As was demonstrated in East Africa in recent years, the proliferation of mobile money platforms can rapidly facilitate energy access. Recent data suggests that there is an opportunity for the GoBF to bring together key stakeholders in the off-grid sector (solar providers, telecommunications companies etc.) to take advantage of the country’s rapidly growing mobile internet usage (**Figure 19**) and high rates of mobile phone ownership in rural areas (**Figure 20**). Moreover, a transition to mobile broadband networks is gaining rapid momentum, with Burkina Faso among the five largest markets in West Africa in terms of size and share of subscriber growth.

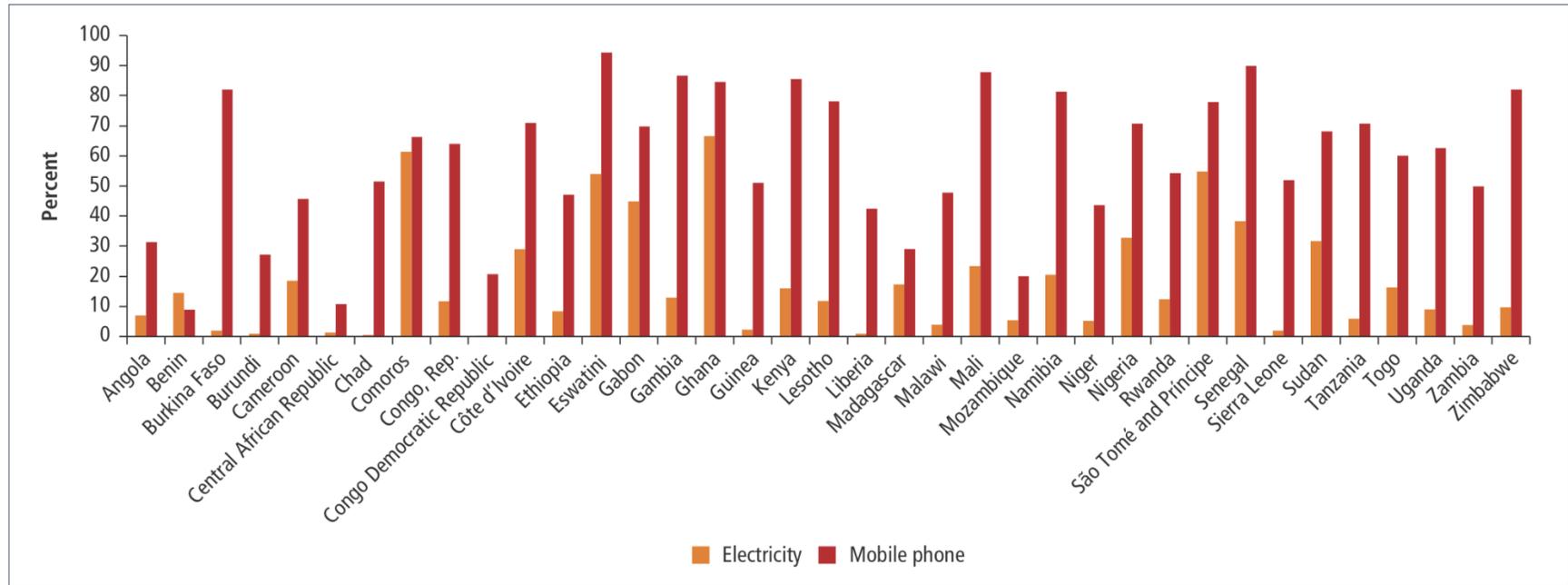
Figure 19: West Africa Mobile Internet Penetration Rates, 2017<sup>96</sup>



Source: GSMA Intelligence

<sup>96</sup> “The Mobile Economy: West Africa 2018,” GSMA Intelligence, (2018): <https://www.gsmaintelligence.com/research/?file=e568fe9e710ec776d82c04e9f6760adb&download>

Figure 20: Electricity Access and Mobile Phone Ownership in Sub-Saharan Africa, 2016 (% of rural households)<sup>97</sup>



Source: World Bank

<sup>97</sup> Blimpo, M., and Cosgrove-Davies, M., "Electricity Access in Sub-Saharan Africa: Uptake Reliability and Complementary Factors for Economic Impact," AFD and World Bank, (2019): <https://openknowledge.worldbank.org/bitstream/handle/10986/31333/9781464813610.pdf?sequence=6&isAllowed=y>

### 1.3.5 Capacity Building and Technical Assistance

To overcome the challenges surrounding rural electrification, a range of technical and financial resources from both the public and private sector must come together. At the institutional level, the MoE, ABER and the electricity market regulator, ARSE, among others, will play key roles in establishing a supportive policy and regulatory framework. Additional reforms to the power sector may be required to provide the incentives necessary to increase private sector participation. Local FIs and MFIs will need incentives and support to develop and implement new financial products and administrative procedures to lend to the off-grid sector. International and local solar companies will need policy and financial support. Local technical capacity of the solar sector will need to be developed to ensure long-term O&M services are available. Above all, financing and TA will be critical for all market actors – government, financial institutions, end-users, suppliers and service providers – in order to accelerate growth. **Table 8** identifies some of the policy/regulatory challenges facing off-grid market development in Burkina Faso and the proposed mitigation measures/TA interventions to overcome these gaps.

Table 8: Gaps in the Off-Grid Policy and Regulatory Framework<sup>98</sup>

Indicator	Policy/Regulatory/Market Gaps	Recommended TA Intervention
1. Specific National Policies, Laws and Programs	<b>A. Lack of Integrated National Electrification Plan</b>	
	a. No integrated plan exists	a. Help Government develop a comprehensive, fully integrated electrification plan with least cost planning to consider where grid extension is the most efficient and sustainable approach to increasing energy access vs. development of the off-grid sector – mini-grids and stand-alone systems powered by local renewable resources
	b. Insufficient focus on or understanding of framework to support private sector participation	b. Help Government develop a planning framework to encourage private participation in off-grid development options, including <i>inter alia</i> preparation of guidelines to enhance collaboration between Government and private companies, industry associations, and other relevant stakeholders to coordinate development of effective policy that is flexible and responsive to the needs of the market
	<b>B. Lack of Energy and Electricity Law</b>	
	a. No specific Energy or Electricity Law exists	a. Help Government develop new legal framework that is flexible and helps create appropriate incentives for private sector participation in off-grid market development (to expedite the process of electricity market liberalization initiated by the 'General Energy Regulation Law' in 2017)

<sup>98</sup> **NOTE:** “Government” as it is used throughout this table refers to the main public institutions, officials and policymakers responsible for planning, management and regulation of the energy sector in Burkina Faso (**Table 2**), including the Ministry of Energy, Rural Electrification Agency (ABER), Regulatory Authority (ARSE), Renewable Energy and Energy Efficiency Agency (ANEREE), the public utility, SONABEL, and Electricity Cooperatives (COPELs) among other national and local authorities.

Indicator	Policy/Regulatory/Market Gaps	Recommended TA Intervention
	<p><b>C. Lack of national policies, laws, or programs targeting off-grid market development</b></p> <ul style="list-style-type: none"> <li>a. No specific Off-Grid Policy, Law, or Action Plan in place</li> <li>b. Insufficient focus on or understanding of framework to support private sector participation</li> <li>c. Government is subsidizing fossil fuel electricity production</li> </ul>	<ul style="list-style-type: none"> <li>a. Help Government establish the medium-long term rural electrification strategy in the country through development and implementation of a rural electrification Master Plan</li> <li>b. Help Government improve policy and regulatory framework to create appropriate incentives for private sector participation to expedite off-grid solar market growth, including <i>inter alia</i> preparation of procurement schemes and financing mechanisms designed to encourage PPP engagement in the off-grid sector</li> <li>c. Help Government analyze where fossil fuel subsidies impede development of safe, clean energy access alternatives</li> </ul>
<p><b>2. Financial Incentives (import duties, taxes, etc.)</b></p>	<p><b>A. Insufficiently supportive financial incentives / tax regime</b></p>	<ul style="list-style-type: none"> <li>a. Help Government expand existing financial incentives<sup>99</sup> to cover the entire off-grid stand-alone solar product supply chain, including batteries, inverters or other system components to provide necessary support to the industry</li> <li>b. Help Government establish a Special Task Force (within MoE or ABER) to (i) mitigate potential difficulties in customs clearance and import logistics, and (ii) oversee implementation of tax exemptions by coordinating with all agencies and regulatory bodies involved</li> <li>c. Help Government introduce appropriate grant and subsidy schemes, which require private funding matches and are predictable and not overly bureaucratic (e.g. through the proposed Rural Electrification Fund, FDE)</li> <li>d. Help Government create PPP schemes<sup>100</sup> to share high project development and market entry costs particularly with developers in remote areas (e.g. through the proposed FDE)</li> <li>e. Help Government analyze where subsidies or exemptions for non-renewable energy sources provide unfair advantage for fossil-fuels and impede development of clean energy solutions</li> </ul>
<p><b>3. Standards and Quality</b></p>	<p><b>A. Insufficient Market Data</b></p> <p><b>B. Need for verification procedures to ensure quality standard requirements are met</b></p>	<ul style="list-style-type: none"> <li>a. Help Government establish a Special Task Force (within MoE or ABER) responsible for collaborating with the private sector to compile and regularly update a database of critical off-grid market data (solar product imports, costs, sales volumes, resource potential etc., GIS data and other key indicators) that can be (i) utilized by policymakers to make informed electrification planning decisions based on accurate market information, and (ii) made easily accessible to interested off-grid developers, investors and other key industry stakeholders</li> <li>a. Help Government integrate existing quality standard requirements under the ‘General Energy Regulation Law’ of 2017 with appropriate oversight agencies to ensure quality-verification procedures are in place</li> </ul>

<sup>99</sup> The GoBF has implemented an “Electrification Development Tax” with VAT exemptions for stand-alone systems

<sup>100</sup> The GoBF has established the General Directorate for Cooperation (DGCOOP) within the Ministry of Economy, Finances and Development to coordinate all of the country’s PPP initiatives.

Indicator	Policy/Regulatory/Market Gaps	Recommended TA Intervention
		<ul style="list-style-type: none"> <li>b. Help Government implement a legal framework that provides protections for consumers and suppliers, including <i>inter alia</i> regulations that (i) require licensing for the sale and installation of solar equipment; (ii) prohibit the sale of certain brands or models; and (iii) enable companies or public authorities to prosecute those caught distributing counterfeit / inferior products that are not up to promulgated standards</li> </ul>
	<p><b>C. Lack of capacity of local technical sector (solar PV technicians, installers, services providers etc.)</b></p>	<ul style="list-style-type: none"> <li>a. Support establishment of technical certification and vocational training programs through government, private sector, and/or academia for installation and maintenance of stand-alone solar systems (e.g. by building on training and rural development initiatives carried out by COPELs)</li> <li>b. Support development of database of best practices / information sharing services to ensure skills transfer from international, local and regional initiatives (e.g. through ABER or ANEREE)</li> </ul>
	<p><b>D. Insufficient attention of private companies to environmental/social standards and community engagement</b></p>	<ul style="list-style-type: none"> <li>a. Assist private sector and/or civil society organizations to ensure environmental/social standards are in place</li> <li>b. Assist in development of strategies encouraging inclusive gender participation (e.g. Women Environmental Programme)</li> <li>c. Support with the implementation of a repair and recycling framework for off-grid solar systems and equipment</li> </ul>
	<p><b>E. Insufficient public awareness</b></p>	<ul style="list-style-type: none"> <li>a. Support Government, trade associations and civic society organizations to develop and implement consumer awareness/marketing/education programs on the benefits of off-grid solar products and the existence of related national programs<sup>101</sup></li> <li>b. Support development and implementation of programs to educate consumers, retailers and distributors on the benefits of quality certified solar products vs. 'non-standard' poor quality products (e.g. through COPELs)</li> </ul>
	<p><b>4. Concession Contracts and Schemes</b></p>	<p><b>A. Need for clear communication and streamlining in licensing and permitting procedures</b></p>

<sup>101</sup> The World Bank Lighting Africa (PASEL) program includes a public awareness component

Indicator	Policy/Regulatory/Market Gaps	Recommended TA Intervention
	<p><b>B. Lack of understanding of emerging concession schemes for off-grid providers</b></p> <p>a. Need for understanding of different SHS concession schemes</p> <p>b. Need for understanding of emerging models for 'Integrated Private Utilities'</p> <p>c. Public finance/budget laws that hamper deployment of energy services models for public facilities</p> <p>d. Lack of standardized contracts for energy services provided by private system operators to public facilities</p> <p>e. Insufficient protection for 'stranded investments'</p>	<p>a. Help Government understand all options and models for possibilities of granting geographic concessions to private operators of SHS<sup>102</sup></p> <p>b. Help Government understand and develop approaches to facilitate pilots of 'Integrated Private Utility' schemes.<sup>103</sup></p> <p>c. Help Government develop procurement and public finance laws that will facilitate stand-alone solar system investment for public facilities (schools, health care facilities, etc.)</p> <p>d. Help Government, trade associations or civic society organizations develop model bilateral PPA and Energy Services Contracts for small scale IPPs and ESCOs to sell power or deliver energy services to public facilities or deliver solar street lighting services to municipalities (e.g. through COPELs/private developers)</p> <p>e. Help Government develop proper procedures and guidelines to protect against stranded investments from competition among all on-grid and off-grid electrification approaches<sup>104</sup></p>
<p><b>5. Business Model Regulation</b></p>	<p><b>A. Lack of understanding about different pricing schemes and business models offered by stand-alone solar system developers</b></p>	<p>a. Support capacity building of regulators, Government, and non-Government stakeholders about different pricing schemes<sup>105</sup> offered by stand-alone solar system providers to improve understanding and help avoid unnecessary interventions to regulate</p> <p>b. Support regulators and off-grid enterprises to collaborate specifically on developing pricing schemes for productive use market segment<sup>106</sup></p> <p>c. Support off-grid entrepreneurs and telecommunications companies in building the capacity of and fostering linkages between telecommunications companies / mobile money providers and off-grid solar companies to roll out PAYG business models</p>

Source: Focus Group Discussions; Stakeholder interviews; GreenMax Capital Advisors analysis

<sup>102</sup> Different models used to grant geographic concessions to SHS providers can yield wide-ranging results. Some observers have lauded the approaches used in Rwanda, Nigeria, Togo and DRC as successful while, there has been criticism of the approach deployed in Senegal.

<sup>103</sup> Innovative models are emerging for entire geographic areas to be concessioned to integrated private energy services operators who may offer an appropriate mix of solutions within their franchised area (i.e. a mix of SHS, rooftop solar, specialized systems for productive use, mini-grids and micro-grids). This is being piloted by the Shell Foundation in several countries.

<sup>104</sup> As the off-grid sector becomes populated by a variety of different approaches, all private operators are subject to potential stranded investments "when the grid arrives" and even SHS providers can have their assets and revenues threatened when the mini-grid arrives.

<sup>105</sup> The term "pricing schemes" used in this context refers to pricing options offered by standalone solar system providers for SHS, productive use, rooftop solar for public facilities, solar street lighting, etc. that are new, innovative and may be difficult for stakeholders to initially well understand. Whether these are PAYG, Lease to Own, electricity sales, commodity-based pricing, time of use or block pricing, the lack of understanding can often cause stakeholders to ask Government to intervene to "protect consumers" where such regulation of the market could in fact be misguided and unwarranted.

<sup>106</sup> The productive use segment is brand new with SHS providers, mini-grid operators and vendors specialized on a single type of SME or agricultural productive use (i.e. grain mills, water pumps, cocoa processing etc.) all grappling to arrive at attractive approaches to billing for energy services. This is an area where TA support is much needed to help all stakeholders sort out fair and practical approaches.

## 1.4 Development Initiatives

### 1.4.1 National Government Initiatives

The GoBF has prioritized improving management of SONABEL, diversifying the energy mix, increasing rural electrification rates, and promoting private sector participation in power production through liberalizing and commercializing energy markets.<sup>107</sup> With support from development partners, the Ministry of Mining and Energy has conducted assessments and developed rural plans and programs to address the country’s low electrification rate. However, no comprehensive rural electrification master plan has been developed yet. Instead, rural cooperatives (COOPELs), under the supervision of ABER, maintain a leading role in electrifying communities in rural areas throughout the country. The Government’s main programs supporting development of the off-grid sector are summarized in **Table 9**.

Table 9: National Government Off-Grid Development Programs

Project/Program	Timeline	Market Segment(s)	Description
National Program for Economic and Social Development (PNDES) <sup>108</sup>	2016-2020	Solar PV, hybrid systems	<ul style="list-style-type: none"> <li>Includes electrifying 300 localities by solar photovoltaic systems or hybrid systems with a Planned investment of XOF 25 billion (about EUR 38 million)</li> <li>Includes the development of two solar equipment assembly plants with planned investment of XOF 70 billion (about EUR 107 million)</li> </ul>
Electrification Plan Programme (PASE)	2013-2015	Rural electrification	<ul style="list-style-type: none"> <li>Electrification of over 600 settlements in Burkina Faso</li> <li>Financed by the EU, AfDB, AFD and World Bank</li> </ul>
National Action Plan for Renewable Energy (PANER), SEforALL Action Agenda	2015-2030	Renewable Energy	<ul style="list-style-type: none"> <li>Aims to increase off-grid decentralized rural electricity access to 13% in 2020 and 27% in 2030.</li> </ul>

### 1.4.2 DFI and Donor Programs

A number of Development Finance Institutions (DFIs) and donor agencies have been engaged in various programs and initiatives supporting development of the off-grid sector in Burkina Faso. In general, the World Bank, AfDB, and the EU are the country’s largest financing partners. The EU has been very active in promotion of rural electrification and is sponsoring the electrification program of Ziro and Gourma provinces (EUR 7.8 million).<sup>109</sup>

On a bilateral level, the French development agency (AFD)<sup>110</sup> is a major partner in Burkina Faso’s electricity sector. AFD has provided direct budget support to Burkina Faso’s rural electrification agency, ABER (formerly FDE) during the period 2013–2016,<sup>111</sup> together with other bilateral partners (DANIDA, the Abu Dhabi Fund) and multilateral partners (World Bank and EU).<sup>112</sup> Other bilateral actors active in Burkina Faso include GIZ, Abu Dhabi Development Bank, China cooperation (which replaced the Taiwan

<sup>107</sup> “Burkina Faso Electricity Sector Support Proposed Additional Credit,” World Bank, (2017):

<http://documents.worldbank.org/curated/en/275641497146431923/pdf/BF-PP-05152017.pdf> and “Burkina Faso - Second Energy and Fiscal Management Development Policy Financing Project,” World Bank, (2017):

<http://documents.worldbank.org/curated/en/970061513479640534/pdf/BURKINA-FASO-PAD-11212017.pdf>

<sup>108</sup> “Plan National de Développement Économique et Social (PNDES) 2016-2020: Matrice de réformes stratégiques et d’investissements structurants, version provisoire,” GoBF, (2018)

<sup>109</sup> “Appui au secteur de l’énergie au Burkina Faso,” EU, (2016): <https://eeas.europa.eu/sites/eeas/files/7.appui-secteur-energie.pdf>

<sup>110</sup> “Faire progresser l’électrification du pays,” AFD, (2018): <https://www.afd.fr/fr/page-region-pays/burkina-faso>

<sup>111</sup> Latest data available on ABER’s budget support by bilateral and multilateral donors

<sup>112</sup> “PowerPoint Presentation of the FDE, Mr. Yacouba Camara, General Director of the FDE,” Ministry of Energy of Burkina Faso, (2017).

Cooperation) and MICROCRED. DFI/donor programs and initiatives supporting development of the off-grid sector are summarized in **Table 10**.

Table 10: DFI and Donor-Funded Off-Grid Development Programs

Project/Program	Sponsor / Funding Source	Timeline	Market Segment(s)	Description
Electricity Services Access Project (Projet d'Accès au Secteur de l'Electricité, PASEL) <sup>113</sup>	World Bank Lighting Africa	2017-present	Pico solar lanterns	<ul style="list-style-type: none"> <li>• USD 1.5 million component of Lighting Africa Program dedicated to decentralized energy access under the World Bank Electricity Sector Support Project</li> <li>• To date, a total of 239 schools have benefited from this initiative in 8 regions of Burkina Faso and 161 additional schools will be reached in 2018. A consumer education campaign focused on energy efficiency and off-grid solar lamps meeting Lighting Global standards is also being prepared in collaboration with the Government of Burkina Faso.</li> </ul>
Sampopo Solar Kits and Public Lighting Project	Conseil de l'Entente	Ongoing	Off-grid, solar home systems	<ul style="list-style-type: none"> <li>• Conseil de L'Entente has started to provide financing for the installation of 350 solar kits and public lighting systems in Sampopo</li> </ul>
IRENA/ Abu Dhabi Fund for Development Rural Electrification Project	IRENA/ADFD	2016-2020	Grid electrification, off-grid, solar PV, mini-grids, SHS	<ul style="list-style-type: none"> <li>• This project is both for grid-connected and off-grid solar (USD 10 million). The objective is to develop a 3.6 MW solar PV mini-grid, as well as SHS for 42 settlements (12,000 households) in Haut-Bassin, Boucle du Mouhoun.</li> </ul>
ACP-EU Energy Facility I and II	European Commission, FDE, Private Sector	2009-2016	Rural electrification	<ul style="list-style-type: none"> <li>• The ACP-EU Energy facility granted 10 rural electrification projects in Burkina Faso: <ul style="list-style-type: none"> <li>- ELSA: Electrification of 28 villages in the Sahel</li> <li>- SINCO: Electrification of 10 settlements in Yatenga and Zandoma with solar kits</li> <li>- ULPE: Electrification with solar PV of 10 communities in the Zoundwéogo province</li> <li>- Distribution of 4,000 solar kits</li> <li>- MICRESOL: Micro credits for purchase of individual solar kits, 1,000 families and entrepreneurs</li> <li>- 3,000 SHS on a fee for service basis</li> <li>- Flexy energy/SONABEL: 30 kW hybrid mini-grid development</li> </ul> </li> </ul>
Regional Program for the Development of Renewable Energy and Energy Efficiency (PRODERE) <sup>114</sup>	WAEMU (UEMOA)	2013-2017	Solar home systems, solar kits and Pico solar lanterns	<ul style="list-style-type: none"> <li>• Large-scale development of solar home systems, PV solar kits and Pico solar lanterns in the 8 UEMOA countries</li> </ul>
AECF REACT		2018 - present		<ul style="list-style-type: none"> <li>• In 2018, the Ministry of Energy launched a two-year pilot project (USD 5 million) to provide a subsidy to households and SMEs (70% and 30% respectively) in urban and peri-urban areas of Ouagadougou for the acquisition of solar PV equipment.</li> </ul>

<sup>113</sup> "Burkina Faso: A Focus on Rural Areas," Lighting Africa / World Bank, (2018): <https://www.lightingafrica.org/country/burkina-faso/>

<sup>114</sup> "Coopération ABREC-UEMOA pour le développement des ER et de l'EE dans les 8 États membres," Mr. Thierno Bocal Tall, President and General Director of ABREC, ABREC, (2013): [http://www.unece.org/fileadmin/DAM/energy/se/pp/gee21/5\\_ge\\_April\\_13/Tall.pdf](http://www.unece.org/fileadmin/DAM/energy/se/pp/gee21/5_ge_April_13/Tall.pdf)

### 1.4.3 Other Initiatives

In addition to the Government and DFI/donor initiatives mentioned above, there are also several non-governmental organization (NGO) programs and other related initiatives in Burkina Faso's off-grid sector:

- **Women Environmental Programme:** working to promote gender equality in the rural energy sector.<sup>115</sup>
- **Projet Production Solaire:** Project Production Solaire is one of the largest private solar companies operating in Burkina Faso's off-grid sector.<sup>116</sup> The company has sold 1,000 solar home systems and 10,000 solar lanterns, with a turnover of USD 2.8 million.
- **MICRESOL:** MICRESOL is a microcredit initiative by the Energy Foundation for the World (Fondation Energie pour le monde, FONDEM).<sup>117</sup> Since 2011, FONDEM, in partnership with Burkinabé supplier K&K International and local MFIs and credit unions, offers microcredits for households, health centers and micro-entrepreneurs. In five years, more than 900 solar kits would have been distributed to 10,000 users.
- **FONDEM:** FONDEM enables women's associations in Burkina Faso to rent portable solar lamps and phone charging equipment. FONDEM has also been involved in the supply of solar lighting installations for various dispensaries in rural areas. In 2015, FONDEM supplied various schools with solar lamps and also provided 160 families with solar kits.
- **SEMAFO Foundation:** Since its inception in 2012, the foundation has supplied schools in Burkina Faso with over 7,000 solar lights and has also connected 27 health centers to solar power.
- **Cowater Sogema and the Electrification Development Fund (EDF):** This project will, among other things, connect 14 localities in Burkina Faso to solar power, and equip 30 health centers with solar OV systems.
- **Tin Tua:** Tin Tua is an NGO contributing to electrification of Gori location through hybridization of a multifunctional rural platform offering energy services for local communities. This project, amounting to XOF 16 million (EUR 24,000) is led by ABER and co-financed by ECREEE.
- **Netherlands Development Organization (SNV):** SNV is a not-for-profit development organization that has been active in Burkina Faso's off-grid solar sector since 2016, supporting the Lighting Africa Program, with a focus on providing solar lighting to the country's education sector. At the end of the program 25,000 Lighting Africa-certified solar lamps will be distributed across 400 primary schools, at least 24,000 solar lamps are to be sold to libraries, with 100,000+ people impacted by the project.

<sup>115</sup> "WEP Burkina Faso," Women Environmental Programme: <http://wepnigeria.net/index.php/wep-burkina-faso/>

<sup>116</sup> "Catégorisation des entreprises du solaire au Burkina Faso," ECREEE, (2018).

<sup>117</sup> "Projet MICRESOL au Burkina Faso," FONDEM, (2018): <http://www.fondem.org/projets/projet.php?projet=5>

## II. OFF-GRID SOLAR PV MARKET ASSESSMENT

This section presents the overall market assessment for stand-alone off-grid solar (OGS) energy systems in Burkina Faso. **Section 2.1** provides an overview of the current household off-grid energy situation and estimates potential household market demand for solar energy systems. **Section 2.2** introduces institutional off-grid energy demand and the potential of solar to supply this market. **Section 2.3** evaluates the demand for off-grid solar to serve productive use applications. **Section 2.4** examines the existing off-grid solar product supply chain in the country. **Table 10** summarizes the overall total cash market potential for OGS systems from each of the analyzed market segments. **Annex 2** provides an overview of the Task 2 methodology.

It should be noted that the Task 2 market sizing assesses the total *potential* demand for off-grid solar, as well as variables that affect demand, such as changes in population density, household income, expansion of national grids and access to finance, among other factors. This data will support policymakers and practitioners as they assess market potential over time. However, the quantitative demand estimate has not been revised to reflect *realistic* market potential. Many other factors and market failures will prevent the full realization of this total market potential, and these will vary by market segment.

For household demand, the off-grid solar market is already tangible. Still, many factors will affect household demand for solar products, such as distribution realities, consumer education, competing economic priorities for households, financial shocks, etc. The institutional market will be affected largely by government and donor budget allocations along with the potential for community-based finance. The productive use market is perhaps the least concrete. Considered a relatively new market segment for the off-grid solar industry, productive use market dynamics are not yet well understood. The ability to realize potential productive use market demand will also be affected by many of the factors that commonly determine enterprise prospects in the country, including infrastructure, rural distribution, marketing, access to finance, insecurity, regulation, etc. The data presented in this report is intended to provide a baseline for future research.

Table 11: Indicative Total Cash Market Potential for Off-Grid Solar PV Products in Burkina Faso, 2018

Off-Grid Market Segment	Annualized Cash Demand (Units)	Annualized Cash Demand (kW)	Annualized Cash Market Value (USD)	Financed Market Value (USD)
<b>Household</b>				
Pico solar	922,629	2,768	\$41,518,316	\$0.00
Plug and play	58,366	584	\$7,295,730	\$0.00
Small SHS	0	0	\$0.00	\$97,313,814
Medium and Large SHS	0	0	\$0.00	\$93,441,465
<b>Household Subtotal</b>	<b>980,995</b>	<b>3,352</b>	<b>\$48,814,046</b>	<b>\$190,755,279</b>
<b>Institutional</b>				
Water supply	39	141	\$352,188	-
Healthcare facilities	313	151	\$375,500	-
Primary and secondary schools	574	622	\$1,639,185	-
Public lighting	79	40	\$118,650	-
<b>Institutional Subtotal</b>	<b>1,005</b>	<b>954</b>	<b>\$2,485,523</b>	-
<b>Productive Use</b>				
SME applications for micro-enterprises	1,378	344	\$861,000	-
Value-added applications	23,139	4,114	\$18,306,837	-
Connectivity / ICT (phone charging)	10,668	4,267	\$9,195,488	-
<b>Productive Use Subtotal</b>	<b>35,185</b>	<b>8,725</b>	<b>\$28,363,325</b>	-
<b>TOTAL</b>	<b>1,017,213</b>	<b>13,044</b>	<b>\$79,662,894</b>	-

Source: African Solar Designs analysis

## 2.1 Demand – Households

This section analyzes the main characteristics of the household (HH) OGS demand in Burkina Faso. Section 2.1.1 provides an overview of the household market segment, including its geographic components. Section 2.1.2 analyzes current household ability and willingness to pay for electricity services to estimate the total potential household sector demand. From this data, the potential household market for off-grid solar products is then calculated for both cash purchases (Section 2.1.3) and financed (2.1.4) purchases. Section 2.1.5 assesses consumer perceptions, interest, and awareness on OGS.

### 2.1.1 Overview of Household Market Segment

According to the International Energy Agency (IEA), in 2016 there were 2.69 million households (15.35 million people)<sup>118</sup> in Burkina Faso without access to electricity.<sup>119</sup> In that year, an estimated 20% of the population had access to electricity, with the rate of access at 58% in urban areas and 1% in rural areas.

This section gives an introduction to household consumer market segments, their characteristics and size (**Table 12**). It then discusses household sources of income and geographic distribution of off-grid households, both presently and projected over time. This provides context for the next section, 2.1.2, which sizes household segment potential market demand through a series of detailed analyses.

<sup>118</sup> See **Annex 2** for more details.

<sup>119</sup> See **Annex 2** for more details.

Table 12: Household Consumer Market Segments<sup>120</sup>

Income Quintile	% of HH w/o access	# of HH w/o access	Avg. GDP per HH per year	Energy Tier	2018 Scenario				2023 Scenario				2030 Scenario				Geographic segments	Description
					% of HH w/o access	# of HH w/o access	Avg. GDP per HH per year	Energy Tier	% of HH w/o access	# of HH w/o access	Avg. GDP per HH per year	Energy Tier	% of HH w/o access	# of HH w/o access	Avg. GDP per HH per year	Energy Tier		
Highest 20%	26%	175,098	\$8,693	Tier 3	1%	7,744	\$11,156	Tier 3	1%	9,460	\$14,379	Tier 3	High income rural	<ul style="list-style-type: none"> <li>• Small portion of rural households using a petrol generator set</li> <li>• Has a demonstrated ability to pay for solar off-grid systems</li> </ul>				
Fourth 20%	85%	572,434	\$4,042	Tier 2	2%	15,488	\$5,187	Tier 3	2%	18,920	\$6,686	Tier 3	Mid to high income urban	<ul style="list-style-type: none"> <li>• Professionals, business owners and salaried people are likely to be connected to the grid.</li> <li>• Small portion without grid access desire replacement to generator power<sup>121</sup></li> </ul>				
Third 20%	90%	606,107	\$2,943	Tier 2	3%	23,233	\$3,777	Tier 2	3%	28,380	\$4,869	Tier 2	Low income peri-urban / urban “under-grid”	<ul style="list-style-type: none"> <li>• Low income urban population engaged in SME work or casual labor</li> <li>• Lives near grid but cannot afford or does not have access to connection</li> </ul>				
Second 20%	99%	666,717	\$2,296	Tier 2	59%	460,219	\$2,946	Tier 2	4%	37,839	\$3,798	Tier 2	Low income rural	<ul style="list-style-type: none"> <li>• Engaged in farming, or SME</li> <li>• Lives more than 15km from the nearest grid connection.</li> </ul>				
Lowest 20%	100%	673,452	\$1,629	Tiers 1, 1.5	100%	774,419	\$2,090	Tier 2	55%	518,869	\$2,694	Tier 2						
<b>Total households without electricity access</b>		<b>2,693,808</b>			<b>Total</b>	<b>1,281,104</b>			<b>Total</b>	<b>613,467</b>								

Source: IEA and World Bank; African Solar Designs analysis

<sup>120</sup> See Annex 1 and Annex 2 for more details

<sup>121</sup> This model does not consider connected on-grid households that would purchase OGS systems as a back-up power system due to poor grid quality and reliability. The “households without electricity access” estimates shown here include households without electricity connections, either from a grid connection or from a renewable energy-based off-grid source. This does include “under-grid” households, largely in the lower income quintiles, that live within grid vicinity but are currently not connected. 2023 and 2030 projections assume that under-grid households will become connected in those years.

➤ **Off-grid household characteristics**

Burkina Faso has a high level of extreme poverty (households living below USD 1.90 a day) compared to some of its neighboring countries in West Africa. As shown in **Table 13**, the vast majority of the country’s households have a low income.

Table 13: Poverty Headcount in Burkina Faso, 2014

Poverty headcount ratio	% of population
Lives at or below \$1.90 a day*	43.7%
Lives at or below \$3.20 a day*	76.4%
Lives at or below \$5.50 a day*	92.3%

\*2011 PPP

Source: World Bank

According to the focus group discussions (FGDs), most households lack the capacity to pay for electricity due to the cost of sale and installations of solar equipment and insufficient financial resources. Households cannot pay for an installation but could pay for a service. Rural households have seasonal income in agricultural areas. Farmers are more receptive to hire-purchase systems provided. Trends in income variation by region: Di, Bagré, Garango, Bama, are high-income areas.

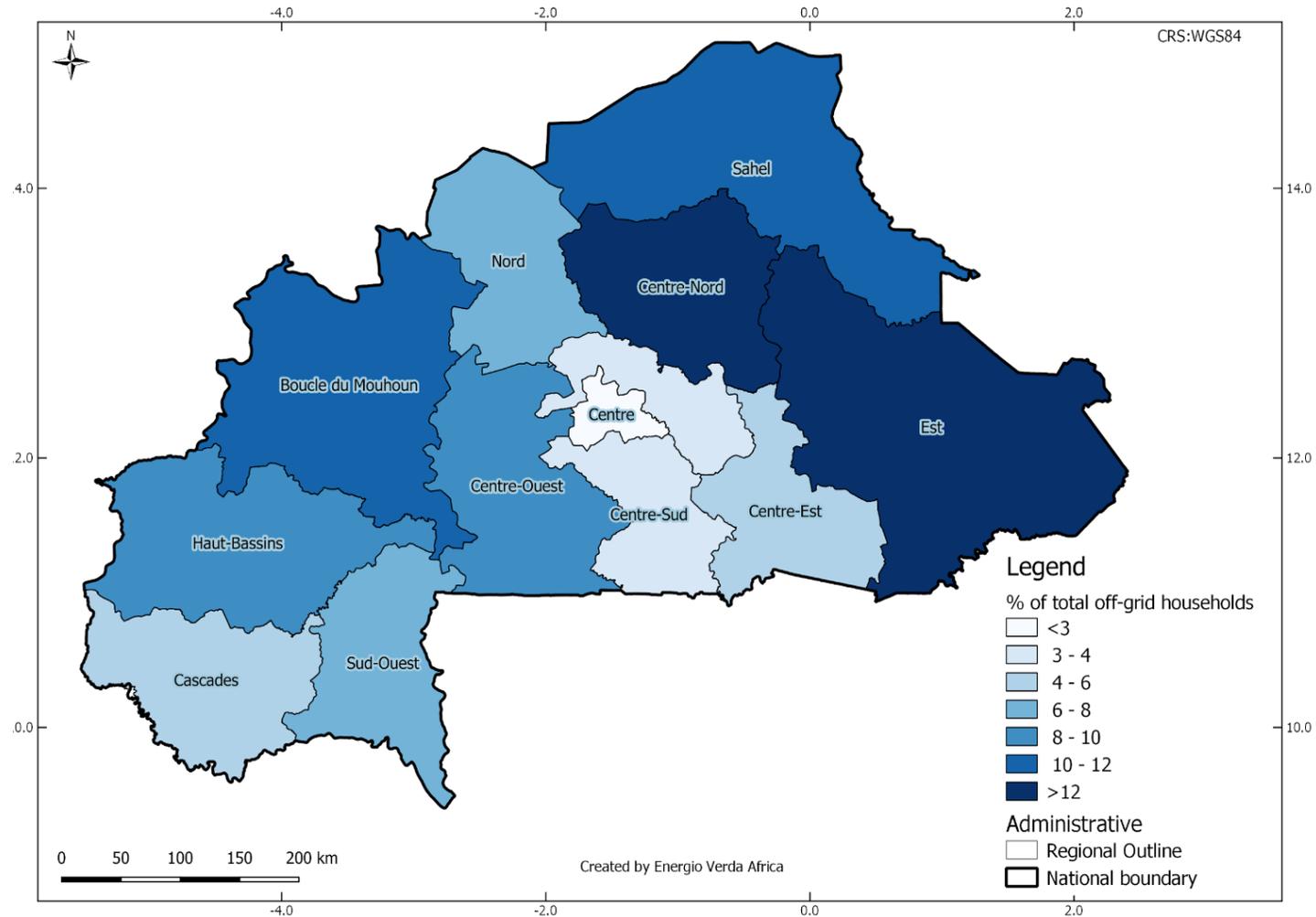
➤ **Geographic components of the solar market**

The total number of off-grid households and their geographic distribution will change significantly over time. To analyze the potential OGS market over time, GIS maps were prepared from demographic information to present potential market areas for OGS. GIS calculations consider drivers of off-grid household market change including grid extension around current urban and peri-urban centers, mini-grid development for more densely populated rural areas, and population growth. Sources of information for the maps presented below (**Figures 21-24**) can be found in **Annex 1**.

GIS maps shown here are for 2018-2023 and 2030. Data shown for 2018-2023 includes information on existing grid lines only. The data of planned “future lines” is not broken down in enough detail to show in which year future lines will be built, so an assumption was made that all future lines would be built after 2023 but prior to 2030.

As shown in the maps and chart summaries below (**Figures 21-24**), the total size of the OGS market will decrease over time, while also becoming somewhat more concentrated in remote regions. In Burkina Faso, off-grid households will remain relatively dispersed across the country. The concentration of off-grid households will slightly increase in the relatively remote eastern regions.

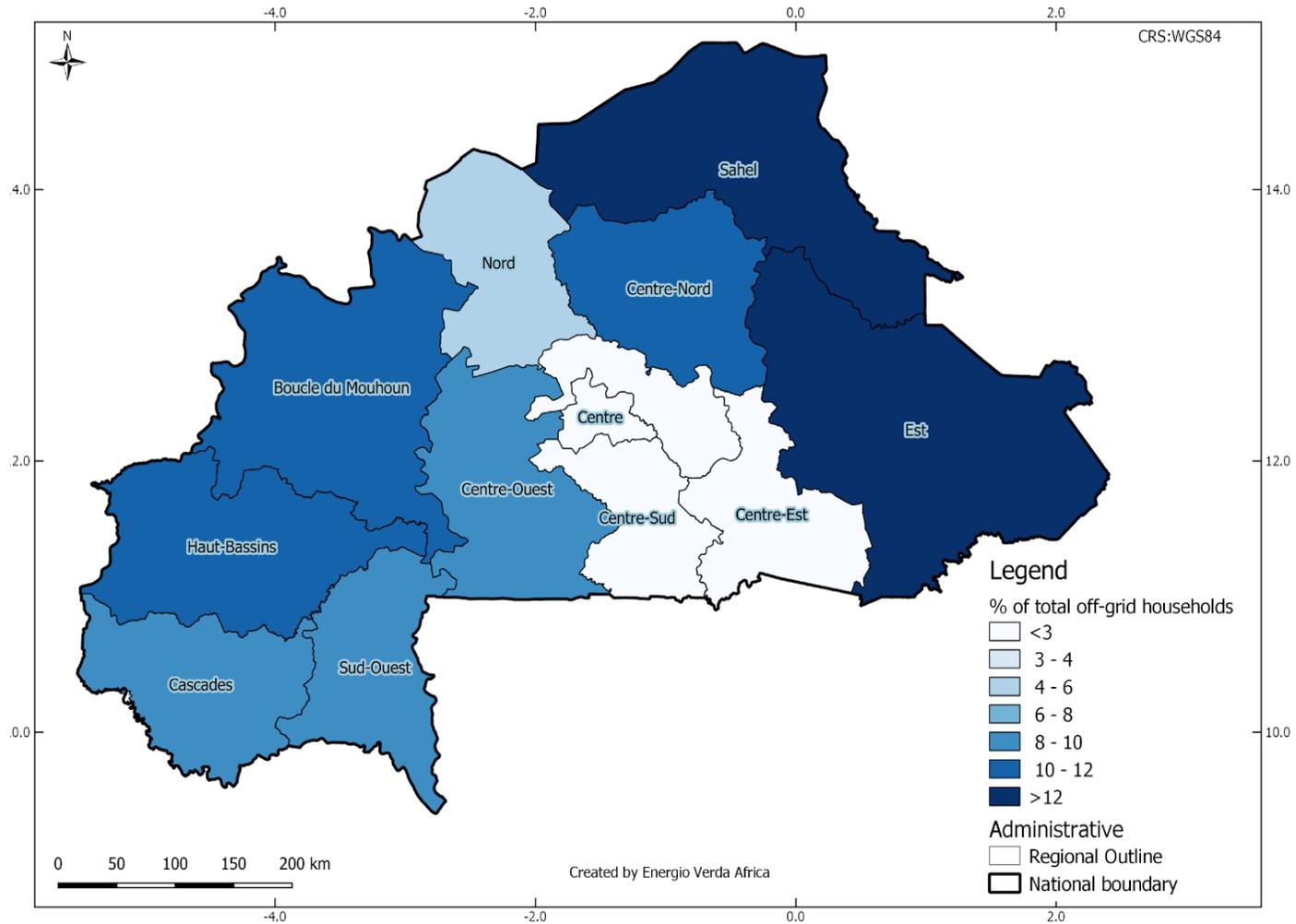
Figure 21: Distribution of Potential Off-Grid Households by Region, 2023<sup>122</sup>



Source: Energio Verda Africa GIS analysis

<sup>122</sup> See Annex 1 for more details, including data sources.

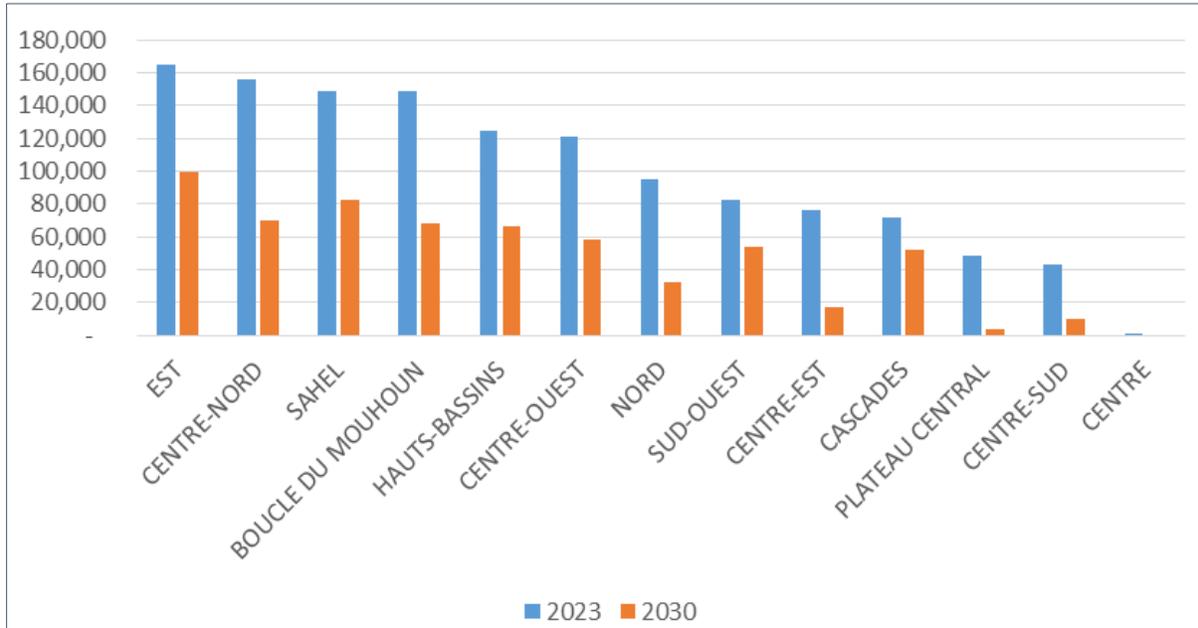
Figure 22: Distribution of Potential Off-Grid Households by Region, 2030<sup>123</sup>



Source: Energio Verda Africa GIS analysis

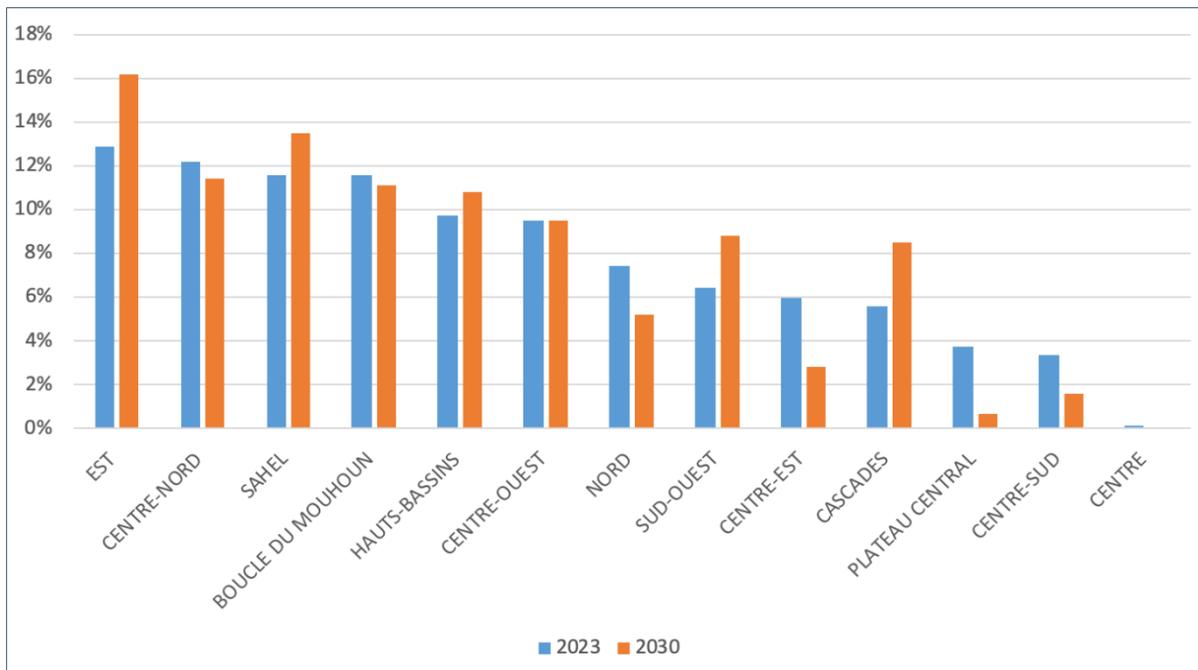
<sup>123</sup> See Annex 1 for more details, including data sources.

Figure 23: Estimated Number of Off-Grid Households by Region, 2023 and 2030



Source: Energio Verda Africa GIS analysis

Figure 24: Estimated Percentage of Off-Grid Households by Region, 2023 and 2030



Source: Energio Verda Africa GIS analysis

### 2.1.2 Analysis of Household Market Segment Demand

In order to calculate total potential household demand for off-grid solar products for the national market, this section examines several indicators:

- Household usage and costs of typical rural energy fuels and devices (non-solar)
- How these rural energy technologies align with typical access to “energy tiers”
- Cost of off-grid solar products alternatives, by energy tier
- Household uptake of solar products thus far
- Potential household demand based on household income quintiles

From this data, the potential household market for off-grid solar products is then calculated for both cash purchases and financed purchases.

#### ➤ Consumption and expenditures on typical rural energy fuels and devices (non-solar)

According to feedback from focus group discussion (FGD) participants, the most commonly used off-grid sources of energy for households are biogas, gas, batteries and generators. The main domestic appliances used by households include lamps, telephones, radios, torches, televisions, and fans.

**Table 14** shows the typical monthly cost of using common rural energy technologies. Household use of different types and amounts of energy technologies is associated with different energy access tiers, as defined in the Multi-Tier Energy Access Framework. For example, a household using one battery powered lantern and one charged cell phone would fall under the Tier 1 level of energy access. A household using two lanterns, one cell phone and a radio would be in Tier 1.5.

These tiers are defined in **Table 15**. Establishing an average monthly household expenditure for each energy tier using common rural technologies shows how household income level aligns with energy tiers. Secondly, it provides a basis to compare these costs to solar products that can offer an equivalent level of service by energy tier. This in turn reveals potential household savings by switching to solar products, as shown in **Figure 25** and **Table 17**.

It should be emphasized that even where households can be categorized into energy tiers by their income, few households actually pay full typical monthly costs because they do not have the available income. In reality, household income is highly variable throughout the year, and they simply do without service for portions of the month and year when cash is not available. This accounts for the difference between “typical monthly costs” (which are real) and “equivalent service costs” (which would be required to maintain the tier-level service). For example, very few households could actually run generators for the number of hours that would enable full tier 3 level services.

Table 14: Rural Energy Technology and Costs<sup>124</sup>

Technology	Description	Average Life (Years)	# of Units/ Month	Unit Operating Cost (USD)	Unit Capital Cost (USD)	Typical Monthly Cost (USD)	Unit Capital Cost (USD)	Typical Monthly Cost (USD)	Unit Capital Cost (USD)	Typical Monthly Cost (USD)
					2018 Scenario		2023 Scenario		2030 Scenario	
Torch lights/Electric Lanterns	Torch lights/electric lanterns powered by D-type, AA-type or AAA-type batteries	0.5	16	\$0.16	\$2.00	\$2.56	\$2.12	\$2.72	\$2.44	\$3.12
Cell Phone Charging	Done at a charging station	-	8	\$0.17	\$0.00	\$1.36	\$0.00	\$1.44	\$0.00	\$1.66
Smart Phone Charging	Done at a charging station	-	16	\$0.17	\$0.00	\$2.72	\$0.00	\$2.89	\$0.00	\$3.32
Battery-powered DC Radio	Radio powered by dry cells replaced two times per month	-	8	\$0.16	\$0.00	\$1.28	\$0.00	\$1.36	\$0.00	\$1.56
Small Petrol Generator	The most popular rural generator for basic use is 0.9kW generator (for phone charging, lighting, TV, fan and music system)	2	30	\$1.04	\$100.00	\$31.20	\$106.10	\$33.11	\$121.90	\$38.03

Source: African Solar Designs analysis

<sup>124</sup> Data from FGDs, field surveys and various published data sources.

Table 15: Typical Tier-Based Energy Costs

Device category and indicative energy supplied	Appliances and level of service	Non-solar devices used to power tier requirement	Typical Monthly Cost (USD) 2018	Typical Monthly Cost (USD) 2023	Typical Monthly Cost (USD) 2030
<b>Tier 0</b> No electricity	<ul style="list-style-type: none"> <li>Characterized by complete lack of electricity services</li> <li>Many cash-poor consumers are in this situation part of each month when they don't have money to buy dry cells or charge phones</li> </ul>	<ul style="list-style-type: none"> <li>Rely solely on kerosene, wood and other fuel sources for cooking and lighting</li> </ul>	<ul style="list-style-type: none"> <li>Subsistence level of energy</li> <li>Absolute energy poverty</li> </ul>	<ul style="list-style-type: none"> <li>Subsistence level of energy</li> <li>Absolute energy poverty</li> </ul>	<ul style="list-style-type: none"> <li>Subsistence level of energy</li> <li>Absolute energy poverty</li> </ul>
<b>Tier 1</b> Range: 1 to 20 Wh/day	<ul style="list-style-type: none"> <li>Access to one torch powered by dry cell batteries</li> <li>One cell phone powered by charging service</li> </ul>	<ul style="list-style-type: none"> <li>One battery-powered light requires dry cell replacement on weekly basis</li> <li>One cell phone charged 8 times per month</li> </ul>	\$3.92	\$4.16	\$4.78
<b>Tier 1.5</b> Range: 20 to 100 Wh/day	<ul style="list-style-type: none"> <li>Access to one torch and one lantern each powered by dry cells</li> <li>One cell phone powered by charging service</li> <li>Radio powered by dry cells</li> </ul>	<ul style="list-style-type: none"> <li>Two battery-powered light points require dry cell replacement on weekly basis</li> <li>One cell phone charged 8 times per month</li> <li>Radio dry cells replaced two times per month</li> </ul>	\$7.76	\$8.23	\$9.46
<b>Tier 2</b> Range: 55 to 500 Wh/day	<ul style="list-style-type: none"> <li>One torch and two lanterns powered by dry cells</li> <li>One cell phone and one smart phone powered by charge service</li> <li>Radio</li> <li>DC TV</li> </ul>	<ul style="list-style-type: none"> <li>Three battery light points require dry cell replacement on weekly basis</li> <li>One cell phone charged 8 times per month and one smart phone charged 16 times per month</li> <li>TV/Radio powered by lead acid battery recharged once per week</li> </ul>	\$14.32	\$15.20	\$17.46
<b>Tier 3</b> Range: 500 to 2500 Wh/day	<ul style="list-style-type: none"> <li>Five lighting points</li> <li>Multiple cell/smart phones</li> <li>AC radio and music system</li> <li>AC TV</li> </ul>	<ul style="list-style-type: none"> <li>Generator powers a set of appliances</li> </ul>	\$31.20	\$33.11	\$38.03

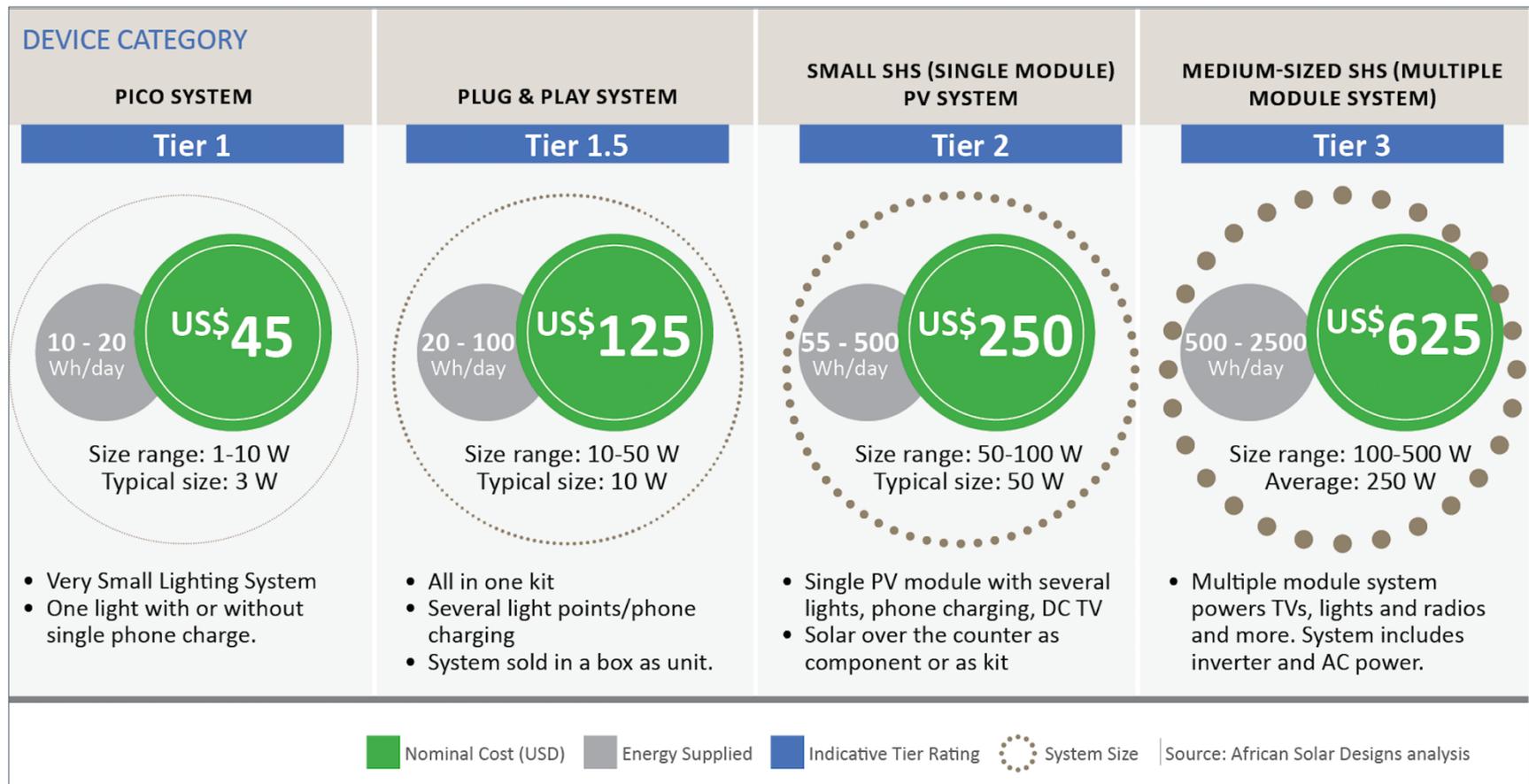
Source: African Solar Designs analysis

Per **Table 15**, it can be seen that, given the purchase price of dry cells and the cost of phone charging, the “ideal” electricity availability is extremely difficult to sustain. This is especially true where there is a high incidence of poverty in rural areas and lack of regular incomes. In reality, households often must reduce their energy consumption when cash is not available. This means that even a Tier 2 level family might drop to Tier 1 for a week each month when cash is not available to pay for phone charging or dry cell purchase.

➤ **Household Solar PV System Types**

Solar PV systems can provide lower cost and higher levels of service than existing dry cell, phone charging and generator options. In order to model how solar systems can meet existing energy use categories, levels of service and ability to pay, four types of household solar systems are configured to match the tier-based demands of off-grid communities. The system descriptions, energy outputs, prices, tier ratings and target consumer groups are listed in **Figure 25**.

Figure 25: Household Solar PV System Descriptions and Market Segments



Source: African Solar Designs analysis

➤ **Current usage and procurement process for household solar products**

Solar products are in limited use amongst off-grid households. The most active sales areas remain in urban hubs. Available solar systems: 1 kW or 1.5 kW installation for households who are a bit far from the city, and in urban areas, installations go up to 4 kW to be able to be autonomous during load shedding, with also small systems of 50W - 250W for lighting and televisions. There are existing distribution structures but not enough suppliers are able to design and maintain solar systems. Suppliers are not present in all geographic areas and important rural areas of the country.

Government policies and initiatives that define solar household use include the Ministry of National Education distributed lamps and some small solar equipment in some villages. Also, the Ministry of Youth and Vocational Training has offered scholarships to some students (about twenty) for training in the field of solar energy in order to increase the solar offer.

➤ **Potential household demand for off-grid solar products**

Looking beyond current use of off-grid solar products by households, this study analyzes potential for OGS market development by estimating potential household demand based on household income. Household income shown in **Table 16** is sourced from World Bank demographic data based on household surveys, which reports income by population quintiles. From household income, potential for energy spending is estimated as 10% of monthly income (see methodology annex). Future scenarios project higher energy budgets as household incomes rise with economic development over time. In all scenarios, the large majority of off-grid households will fall under the lowest income quintile.

Table 16: Energy Expenditure of Different Income Groups

Population Income Quintiles	Per Capita Income (USD per month)	Household Income (USD per month)	Energy as % of Income	Monthly Energy Budget (USD)
<b>2018 Scenario</b>				
Lowest Quintile of Population	\$23.81	\$135.73	10%	\$13.57
2nd Quintile of Population	\$33.57	\$191.33	10%	\$19.13
3rd Quintile of Population	\$43.03	\$245.29	10%	\$24.53
4th Quintile of Population	\$59.10	\$336.87	10%	\$33.69
Highest Quintile of Population	\$127.09	\$724.42	10%	\$72.44
<b>2023 Scenario</b>				
Lowest Quintile of Population	\$30.56	\$174.17	10%	\$17.42
2nd Quintile of Population	\$43.07	\$245.52	10%	\$24.55
3rd Quintile of Population	\$55.22	\$314.77	10%	\$31.48
4th Quintile of Population	\$75.84	\$432.29	10%	\$43.23
Highest Quintile of Population	\$163.09	\$929.63	10%	\$92.96
<b>2030 Scenario</b>				
Lowest Quintile of Population	\$39.39	\$224.51	10%	\$22.45
2nd Quintile of Population	\$55.52	\$316.47	10%	\$31.65
3rd Quintile of Population	\$71.18	\$405.73	10%	\$40.57
4th Quintile of Population	\$97.76	\$557.21	10%	\$55.72
Highest Quintile of Population	\$210.22	\$1,198.27	10%	\$119.83

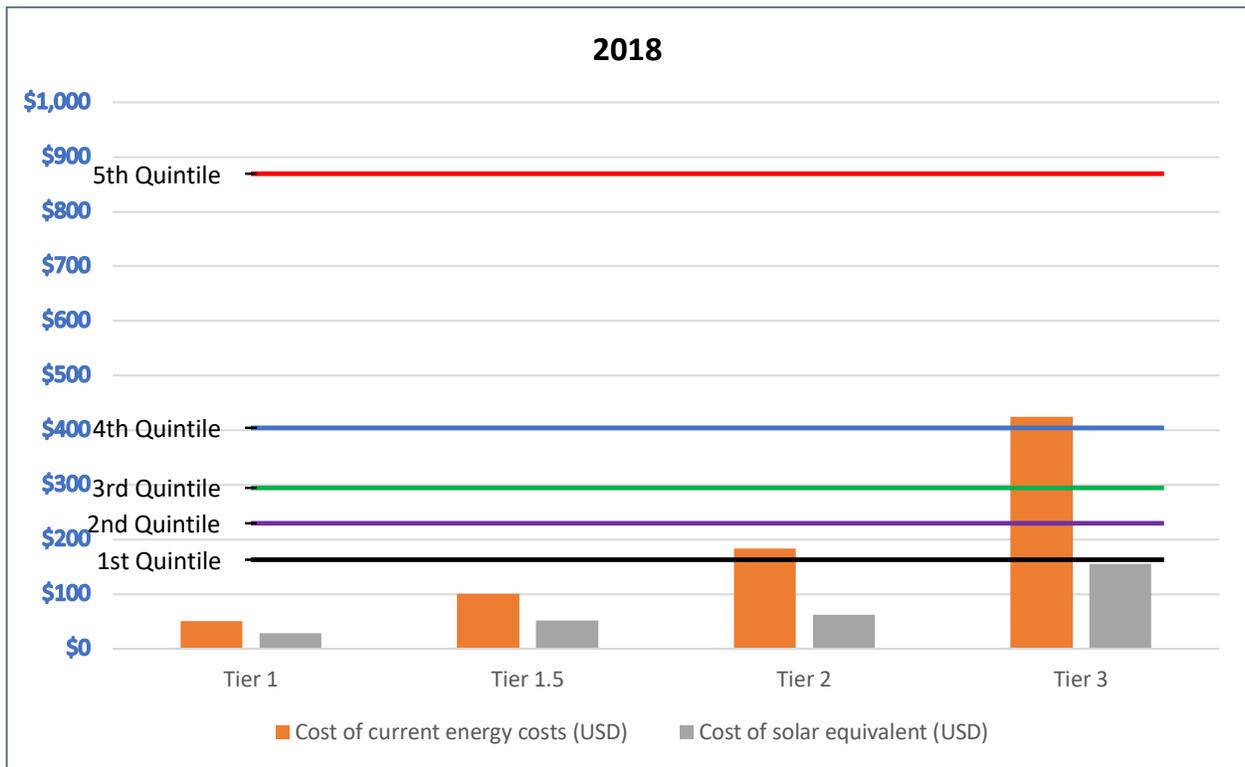
Source: African Solar Designs analysis

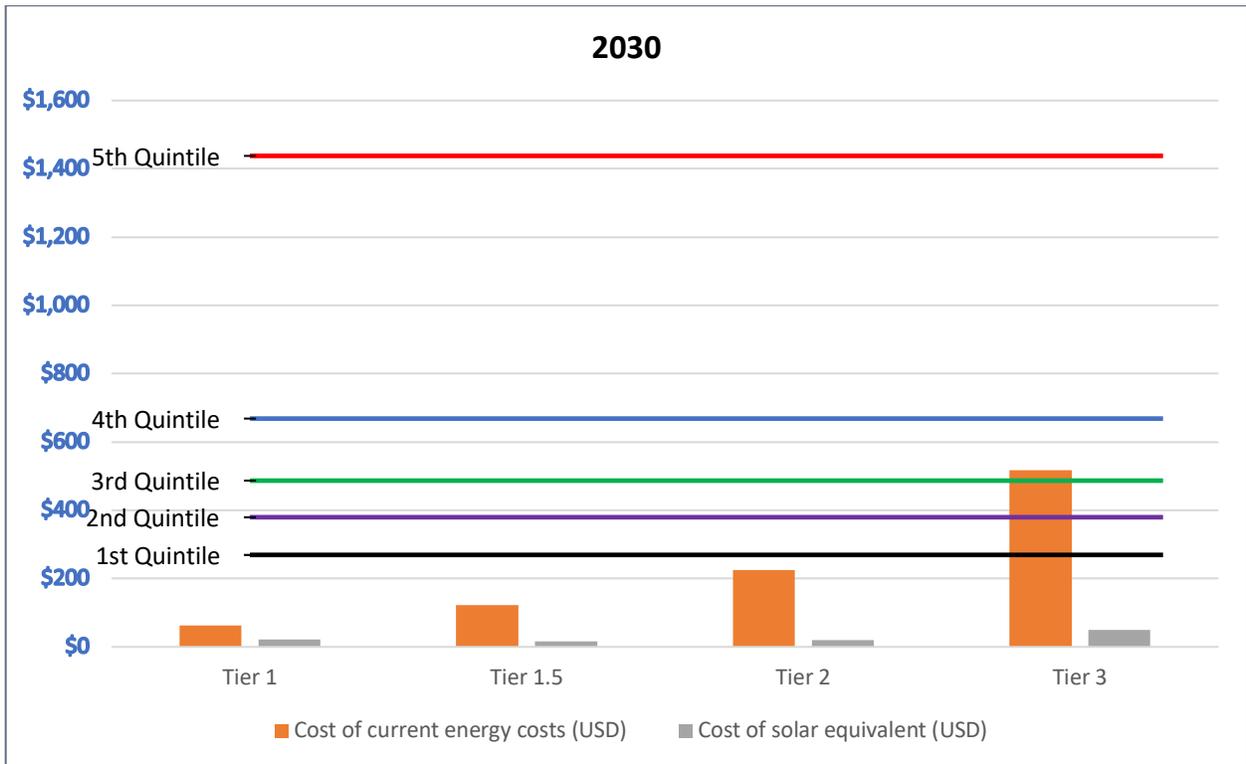
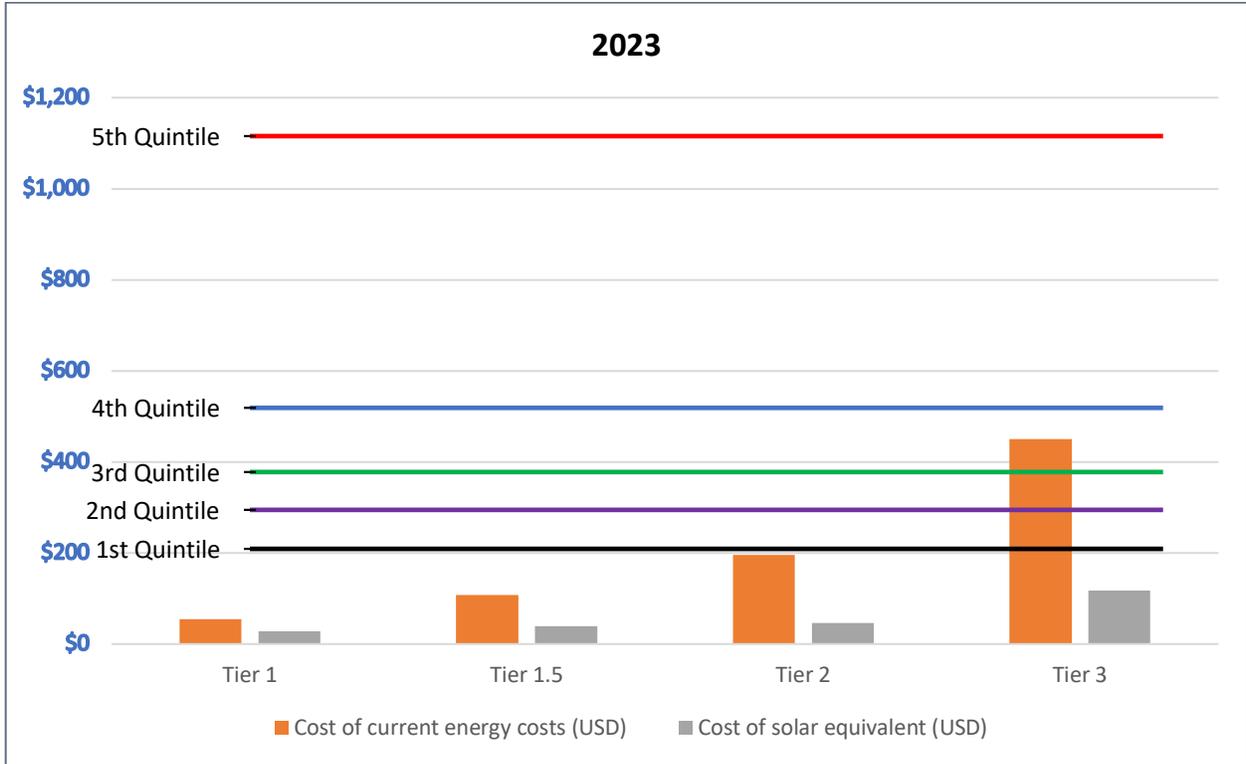
**Figure 26** summarizes the preceding data in this section by comparing household energy spending with typical rural energy costs and their solar equivalents. This analysis presents annualized costs (not including

financing cost) of current energy technologies for each energy tier, compared with the annual cost of an equivalent solar product. Both the annual costs of current energy technologies and equivalent solar solutions consider the capital costs of the units, and the operating costs considered over the average unit life times.

The data clearly shows strong potential savings for households to switch to solar products. Affordability also increases over time, as the cost of solar technology reduces, while the cost of traditional energy sources increases with inflation, and household income increases. Affordability here is shown by comparing annual income and energy costs over the life of a product. This indicates the need for short term financing, as many households still struggle to pay up front unit capital costs to achieve subsequent savings.

Figure 26: Annual Household Energy Budget by Quintile, Annual Energy Costs and Cost of Solar Equivalents





Source: African Solar Designs analysis

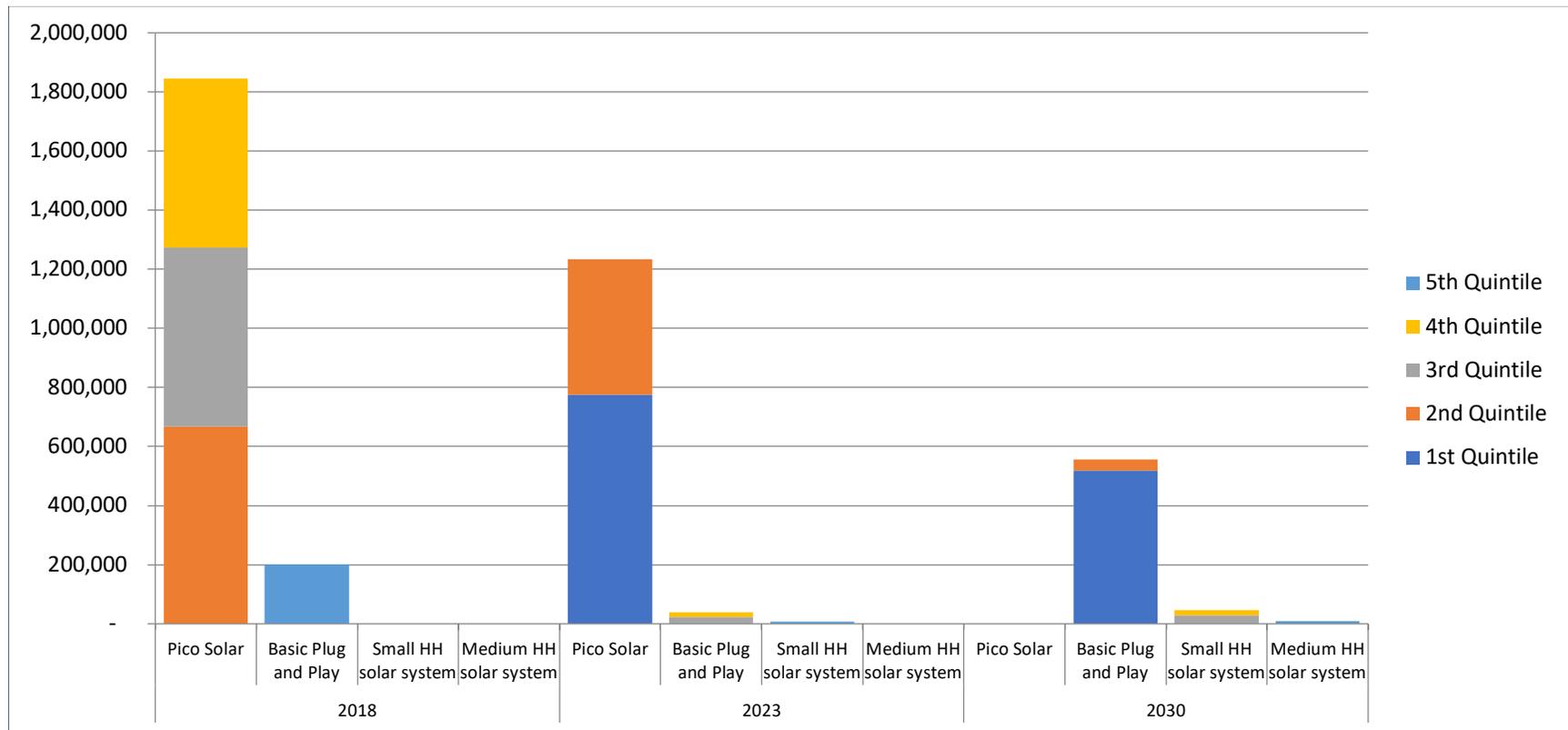
### 2.1.3 The Market for Household Devices without Consumer Finance

This section analyzes the cash market for various income levels and the corresponding energy services powered by OGS systems they can afford. Modeling of the viable market was based on income quintiles associated with data from the World Bank. The calculations and assumptions made are presented in **Table 16**. It was assumed that for a cash purchase a household is willing to save three months of their current energy expenditure to purchase the OGS system.

Based on the income quintiles and corresponding estimated current energy expenditure, in 2018, all the households without access in all the income quintiles except the lowest quintile can afford an OGS system unfinanced. In 2018, households in the lowest quintile, which represent the vast majority of the off-grid market, cannot afford even a pico solar product. However, affordability increases significantly over time as these households (in the lowest income quintile) are able to afford at least one pico solar system unfinanced by 2023 and 2030. Yet, the need for financing solutions for the lower income quintiles is clear.

The model assumes that each household purchases only one system. It also does not consider on-grid households that would purchase OGS systems as a back-up power system due to poor grid quality and reliability. This market has become a key segment of the more mature OGS markets (e.g. in East Africa), but is not the focus of this study, which is based on sizing the current markets in West Africa, alongside a least cost analysis for future access to energy that prioritizes reliable grid connections where possible.

Figure 27: Estimated Number of Households Able to Afford Cash Purchase of OGS Systems by Income Group



Source: African Solar Designs analysis

**Table 17** presents the estimated annualized cash market potential for off-grid solar product sales in the country’s household sector.

**Table 17: Estimated Cash Market Potential for Household Sector**

Solar System	Annualized Demand (Units)	Annualized Demand (kW)	Annualized Market Value (USD)
<b>2018 Scenario</b>			
Pico Solar	922,629	2,768	\$41,518,316
Basic Plug and Play	58,366	584	\$7,295,730
Small HH solar system	0	0	\$0.00
Medium HH solar system	0	0	\$0.00
<b>Total</b>	<b>980,995</b>	<b>3,352</b>	<b>\$48,814,046</b>
<b>2023 Scenario</b>			
Pico Solar	617,319	1,852	\$27,441,392
Basic Plug and Play	12,907	129	\$1,216,786
Small HH solar system	1,549	77	\$292,029
Medium HH solar system	0	0	\$0.00
<b>Total</b>	<b>631,775</b>	<b>2,058</b>	<b>\$28,950,207</b>
<b>2030 Scenario</b>			
Pico Solar	0	0	\$0.00
Basic Plug and Play	185,569	1,856	\$9,057,610
Small HH solar system	9,460	473	\$923,466
Medium HH solar system	1,892	473	\$461,733
<b>Total</b>	<b>196,921</b>	<b>2,802</b>	<b>\$10,442,809</b>

Source: African Solar Designs analysis

The following considerations should also be taken into account when analyzing this data:

- The most common type of systems which the market can afford on a cash basis are pico and small plug and play systems. Based on available income figures Tier 2 and Tier 3 solutions are less viable for the vast majority of the population in the near term. However, this picture changes significantly with the introduction of finance.
- The model does not adequately address highest quintile and actual sales in the market. Note that the analysis does not predict purchases of Tier 3 equipment and it does not reflect what is happening at the extreme high end of the market. Because the analysis divides the population into relatively wide quintiles, it does not adequately address the very small portion of apex rural (and peri-urban) customers that now use generators.

#### 2.1.4 The Financed Market for Off-Grid Solutions

##### ➤ Financial Model

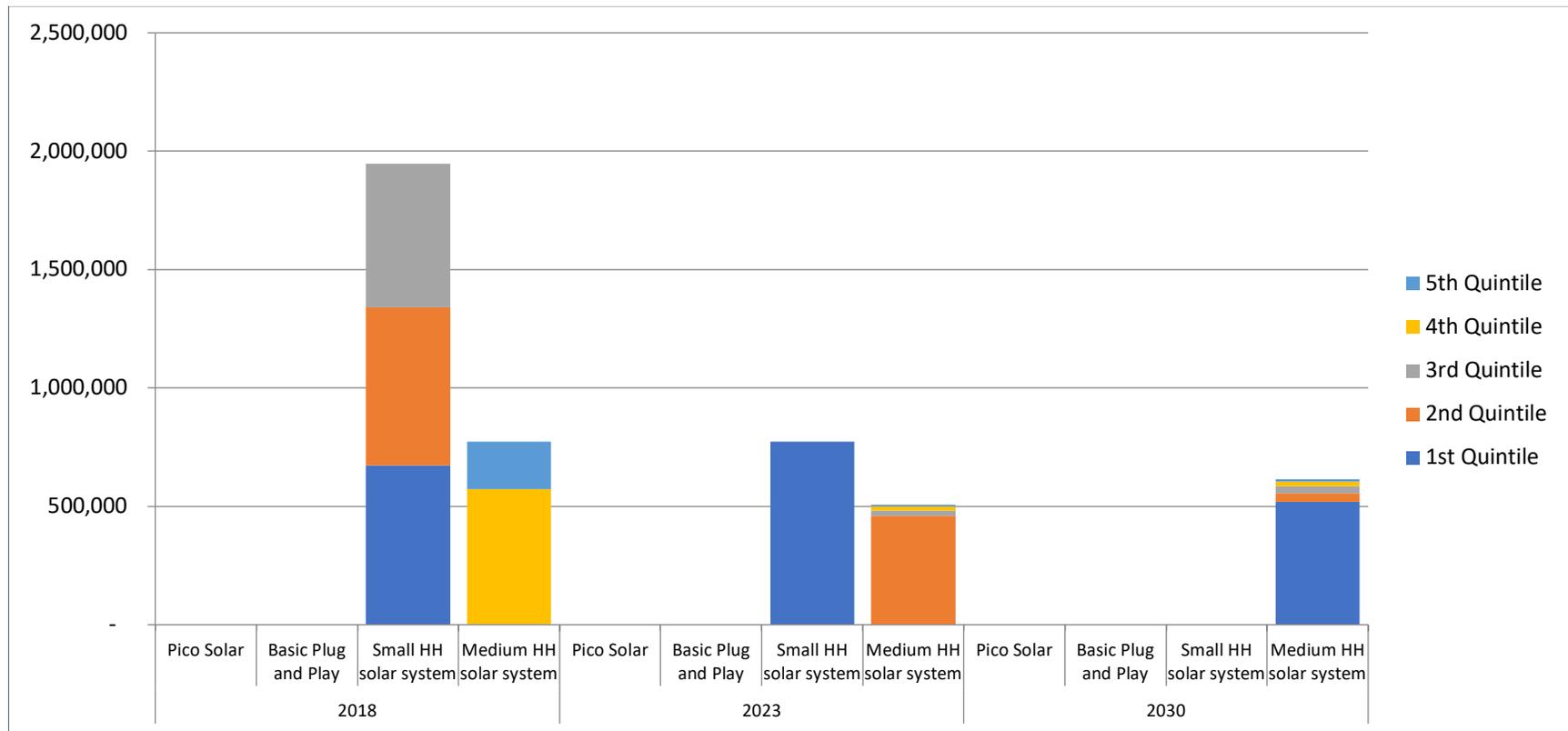
In order to portray the effects of finance, a simple model was prepared that provides OGS system finance with a 24% p.a. interest rate<sup>125</sup> and a 24-month term. The financial model assumes that the households would be willing to save for 3 months of their current energy expenditure to cover a small upfront deposit of 10% of the system and their current energy expenditure would be used to pay the monthly installments.

This model assumes that each household will purchase the system that offers the highest energy serve level they can afford. As with the cash market model, it assumes that each household purchases one unit each. However, this finance model greatly over-estimates the potential market for credit as both MFIs and PAYG companies would likely be extremely cautious in approving customers. Without concrete data on the loans given to consumers in each income quintile in the country, it is difficult to estimate what the more realistic figures are. Nevertheless, this model does give a clear indication that long loan tenors combined with a low upfront payment would result in significant market transformation. The results of this analysis are presented below.

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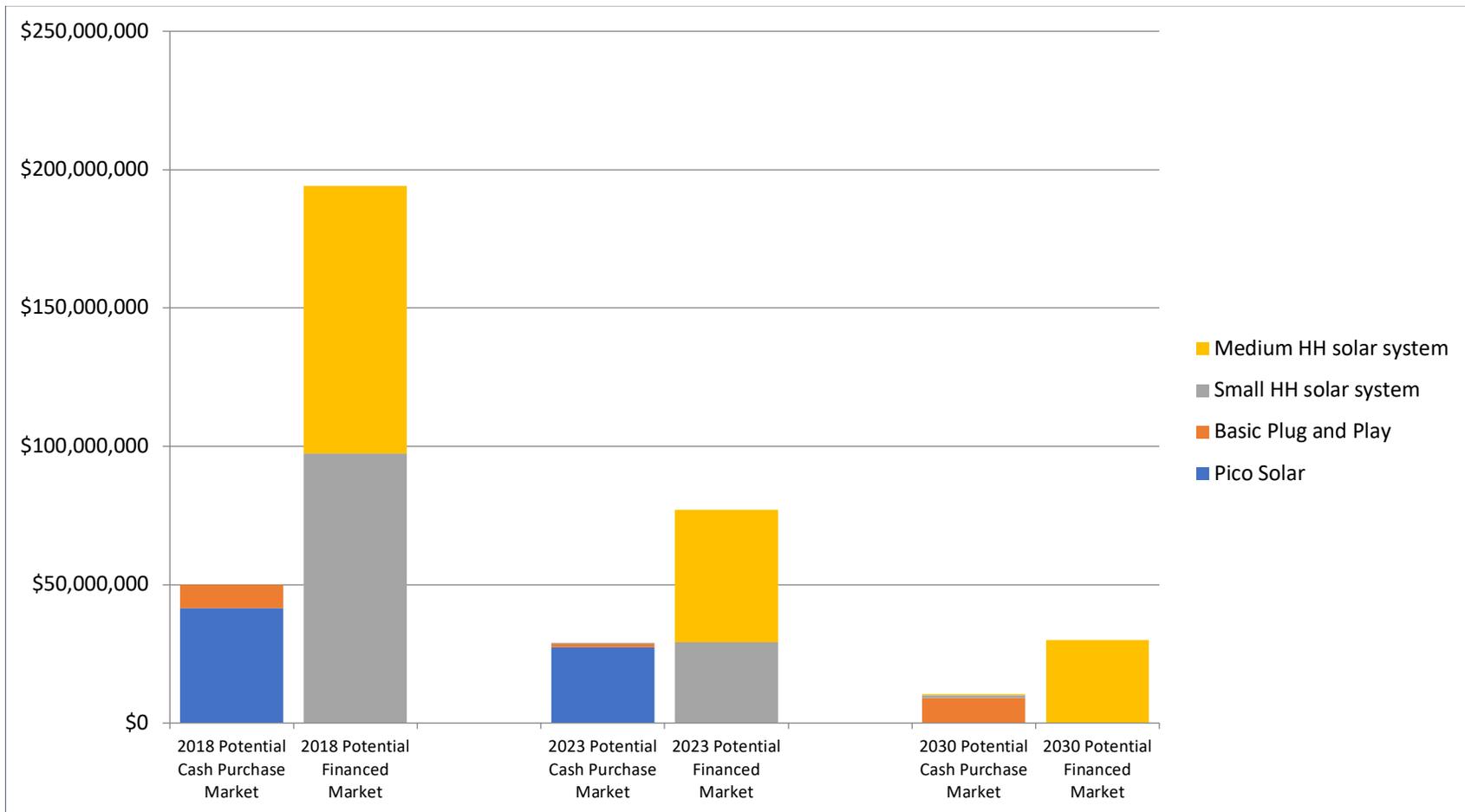
<sup>125</sup> Ferrari, A., Masetti, O., Ren, J., "Interest Rate Caps: The Theory and the Practice," World Bank Policy Research Working Paper, (April 2018): <http://documents.worldbank.org/curated/en/244551522770775674/pdf/WPS8398.pdf>

Figure 28: Estimated Number of Households Able to Afford Financed OGS Systems by Income Group



Source: African Solar Designs analysis

Figure 29: Estimated Off-Grid Solar Cash and Financed Market Potential for Household Sector by System Type



Source: African Solar Designs analysis

In 2018, without financing, 2,020,356 households (75% of the total households located in off-grid areas) in the country could afford an OGS system. However, with financing, 2,693,808 households (100% of off-grid households) could afford an OGS system as the 673,452 off-grid HH in the lowest income quintile are enabled to acquire at least one OGS system. Consequently, the annualized potential market size increases from USD 48,814,046 to USD 190,755,279 mainly due to the fact that the households are enabled to purchase larger systems (**Figure 29**).

The least-cost electrification 2023 scenario calculates that 1,281,104 households could be electrified by stand-alone systems. Under this scenario, all the households without access would have the ability to acquire at least one OGS system, however, financing enables them to acquire the larger systems. The annualized potential market size therefore increases from USD 28,950,207 to USD 76,969,718 (**Figure 29**).

The least-cost electrification 2030 scenario calculates that the total number of households that could be electrified by stand-alone systems would drop to 613,467. Under this scenario, all the households without access would also have the ability to acquire at least one OGS system, however, financing enables them to acquire the larger systems. The annualized potential market size therefore increases from USD 10,442,810 to USD 29,943,229 (**Figure 29**).

**Table 18** presents the estimated annualized financed market potential for off-grid solar product sales in the country’s household sector.

**Table 18: Estimated Financed Market Potential for Household Sector**

Solar System	Annualized Demand (Units)	Annualized Demand (kW)	Annualized Market Value (USD)
<b>2018 Scenario</b>			
Pico Solar	0	0	\$0.00
Basic Plug and Play	0	0	\$0.00
Small HH solar system	389,255	19,463	\$97,313,814
Medium HH solar system	149,506	37,377	\$93,441,465
<b>Total</b>	<b>538,761</b>	<b>56,840</b>	<b>\$190,755,279</b>
<b>2023 Scenario</b>			
Pico Solar	0	0	\$0.00
Basic Plug and Play	0	0	\$0.00
Small HH solar system	154,884	7,744	\$29,202,858
Medium HH solar system	101,337	25,334	\$47,766,859
<b>Total</b>	<b>256,221</b>	<b>33,078</b>	<b>\$76,969,717</b>
<b>2030 Scenario</b>			
Pico Solar	0	0	\$0.00
Basic Plug and Play	0	0	\$0.00
Small HH solar system	0	0	\$0.00
Medium HH solar system	122,693	30,673	\$29,943,229
<b>Total</b>	<b>122,693</b>	<b>30,673</b>	<b>\$29,943,229</b>

Source: African Solar Designs analysis

### 2.1.5 Consumer Perceptions, Interest and Awareness

- **Purchasers of solar are “early adopters” who tend to buy from system integrators as well as hardware traders**
  - **Retail purchasers:** Most purchases are made over-the-counter sales in capital and major cities as cash purchases. As with the consumer migration from kerosene to electric lights, there is a gradual migration from low cost dry-cell electric lamps to solar PV systems. Consumers make purchases in the same shops, and sellers are adapting to changes in demand by offering solar equipment.
  - **High-end consumers:** As elaborated in **Section 2.4**, a small number of early adopting consumers buy from specialized solar integrators who offer quality services and components. A large portion of buyers in this segment opt for systems above 200Wp for residential and small business demand.
  - **PAYG:** As the PAYG market segment is still in its nascent stages, detailed data of PAYG customers is still largely unavailable, although recent experience from East Africa suggests that these customers include both rural and peri-urban inhabitants. The PAYG business model / method is still not widely understood; moreover, there are still questions about how to account for the seasonality of incomes as opposed to regular monthly payment plans.
  
- **Consumers have a general awareness that solar can economically replace generators and batteries, but they are still largely uninformed about solar electric specifics<sup>126</sup>**
  - While knowledge is gradually improving (particularly for small/pico solar lighting systems) most consumers are not yet educated enough to make informed decisions about solar systems.
  - There are often geographic disparities in awareness levels of OGS products, as households in urban or peri-urban areas tend to have better understanding of solar vis-à-vis rural villages.
  - Consumers are hearing “general messages” (i.e. “solar is good,” “solar can be cheap,” “solar can be more economical”). These messages need to be translated into more specific understanding of the technology (i.e. what are the options, what products are better than others, where to buy solar, what is a best way to pay for solar, what suppliers are more reliable, how to manage O&M, etc.).
  - Consumers often do not get fair information on the product they are buying. Marketing messages are quite mixed and much ‘overpromising’ occurs for systems. Consumers are largely unaware of standards and quality assurance for solar.
  
- **Perceptions of households vary according to experience they have had with solar**
  - Although many households recognize the benefits of solar, there is a general perception that solar equipment is very expensive and that products are considered largely un-affordable.
  - Many customers are disappointed with solar technology or mistrust it because:
    - They have bought a substandard/not certified product that broke down quickly;
    - There was no adequate maintenance, aftersales service when the system broke down;
    - There was lack of understanding/experience on how to use the system and it broke down due to over usage or incorrect usage.
    - There is no warranty or fault management system (long-term O&M)
  - Households that have a fuel-powered generator, consider them as a ‘sunk cost’ and treat solar only as an addition to that cost.
  - Solar is seen as risky by many. Since there are so many options and little information as to what the best solution is, many people think that it is easy to make a costly mistake in choosing what is

<sup>126</sup> The MoE organizes an annual renewable energy week with conferences and fairs to increase awareness of the benefits of solar. The NGO initiative, “Go for Change,” participates in a wide range of awareness raising campaigns. Despite this, focus group participants noted that the level of household awareness of solar solutions remains relatively low.

best for them. Generators are much better understood.

- Some consumers have ‘investment fatigue’ from buying multiple solar products of low or unknown quality and are unwilling to make further investments.

➤ **Willingness to Pay is strongly associated with consumer understanding and perceptions of OGS**

Although there is demonstrated ability to pay for households in higher income demographics on cash purchase, and for many households through a financed scenario, willingness to pay is strongly associated with consumer understanding and perceptions of OGS. Component-based Plug-and-Play SHS are much more expensive than battery-powered alternatives and are more than what households expect to pay for access to lighting. Consumers who purchase low-priced inferior lighting products for which they have low expectations are less likely to be willing to purchase a relatively high priced OGS system without fully understanding the difference between the products.

Since most of the retail-shop dry-cell battery-powered lighting products are extremely low cost (and short-lived), conservative rural consumers are wary of expensive new products if they are unable to assess product quality and durability. For this reason, willingness to pay presents a much larger barrier for the development of sales than actual *ability* to pay. East African experience with Global Lighting-certified products has demonstrated that consumer awareness campaigns can grow the demand for quality products.

## 2.2 Demand – Institutional

### 2.2.1 Overview of Institutional Market Segment

This section estimates the market potential for off-grid solar products for institutional users in Burkina Faso. This market includes the following segments: (i) rural water supply, (ii) healthcare facilities, (iii) primary and secondary schools, and (iv) public town center lighting. The following sub-sections provide an overview of the assumptions used for each market segment along with corresponding analysis. The section concludes with an assessment of institutional ability to pay, looking at funding sources and highest potential market segments. **Annex 2** provides an overview of the methodology, including all calculations.

### 2.2.2 Analysis of Institutional Market Segment Demand

**Table 19** shows the estimated annualized cash market potential for institutional users in Burkina Faso. This estimation is calculated using available GIS data, secondary research, and primary source field data. The analysis is based on available information from planned expansion of the sectors and typical usage patterns and costs of existing systems in the country. There was insufficient GIS data available to properly estimate the market size; as a result, per capita comparisons were made with similar countries to analyze certain sectors as described below.<sup>127</sup>

Table 19: Indicative Total Cash Market Potential for Institutional Sector<sup>128</sup>

Institutional Sector		Units	kW Equivalent	Cash Value (USD)
Water supply	Low power pumping system	19	29	\$72,188
	Medium power pumping system	14	54	\$135,000
	High power pumping system	6	58	\$145,000
	Subtotal	39	141	\$352,188
Healthcare	Health post (HC1)	271	68	\$169,625
	Basic healthcare facility (HC2)	34	51	\$127,125
	Enhanced healthcare facility (HC3)	8	32	\$78,750
	Subtotal	313	151	\$375,500
Education	Primary schools	388	169	\$506,625
	Secondary schools	236	453	\$1,132,560
	Subtotal	574	622	\$1,639,185
Public lighting	Public lighting (excluding street lighting)	79	40	\$118,650
<b>TOTAL</b>		<b>1,005</b>	<b>954</b>	<b>\$2,485,523</b>

Source: African Solar Designs analysis

<sup>127</sup> See **Annex 2** for more details.

<sup>128</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.

➤ **Water Supply**

Table 20: Key Assumptions for Water Supply Sector Analysis

Sector	System Sizes	Key Assumptions
Water supply	<ul style="list-style-type: none"> <li>• Low Power (1,500 W)</li> <li>• Medium Power (4,000 W)</li> <li>• High Power (10,000 W)</li> </ul>	<p>The type of pump selected is dependent on depth, yield, community need and other factors. System sizes depend on the common pump sizes used for rural applications:</p> <ul style="list-style-type: none"> <li>• Low power pumps are used for low/medium head applications. They replace hand pumps for shallow wells</li> <li>• Medium power pumps have high volume low head and medium volume medium head applications</li> <li>• High power pumps are used for high volume or high head applications such as deep wells and boreholes</li> </ul>

The water supply sector analysis considered the electricity needs for water supply for communities in off-grid areas. Energy is only one component of this sector – a variety of factors (water quality, number of users, yields of well, delivery system etc.) need to be considered when planning for off-grid water supply. The supply of solar powered pumping systems for village water supply requires additional planning and study to identify the most viable sites.

Available GIS data identified off-grid water points such as boreholes and wells that could be electrified by stand-alone systems. Based on the analysis, the estimated annualized cash market potential for the water supply sector is presented in **Table 21**. The distribution of potential off-grid water points is shown in **Figures 30-31**.

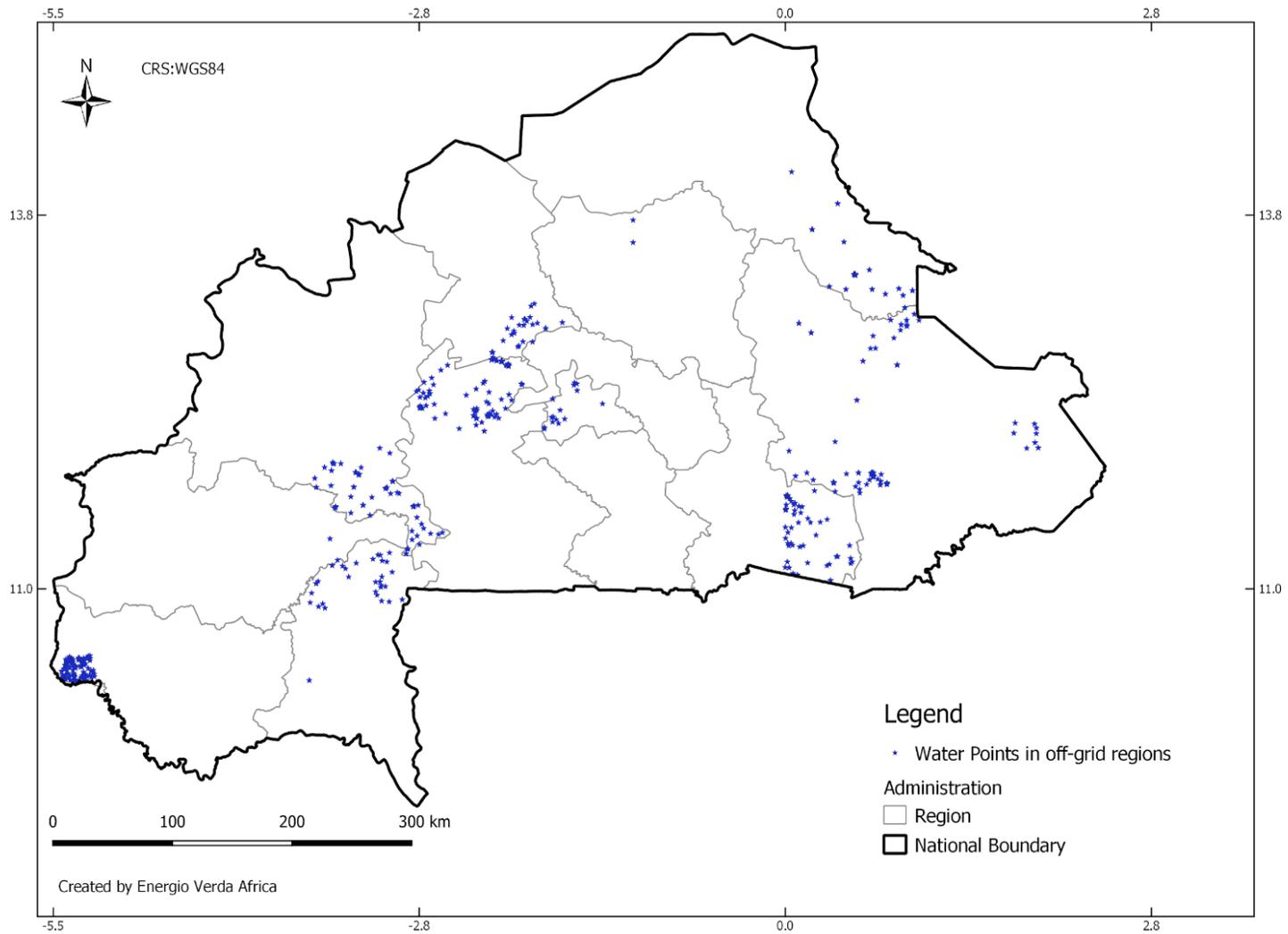
Table 21: Estimated Cash Market Potential for Water Supply<sup>129</sup>

Pump Type	Units	Size (kW)	Cash Value (USD)
Low power	19	29	\$72,188
Medium power	14	54	\$135,000
High power	6	58	\$145,000
<b>Total</b>	<b>39</b>	<b>141</b>	<b>\$352,188</b>

Source: African Solar Designs analysis

<sup>129</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.

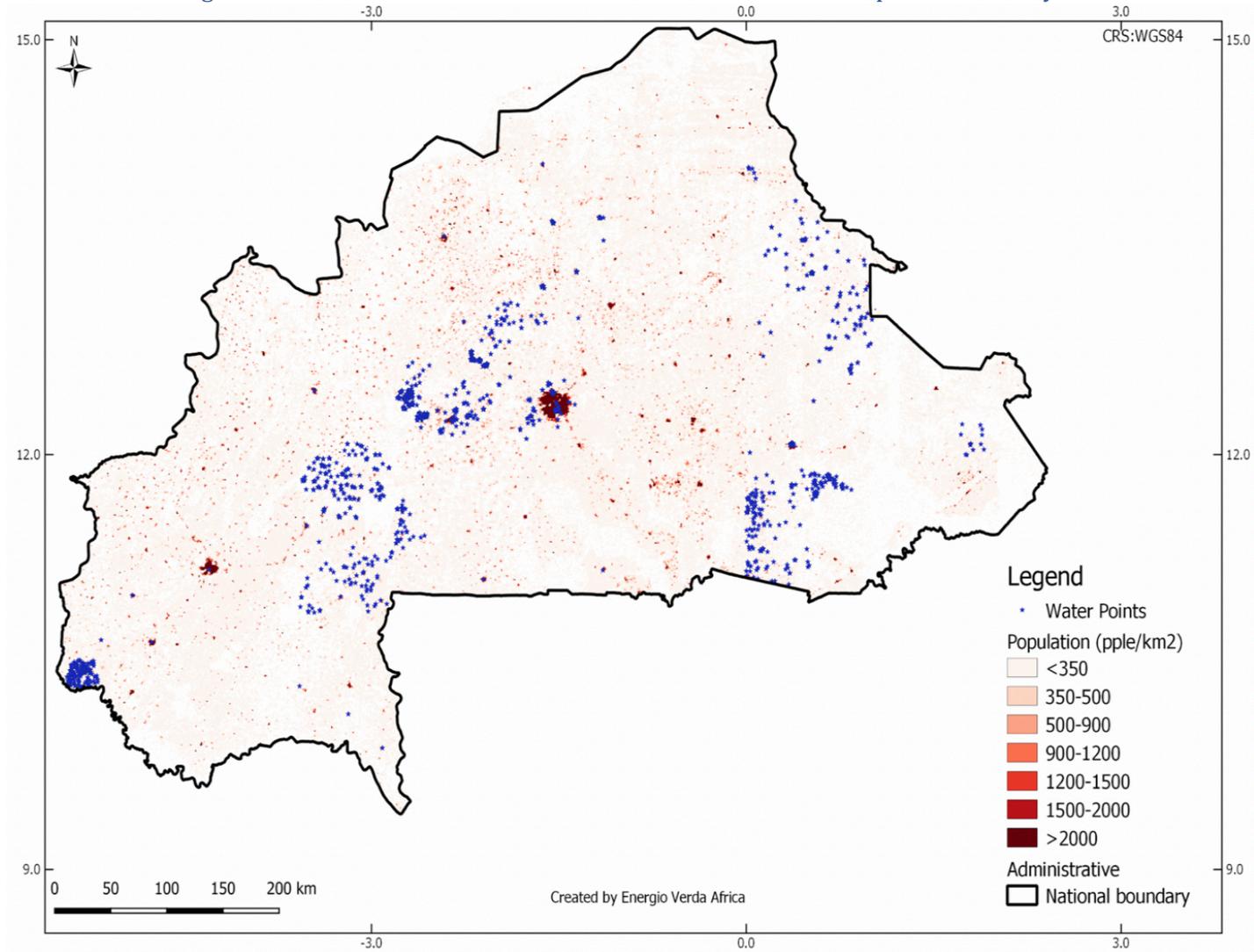
Figure 30: Distribution of Water Points in Off-Grid Areas<sup>130</sup>



Source: Energio Verda Africa GIS analysis

<sup>130</sup> Displaying identified water points with known location (given coordinates) only; see **Annex 1** for more details, including data sources.

Figure 31: Distribution of Water Points in Off-Grid Areas and Population Density<sup>131</sup>



Source: Energio Verda Africa GIS analysis

<sup>131</sup> Displaying identified water points with known location (given coordinates) only; see **Annex 1** for more details, including data sources.

➤ **Healthcare**

Table 22: Key Assumptions for Healthcare Sector Analysis

Sector	System Sizes	Key Assumptions
Healthcare	<ul style="list-style-type: none"> <li>HC1: Dispensary health post (300 W)</li> <li>HC2: Basic healthcare facility (1,500 W)</li> <li>HC3: Enhanced healthcare facility (4,200 W)</li> </ul>	A per capita comparison identified 2,185 off-grid healthcare facilities that could be electrified by stand-alone systems

The healthcare sector analysis considered the electricity needs for off-grid health facilities in the country. Off-grid clinics require power for lighting and various Information and Communications Technology (ICT) needs, including phone charging, maternity, medical examinations, vaccine refrigeration, laboratory, sterilization and staff housing. The size of a facility and number of patients served determines the amount of energy it requires.

As available GIS data was not sufficient to conduct the analysis, a per capita comparison made using data from Guinea<sup>132</sup> identified off-grid health facilities categorized according to their size (HC1, HC2, and HC3) that could be electrified by stand-alone systems.<sup>133</sup> To establish electricity demand, an assessment of equipment found within each category of healthcare facility was undertaken, with the daily demand of each used to calculate the system size required to cater to the load of the facility (Table 23). The assumptions of system size below are based on the services offered at each of these facilities.

Table 23: Healthcare Facility Categorization and Electricity Demand<sup>134</sup>

Type of Facility	Load Category	Wh/day	Total Load (Wh/day)	System Size (W)
Health post (HC1)	Lighting	240		
	Communication	160		
	ICT	800		
			<b>1,200</b>	<b>250</b>
Basic healthcare facility (HC2)	Lighting	1,600		
	Maternity	800		
	Vaccine refrigeration	800		
	Communication	400		
	Examination room	400		
	ICT	1,600		
	Staff housing	400		
			<b>6,000</b>	<b>1,500</b>
Enhanced healthcare facility (HC3)	Lighting	3,200		
	Communication	1,600		
	Examination room	1,200		
	ICT	2,400		
	Maternity	2,400		
	Laboratory	2,000		
	Sterilization	1,200		
	Vaccine refrigeration	1,200		
	Staff housing	1,600		
			<b>16,800</b>	<b>4,200</b>

Source: GIZ; African Solar Designs analysis

<sup>132</sup> Guinea was grouped in the same category as Burkina Faso; See Annex 2 for more details.

<sup>133</sup> NOTE: This represents a small subset of the overall health infrastructure in the country; See Annex 1 for more details.

<sup>134</sup> "Photovoltaics for Productive Use Applications: A Catalogue of DC-Appliances," GIZ, (2016): [https://www.sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/GIZ\\_2016\\_Catalogue\\_PV\\_Appliances\\_for\\_Micro\\_Enterprises\\_low.pdf](https://www.sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/GIZ_2016_Catalogue_PV_Appliances_for_Micro_Enterprises_low.pdf)

Based on these assumptions, the estimated annualized cash market potential for the healthcare sector is presented in **Table 24**. The distribution of potential off-grid health facilities is shown in **Figures 10-11** in **Section 1.2.2.4**.

**Table 24: Estimated Cash Market Potential for Healthcare Facilities** <sup>135</sup>

Type of Facility	Units	kW Equivalent	Cash value (USD)
Health post (HC1)	271	68	\$169,625
Basic healthcare facility (HC2)	34	51	\$127,125
Enhanced healthcare facility (HC3)	8	32	\$78,750
<b>Total</b>	<b>313</b>	<b>151</b>	<b>\$375,500</b>

Source: African Solar Designs analysis

➤ **Education**

**Table 25: Key Assumptions for Education Sector Analysis**<sup>136</sup>

Sector	System Sizes	Key Assumptions
Education	<ul style="list-style-type: none"> <li>Primary schools (500 W)</li> <li>Secondary schools (1,920 W)</li> </ul>	Available GIS data and a per capita comparison identified 6,755 off-grid primary schools and 4,719 off-grid secondary schools that could be electrified by stand-alone systems

The education sector analysis considered the electricity needs of off-grid primary and secondary schools.<sup>137</sup> These include lighting, ICT (computers, tablets etc.), communication (phone charging), laboratories and staff housing. The size of a school and number of students determines the amount of energy it requires. As available GIS data was not sufficient to conduct the analysis, a per capita comparison made using data from Guinea off-grid primary and secondary schools that could be electrified by stand-alone systems. To establish electricity demand, an assessment of equipment found within each type of school was undertaken, with the daily demand of each used to calculate the system size required to cater to the load of the school (**Table 26**).

**Table 26: Education Center Categorization and Electricity Demand** <sup>138</sup>

Type of Facility	Load Category	Wh/day	Total Load (Wh/day)	System Size (W)
Primary School	Communication	160		
	Lighting	640		
	ICT	800		
	Staff house	400		
			<b>2,000</b>	<b>500</b>
Secondary School	Communication	160		
	Lighting	1,920		
	ICT	3,200		
	Laboratory use	800		
	Staff house	1,600		
			<b>7,680</b>	<b>1,920</b>

Source: GIZ; African Solar Designs analysis

<sup>135</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.

<sup>136</sup> NOTE: While the GIS analysis in **Section 1.2.2.4** covers all education centers (including nursery, pre-primary, primary, secondary, technical-vocational, universities etc.), this analysis only examines primary and secondary schools (see **Annex 1** and **Annex 2**).

<sup>137</sup> Primary schools encompass both primary and nursery schools. Vocational schools and universities were not considered because they tend to be in cities, which are often grid electrified.

<sup>138</sup> "Photovoltaics for Productive Use Applications: A Catalogue of DC-Appliances," GIZ, (2016): [https://www.sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/GIZ\\_2016\\_Catalogue\\_PV\\_Appliances\\_for\\_Micro\\_Enterprises\\_low.pdf](https://www.sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/GIZ_2016_Catalogue_PV_Appliances_for_Micro_Enterprises_low.pdf)

Based on these assumptions, the estimated annualized cash market potential for the education sector is presented in **Table 27**. The distribution of potential off-grid primary and secondary schools is shown in **Figures 10-12** in **Section 1.2.2.4**.

**Table 27: Estimated Cash Market Potential for Primary and Secondary Schools** <sup>139</sup>

Type of Facility	Units	kW Equivalent	Cash value (USD)
Primary School	388	169	\$506,625
Secondary School	236	453	\$1,132,560
<b>Total</b>	<b>574</b>	<b>622</b>	<b>\$1,639,185</b>

Source: African Solar Designs analysis

➤ **Public Lighting**

**Table 28: Key Assumptions for Public Lighting Sector Analysis**<sup>140</sup>

Sector	System Sizes	Key Assumptions
Public lighting	Standard system (200 W)	<ul style="list-style-type: none"> <li>District population figures were used to determine the number of market centers per district, assuming 5,000 people per market center</li> <li>Each market center was assumed to have two public lighting points</li> </ul>

Analysis of the public lighting sector considered the public lighting needs for off-grid villages and market centers. It did not assess public street lighting, which would generally be included in road infrastructure projects. Based on these assumptions, the estimated annualized cash market potential for the public lighting sector is presented in **Table 29**.

**Table 29: Estimated Cash Market Potential for Public Lighting** <sup>141</sup>

Public Lighting Network	Units	kW Equivalent	Cash value (USD)
Village lighting (excluding street lighting)	79	40	\$118,650

Source: African Solar Designs analysis

**2.2.3 Ability to Pay and Access to Finance**

Financing for institutional off-grid systems in Burkina Faso typically comes from budget allocations made directly by relevant ministries or, more commonly, by donor-funded projects. In recent years, virtually all institutional solar projects in the country have been financed with tender-based procurements and cash-based contracts. Government allocations are typically made ad-hoc, depending on the needs and priorities of the ministry, and whether funds are available. Operation, maintenance and replacement of parts in energy systems (e.g. solar system batteries and inverters) is typically the responsibility of the institution and community. Schools, clinics and other institutions with generators must buy fuel on a regular basis. With the development of the renewable energy sector, NGO/donor funds increasingly design projects that ensure that maintenance of the system is factored into its implementation. However, when there are no funds to maintain the system any further, usage is typically discontinued, and the system falls into disrepair.

<sup>139</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.

<sup>140</sup> Population figures used in this analysis were obtained from: <https://www.citypopulation.de/BurkinaFaso.html>

<sup>141</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.

Institutional users that rely on government or donor funds for the purchase and O&M of solar systems may be constrained by limited funds and/or competing budget priorities. Thus, local communities benefiting from solar electrification would also have to bear some long-term costs for the maintenance of systems and replacement of parts. In the event that public or donor funding is made available to cover the initial capital expenditure, funds can be raised by local communities through a minimal tariff to customers of the health facilities, water pumping stations etc. for long-term O&M. A market standard of 5-10% of the capital expenditure is accepted as a rate for annual maintenance of systems.<sup>142</sup>

Given budgetary constraints, some institutional sectors may be prioritized for solar electrification over others. Advanced health centers for example, could be prioritized by governments and communities given that electricity is essential to run advanced healthcare equipment. It may be easier in this case to extract maintenance fees from community members receiving health services or budget allocations from local government. In contrast, off-grid schools can be run more easily without access to electricity and may therefore present a lower priority institutional market.

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<sup>142</sup> Grundfos: <https://www.grundfos.com/service-support/encyclopedia-search/maintenance-and-repaircostscm.html>

## 2.3 Demand – Productive Use

### 2.3.1 Overview of Productive Use Market Segment

The section provides an overview of the main characteristics of productive use of energy (PUE) and how off-grid solar applications have the potential to generate economic activity, increase productivity and transform rural livelihoods in Burkina Faso. Focus group participants noted that productive use applications in the agricultural, food processing and informal sectors already exist in the country, including solar powered lighting, mobile phone charging, refrigeration and chilling, water pumping, irrigation and agricultural processing. The PUE market sizing analyzed demand for SME applications for village microenterprises, value-added applications for solar powered irrigation, milling and refrigeration, and connectivity applications for mobile phone charging enterprises.

The calculation of the estimated off-grid solar market for SMEs focused only on barbering and tailoring appliances, which comprises a small portion of overall SME sector demand. These two microenterprises are indicative of the service-based SME off-grid solar market, as they benefit significantly from extended working hours and the use of modern appliances/machinery. The estimated demand for this market segment is therefore intended to provide a baseline for future research, as a more robust analysis would be necessary to assess realistic demand from all SMEs.

The value-added applications that were analyzed include solar pumping for smallholder agricultural irrigation, solar powered milling and solar refrigeration. Access to energy for agriculture is critical to economic development, particularly given the sector’s importance to GDP in the country.

Off-grid solar power supports a wide range of connectivity applications, including mobile phone charging, wi-fi servers, banks, mobile money kiosks, and telecommunications towers. Mobile phone and internet connectivity are also necessary precursors for mobile money and PAYG solutions in the off-grid solar sector. The market sizing examined rates of mobile phone ownership and mobile internet penetration to estimate the market potential for mobile phone charging enterprises (stations/kiosks) in the country.

Burkina Faso is one of the largest cotton producers in the region, along with Benin and Mali. Burkina Faso’s cotton, which is largely produced by smallholder farmers, accounts for 12% of the country’s exports.<sup>143</sup> Solar powered appliances that support the cotton value chain, such as irrigation, ginning and edible oil processing equipment, could therefore serve as important inputs for the sector’s growth. Further, Burkinabe economic growth largely depends on the ability to leverage private sector investment to improve electrification.<sup>144</sup> Customers in the capital, Ouagadougou, report experiencing frequent power outages equivalent to three months or 600 hours of lost productivity.<sup>145</sup> In 2018, the Ministry of Energy, together with the African Enterprise Challenge Fund (AECF), launched a two-year partnership project, the Renewable Energy and Adaptation to Climate Technologies-Efficiency Electrification Project (REACT EEP), to help households and SMEs get access to solar energy as a primary or back-up source of electricity. Through this project, SMEs will receive 30% subsidy for acquisition of the solar equipment.<sup>146</sup>

<sup>143</sup> Gakpo, J. O., “Burkina Faso loses rank as top African producer after dropping GMO cotton,” Cornell, Alliance for Science (2018): <https://allianceforscience.cornell.edu/blog/2018/01/burkina-faso-loses-rank-as-top-african-producer-after-dropping-gmo-cotton/>

<sup>144</sup> “Burkina Faso: Priorities for Poverty Reduction and Shared Prosperity, Systematic Country Diagnostic,” World Bank, (April 2017): <http://documents.worldbank.org/curated/en/950551492526646036/SCD-Final-april-10-FINAL-002-de-002-04132017.docx>

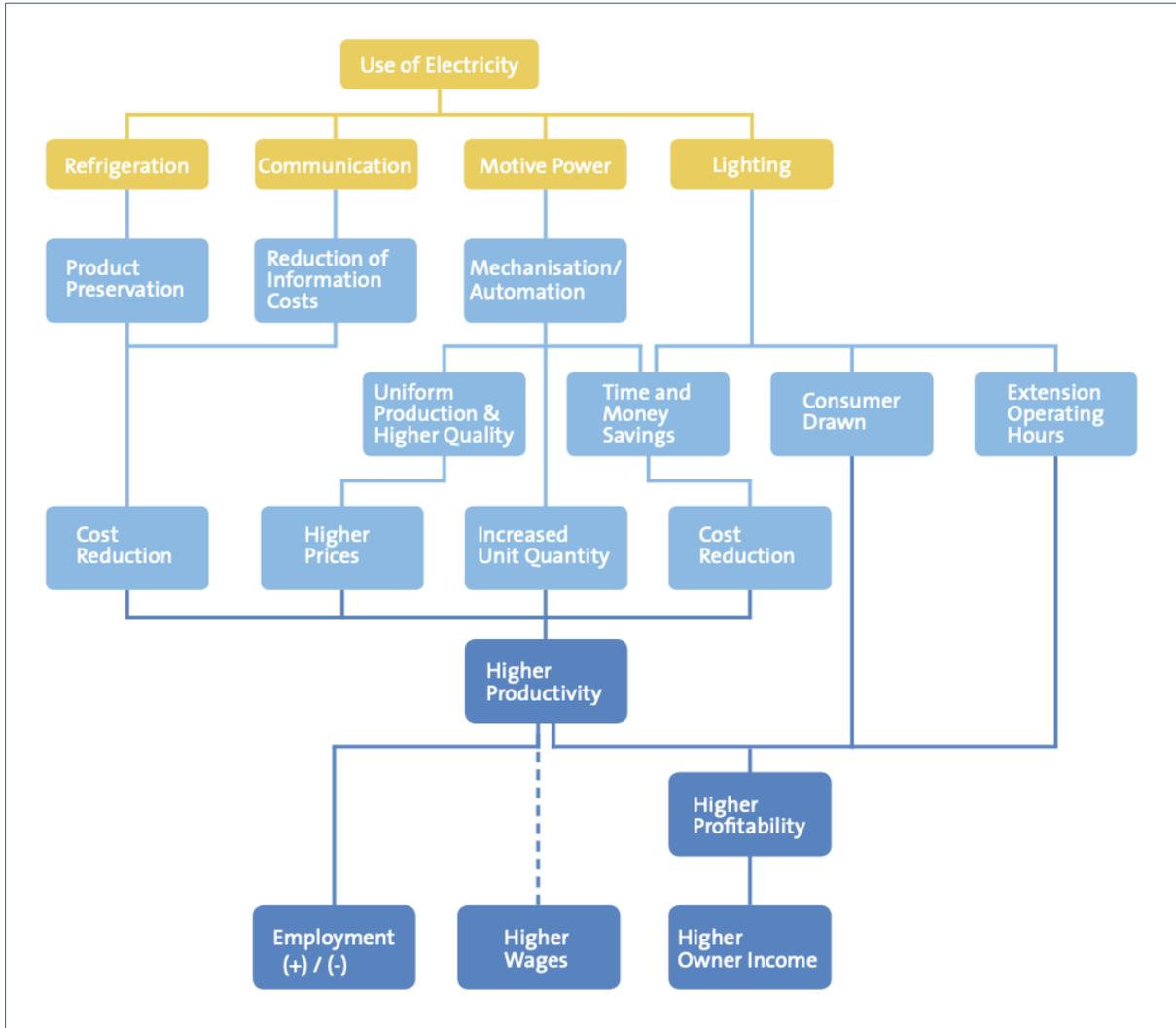
<sup>145</sup> Odhiambo, L., “Ministry of Energy and AECF launches Renewable Energy Project to increase Efficient Electrification in Burkina Faso,” Africa Enterprise Challenge Fund (AECF), 2018:

[https://www.aecfafrica.org/media\\_centre/news/ministry\\_of\\_energy\\_and\\_aecf\\_launches\\_renewable\\_energy\\_project\\_to\\_increase\\_efficient\\_electrification\\_in\\_burkina\\_faso](https://www.aecfafrica.org/media_centre/news/ministry_of_energy_and_aecf_launches_renewable_energy_project_to_increase_efficient_electrification_in_burkina_faso)

<sup>146</sup> Ibid.

The impact of electricity use on SMEs depends on a variety of external and internal factors, especially access to markets, supply of inputs and financial capability. Therefore, the extent to which firms can afford to invest in off-grid solar solutions is determined largely by increases in productivity, profitability, and employment/wages from the investment in the off-grid appliance (**Figure 32**).

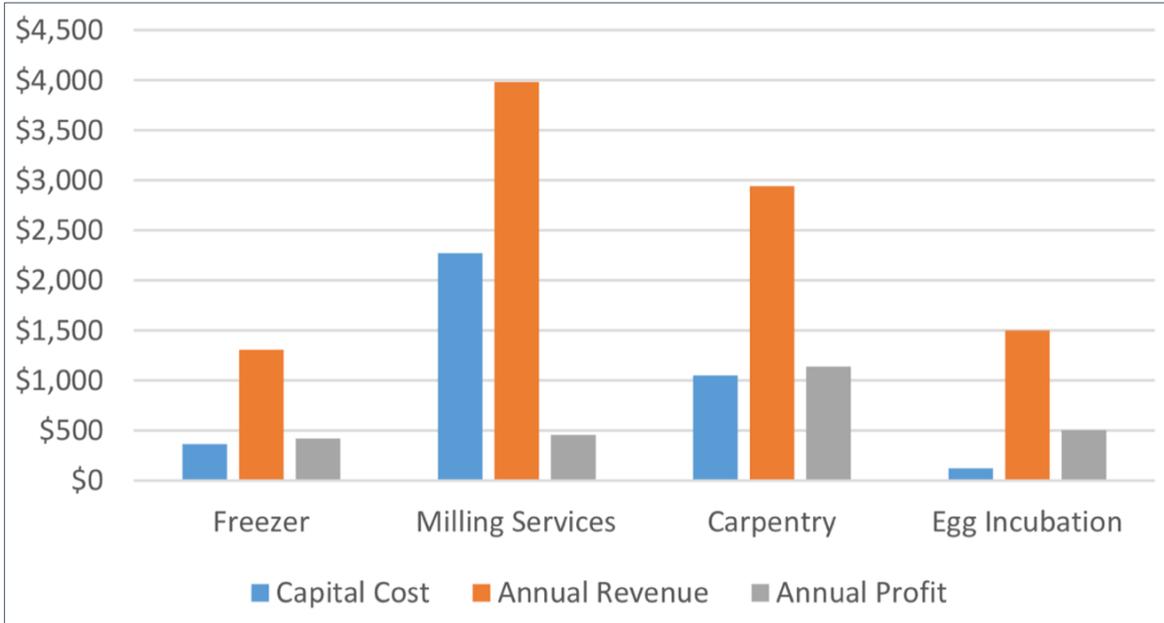
Figure 32: Pathways from Electricity to Income Generation<sup>147</sup>



Source: EUEI PDF and GIZ: Productive Use of Energy – A Manual for Electrification Practitioners

<sup>147</sup> Productive Use of Energy – A Manual for Electrification Practitioners,” European Union Energy Initiative Partnership Dialogue Facility (EUEI PDF) and GIZ, (2011): <https://www.giz.de/fachexpertise/downloads/giz-eueipdf-en-productive-use-manual.pdf>

Figure 33: Analysis of Cost, Revenue and Profit for Various Off-Grid Productive Use Applications<sup>148</sup>



NOTE: Annual profit does not include recovery of cost capital

Source: USAID-NREL and Energy 4 Impact: Productive Use of Energy in African Microgrids

In order to organize and simplify this analysis and to deliver meaningful insights on country-level market sizing, productive solar applications have been divided into three main groups (Table 30).

Table 30: Overview of Productive Use Applications

Productive Use Application	Description
1) SME applications for village businesses	Barbers and tailors are the two microenterprises that were analyzed. While these businesses employ people and are critical for off-grid towns, they do not create additional income for towns and are not transformative in nature. SME businesses are therefore most at risk during economic downturns because they are at the mercy of the overall economic and political climate.
2) Value-added applications	Solar-powered irrigation, refrigeration/chilling and milling are the three value-added applications that were analyzed. Value-added productive use applications enable businesses to add value to products or services and to build new income streams. This can be done by creating a new product or service or by enhancing the value of an existing product (e.g. milling maize). Water pumping tools that support the agricultural, dairy or fishing value chains are included here (water pumps, refrigerators/chillers, and grain mills).
3) Connectivity / ICT applications	Mobile phone charging is the connectivity application that was analyzed. Connectivity applications enable consumers to communicate and access data from the internet. Following the advent of mobile phones and mobile money in East Africa, solar devices that support connectivity applications became the most important income earning applications in East Africa. Mobile phone charging is extremely important for the telecommunications sector. Other connectivity applications include wi-fi servers, mobile money kiosks, banks, and telecommunications towers.

Source: African Solar Designs

<sup>148</sup> “Productive Use of Energy in African Micro-Grids: Technical and Business Considerations,” USAID-NREL and Energy 4 Impact, (August 2018): [https://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/productive\\_use\\_of\\_energy\\_in\\_african\\_micro-grids.pdf](https://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/productive_use_of_energy_in_african_micro-grids.pdf)

➤ **Geographic Locations**

Most PUE sector activities will take place in rural off-grid areas in Burkina Faso, particularly in mining areas, western regions and other rural areas where electricity access is restricted. Solar components and appliances are more readily available for purchase in large cities like Ouagadougou, Bobo Dioulasso, and Koudougou.

2.3.2 Analysis of Productive Use Market Segment Demand

Data from the World Bank, Food and Agriculture Organization of the UN (FAO) and GSMA was used to conduct the PUE market study. In order to conduct the analysis, several key assumptions were made about PUE applications, which are presented in the sections below and in **Annex 2** in greater detail. **Table 31** presents the estimated annualized cash market potential for off-grid solar productive use applications.

Table 31: Indicative Total Cash Market Potential for Productive Use Sector<sup>149</sup>

Productive Use Sector		Units	kW Equivalent	Cash Value (USD)
<b>SME Applications for Village Businesses</b>	Microenterprises	1,378	344	\$861,000
<b>Value-added Applications</b>	Irrigation	22,917	2,750	\$14,895,833
	Milling	143	929	\$2,323,379
	Refrigeration	79	435	\$1,087,625
	Subtotal	23,139	4,114	\$18,306,837
<b>Connectivity Applications</b>	Phone Charging	10,668	4,267	\$9,195,488
<b>TOTAL</b>		<b>35,185</b>	<b>8,725</b>	<b>\$28,363,325</b>

Source: Food and Agriculture Organization, GIZ and GSMA; African Solar Designs analysis

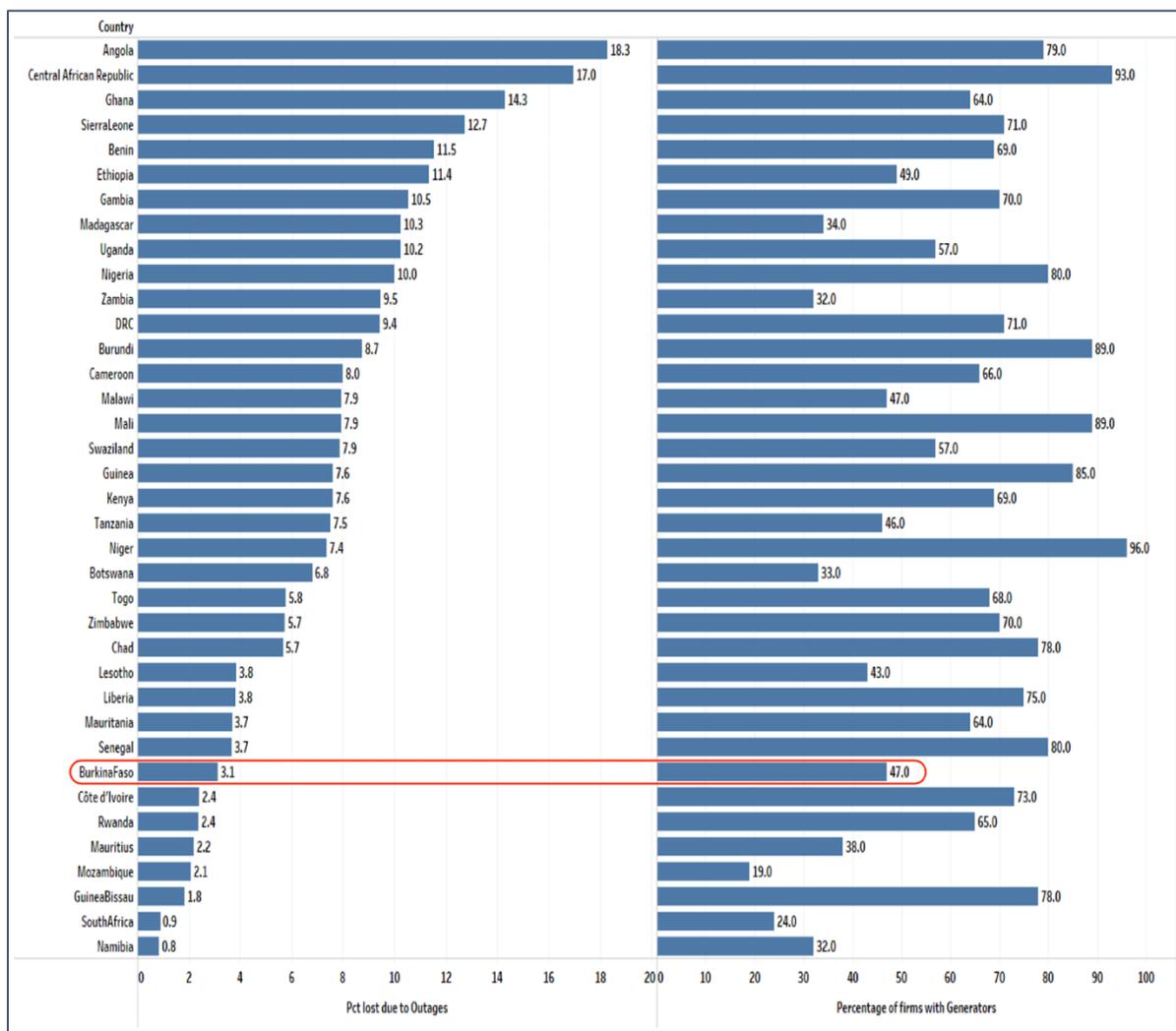
➤ **SME Applications for Village Businesses**

Access to solar powered appliances can have a wide-ranging impact on SMEs, many of which would otherwise rely on diesel generators to power their enterprises. An estimated 33% of SMEs in developing countries use fossil fuel powered generators in order to address energy insecurity.<sup>150</sup> This practice is extremely common in Burkina Faso, where power outages have accounted for more than 3% of annual sales lost and where 47% of firms own generators (**Figure 34**).

<sup>149</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.

<sup>150</sup> Foster, V., and Steinbuks, J., "Paying the Price for Unreliable Power Supplies: In-House Generation of Electricity by Firms in Africa," World Bank Policy Research Working Paper, (2009): <https://openknowledge.worldbank.org/handle/10986/4116>

Figure 34: Percentage of Sales Lost due to Power Outages and Percentage of Firms with Generator<sup>151</sup>



Source: Center for Global Development

While many rural microenterprises would benefit from access to solar power, it may not be a requirement for a commercial enterprise to have access to electrical appliances. Further, while petit trade is facilitated greatly by the availability of electricity (kiosks and retail shops can be open longer hours and sell more and fresher products), electricity is not essential for SMEs because even without lighting, small shops can still sell their merchandise. Additionally, unlike value-added applications, there is not as strong a correlation between the value of the electric appliance and the economic capability of the SME. For example, a refrigerator used to preserve perishable food and chill beverages, irrespective of the value of food and beverages, may be used by either a large hotel or a street side vendor.

With the exception of replacing diesel gensets, the estimation of the available market for off-grid solar appliances for SMEs is not as closely correlated with economic indicators. Nonetheless, some widely marketed solar powered appliances are more centrally related to the revenue generation of SMEs.

<sup>151</sup> Ramachandran, V., Shah, M. K., Moss, T., “How Do African Firms Respond to Unreliable Power? Exploring Firm Heterogeneity Using K-Means Clustering,” Center for Global Development, (August 2018): <https://www.cgdev.org/sites/default/files/how-do-african-firms-respond-unreliable-power-exploring-firm-heterogeneity-using-k-means.pdf>

Investments in such appliances in off-grid and low-income settings are more likely to be sustainable. This study analyzed barbering and tailoring appliances (i.e. hair clippers and sewing machines designed or marketed for off-grid solar powered settings) with respect to microenterprises that face difficulty in accessing outside capital, as the two appliances would provide an economic opportunity for such entrepreneurs that are demographically most likely to be in off-grid communities. A study undertaken in West Africa that found little correlation between electricity access and a firm’s profitability did, however, find that tailors do consistently benefit from electricity access.<sup>152</sup>

Focus group participants also highlighted the potential for solar power to support service-based industries, specifically those participating in retail sales of fish, meat, beverages, entertainment and phone charging. The calculation of the estimated OGS market focused only on barbering and tailoring appliances, which comprises a small portion of overall SME sector demand. These two microenterprises are indicative of the service-based SME off-grid solar market, as they benefit most from extended working hours and the use of modern appliances/machinery. The quantitative demand estimate for this market segment is therefore intended to provide a baseline for future research, as a more robust analysis would be necessary to assess OGS demand from all SMEs.

According to the analysis, estimated annualized off-grid solar cash market potential for barbers and tailors is USD 861 thousand (**Table 32**).

**Table 32: Estimated Cash Market Potential for SMEs – Barbers and Tailors** <sup>153</sup>

No. of SMEs with Constrained Access to Finance <sup>154</sup>	Units	kW Equivalent	Cash Value (USD)
6,888	1,378	344	\$861,000

Source: World Bank; African Solar Designs analysis

➤ **Value-Added Applications**

Agricultural practices, especially for smallholder farmers, can benefit from a wide range of off-grid solar technologies. Cold rooms and ice production are valuable investments for economies engaged in aquaculture. Solar refrigeration, cooling and processing equipment would enable traders and livestock farmers to sell dairy products. Solar drying of cocoa and palm oil processing are productive use applications that would greatly benefit rural farmers in countries where these products contribute to export revenues.

As described above, cotton is an important cash crop for Burkina Faso and its smallholder farmers. Therefore, solar powered applications, which support its value chain (e.g. irrigation, ginning and edible oil processing equipment) could serve as important inputs for growth and development of the sector. Burkina Faso’s cotton value chain is not directly incorporated into this analysis; rather, cotton production is integrated into the assessment of the size of Burkina Faso’s irrigation market.

The three value-added applications that were analyzed include solar pumping for agricultural irrigation, solar milling and solar powered refrigeration.

<sup>152</sup> Grimm, M., Harwig, R., Lay, J., “How much does Utility Access matter for the Performance of Micro and Small Enterprises?” World Bank (2012): [http://siteresources.worldbank.org/INTLM/Resources/390041-1212776476091/5078455-1398787692813/9552655-1398787856039/Grimm-Hartwig-Lay-How\\_Much\\_Does\\_UTILITY\\_Access\\_Matter\\_for\\_the\\_Performance\\_of\\_MSE.pdf](http://siteresources.worldbank.org/INTLM/Resources/390041-1212776476091/5078455-1398787692813/9552655-1398787856039/Grimm-Hartwig-Lay-How_Much_Does_UTILITY_Access_Matter_for_the_Performance_of_MSE.pdf)

<sup>153</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.

<sup>154</sup> “MSME Finance Gap,” SME Finance Forum: <https://www.smefinanceforum.org/data-sites/msme-finance-gap>

Solar Powered Irrigation:

In most West African countries, the national government is typically responsible for carrying out irrigation initiatives, which vary by the scale of the project and often require the construction of civil works such as dams, canals, embankments, and piping. Donor agencies and development partners provide funding for such projects. This analysis focused instead on a small-scale private sector driven approach and estimated the market potential for off-grid solar pumping systems to support smallholder farmers.

Solar pumping systems vary in their wattage depending on the area of land irrigated, the depth of water abstracted and the quality of the soil and crops among other factors.<sup>155</sup> GIS analysis demonstrated that access to the water table and surface water is not a major determinant of the costing of applicable solar irrigation systems, as most farming settlements in Burkina Faso are within close proximity to either surface water or relatively easily extractable sources of water (**Figure 35**).

It is important to note Burkinabe farmers may be discouraged from making long-term irrigation investments on their land due to unclear land tenure rights resulting from competing claims under customary land laws.<sup>156</sup> A recent study found that land tenure security serves as a source of economic power for farmers and can lead to a 30% increase in the productivity of their soil, due in part to the increased investment in inputs such as irrigation.<sup>157</sup> Subsequently, donor led initiatives such as the Millennium Challenge Corporation’s Compact are working to improve tenure insecurity and land management and to enhance the volume and value of agriculture production.<sup>158</sup>

In analyzing the available market for solar-powered irrigation, this market scoping exercise focused exclusively on smallholder farmers and solar water pumping irrigation technologies to address their needs. In doing so, this analysis took into consideration the emerging experience with small-scale productive use pumping in East Africa. Small pumps of 80 Wp-150 Wp (e.g. Futurepump and SunCulture) make up the bulk of sales, while larger-sized pumps (e.g., Grundfos) are also frequently marketed to address differing water access and crop conditions.

**Table 33** presents the estimated annualized off-grid solar cash market potential for smallholder value-added solar irrigation applications in Burkina Faso, which has an estimated cash value of USD 14.9 million (see **Annex 2** for more details).

Table 33: Estimated Cash Market Potential for Value-Added Applications – Irrigation<sup>159</sup>

Estimated No. of Smallholder Farms Suitable for OGS Pumping for Irrigation	Units	kW Equivalent	Cash Value (USD)
137,500	22,917	2,750	\$14,895,833

Source: Food and Agriculture Organization; World Bank; African Solar Designs analysis

<sup>155</sup> See GIZ Powering Agriculture Toolbox on Solar Powered Irrigation Systems: [https://energypedia.info/wiki/Toolbox\\_on\\_SPIS](https://energypedia.info/wiki/Toolbox_on_SPIS)

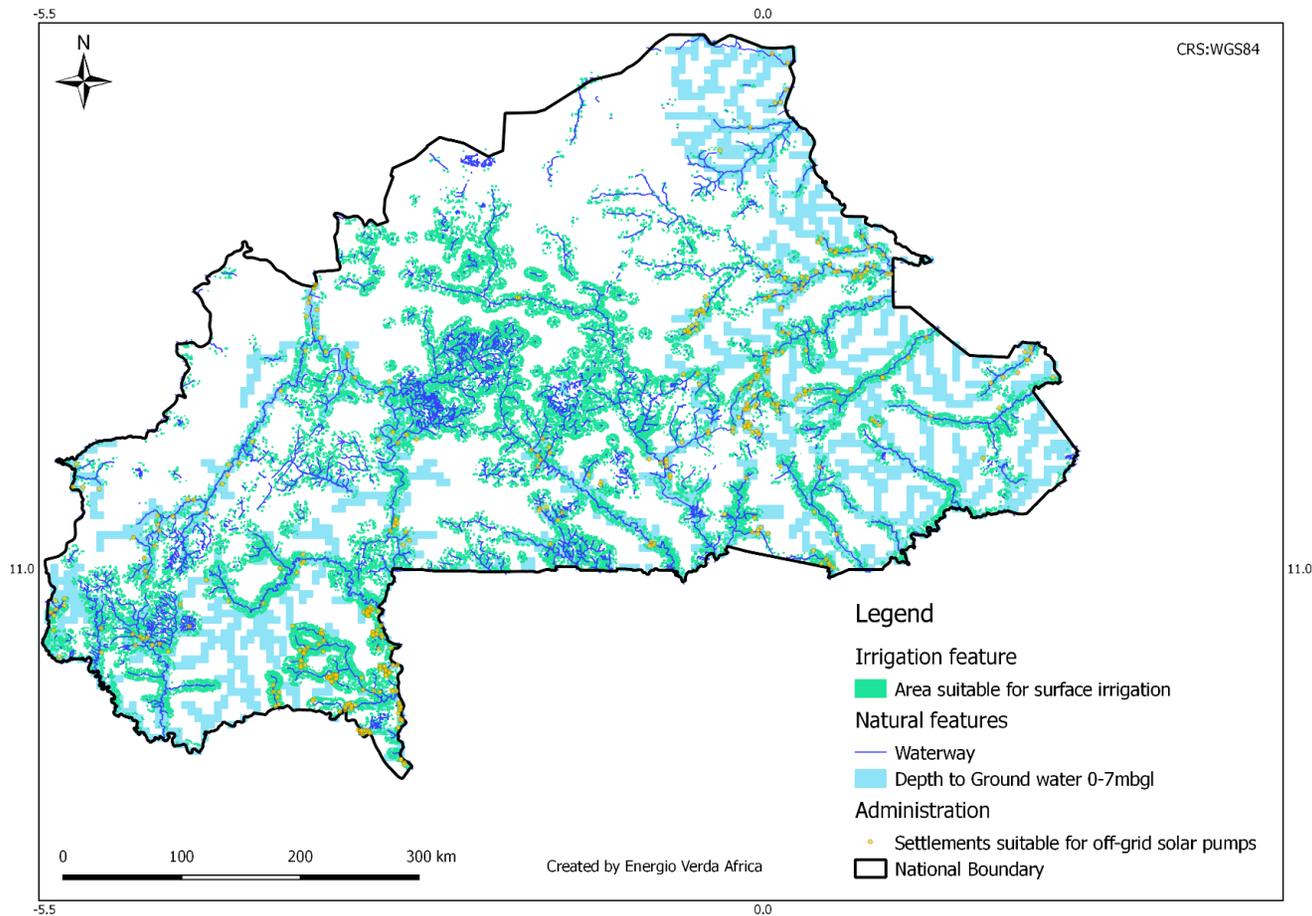
<sup>156</sup> Land ownership in Burkina Faso is determined under either formal or customary laws, which do not apply.

<sup>157</sup> Korsaga, S., “Land Tenure Security, Land-Related Investments and Agricultural Performance in Sub-Saharan Africa: Efficiency or Equity? A Microeconomic Analysis Applied to Burkina Faso,” (2018): <https://ideas.repec.org/p/hal/wpaper/halshs-01699118.html>

<sup>158</sup> “U.S. Millennium Challenge Corporation Announces \$8.8 million to Advance Progress on Development of Burkina Faso Compact,” (2018): <https://www.mcc.gov/news-and-events/release/release-042418-burkina-cdf-signing>; “Burkina Faso’s family farmers shift from local growers to regional exporters”: <https://www.mcc.gov/where-we-work/program/burkina-faso-compact>

<sup>159</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.

Figure 35: Area Suitable for Surface Irrigation and Identified Settlements Suitable for Off-Grid Solar Pumps



Source: British Geological Survey, Bureau of Statistics; ESA Climate Change Initiative; SeforALL Africa Hub and African Development Bank; Energio Verda Africa GIS analysis<sup>160</sup>

<sup>160</sup> NOTE: mbgl = meters below ground level;

Sources: Mapping provided by British Geological Survey © NERC 2012. All rights reserved; Irrigation area identified from a Land Cover data set through the ESA Climate Change Initiative, Land Cover project 2017. © Modified Copernicus data (2015/2016): <https://www.esa-landcover-cci.org/?q=node/187>; Settlements provided by SeforALL Africa Hub and African Development Bank Green Mini-Grid Market Development Programme, (2017): <https://greenminigrid.SeforALL-africa.org/sites/default/files/GMG%20Burkina%20Faso%20report%20final.pdf>

Solar Powered Milling:

Cereal crops like maize, sorghum, millet, and rice provide an opportunity for value addition through hulling or milling. Off-grid communities use maize or rice milling equipment that is typically powered by diesel generators. Discussions with off-grid community groups revealed that although many are aware of the long-term cost savings associated with solar powered mills, the up-front cost of purchasing equipment was viewed as too high.

**Table 34** presents the estimated annualized off-grid solar market potential for smallholder value-added solar grain milling applications in Burkina Faso, which has an estimated cash value of USD 2.3 million (see **Annex 2** for more details).

Table 34: Estimated Cash Market Potential for Value-Added Applications – Milling <sup>161</sup>

Estimated No. of Solar Mills	Units	kW Equivalent	Cash Value (USD)
2,860	143	929	\$2,323,379

Source: Food and Agriculture Organization; African Solar Designs analysis

Solar Powered Refrigeration:

Solar-powered refrigerators and freezers in rural areas serve multiple purposes, including to store milk, fish, meat and vegetables to extend the life of produce and reduce losses. In addition to storing produce, ice-makers can increase the income of rural SMEs by providing ice to businesses that require cold storage (stores, restaurants etc.). **Table 35** presents the estimated annualized off-grid solar market potential for smallholder value-added solar refrigeration applications in Burkina Faso, which has an estimated cash value of USD 1.1 million (see **Annex 2** for more details).

Table 35: Estimated Cash Market Potential for Value-Added Applications – Refrigeration <sup>162</sup>

Off-Grid Market Centers	Units	kW Equivalent	Cash Value (USD)
1,582	79	435	\$1,087,625

Source: Solar-Powered Cold Hubs, Nigeria; African Solar Designs analysis

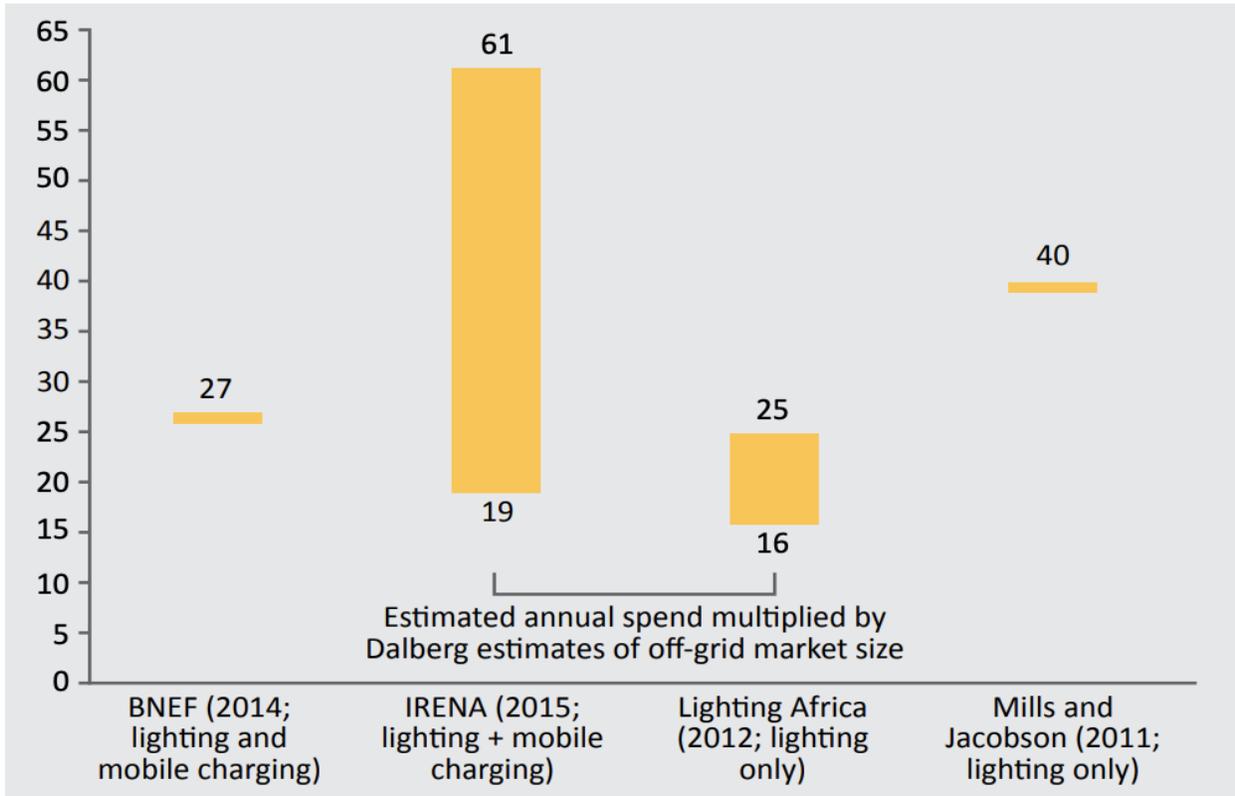
Ultimately, the ability for an agricultural community to benefit from productive use applications has as much to do with access to markets and improved crop inputs, as it has to do with the pricing and availability of financing to purchase the equipment. Hence, the macroeconomic approach used to carry out this market sizing does not account for country-specific cost and supply chain constraints.

➤ **Connectivity/ICT Applications**

Mobile phone charging stations/kiosks make up a critical segment of off-grid solar demand, as the market for solar phone charging is expected to grow significantly in the near-term. Household rates of mobile phone ownership often greatly exceed rates of electricity access (**Figure 20**), while households spend a significant share of income on lighting and phone charging (**Figure 36**). Increasingly, off-grid solar devices, such as lighting devices, also include phone-charging capabilities that enable owners to engage in mobile-phone charging businesses.

<sup>161</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.  
<sup>162</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.

Figure 36: Estimated Annual Off-Grid Household Expenditure on Lighting and Mobile Phone Charging<sup>163</sup>



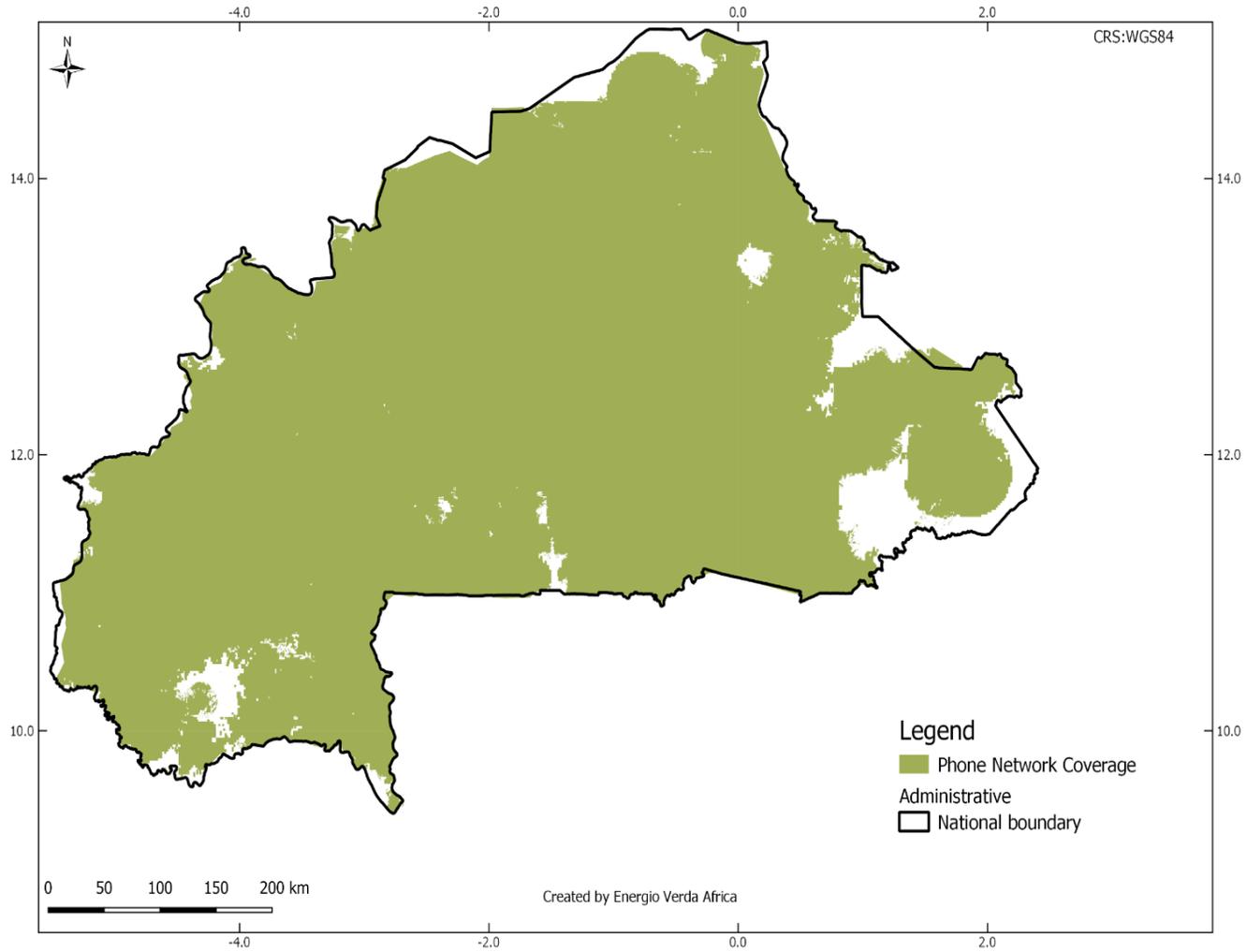
NOTE: Figures in Billion USD

Source: Dahlberg Advisors, Lighting Global, GOGLA and World Bank ESMAP, 2018

**Figure 37** shows the relatively broad geographic coverage of cellular signals across the region. Cellular connectivity is essential for solar PV markets. In many African countries, mobile phone charging provides a primary productive use application for off-grid solar. Mobile phone access – and more importantly connectivity – helps drive commerce and employment in rural areas. The penetration of mobile money services is also critical, as it drives greater financial inclusion, expands consumer financing options and further increases demand for phone charging enterprises. Above all, mobile phones and connectivity are a necessary precursor to PAYG solutions in the OGS sector. Countries with expanding mobile phone coverage and especially broadband internet users are more attractive to PAYG solar companies (**Figure 19**).

<sup>163</sup> “Off-Grid Solar Market Trends Report 2018,” Dahlberg Advisors, Lighting Global, GOGLA and World Bank ESMAP, (January 2018): [https://www.lightingafrica.org/wp-content/uploads/2018/02/2018\\_Off\\_Grid\\_Solar\\_Market\\_Trends\\_Report\\_Full.pdf](https://www.lightingafrica.org/wp-content/uploads/2018/02/2018_Off_Grid_Solar_Market_Trends_Report_Full.pdf)

Figure 37: Mobile Phone Network Geographic Coverage<sup>164</sup>



Source: GSMA

<sup>164</sup> See Annex 2 for more details.

The analysis of the potential solar-powered phone charging market was based on the country’s mobile phone penetration rate, rural population rate, and the average costs of OGS phone charging appliances. **Table 36** presents the estimated annualized cash market potential for off-grid solar mobile phone charging enterprises in Burkina Faso, which has an estimated cash value of USD 9.2 million (see **Annex 2**).

**Table 36: Estimated Market Potential for Mobile Phone Charging Enterprises** <sup>165</sup>

Mobile Subscribers <sup>166</sup>	Rural Population (%) <sup>167</sup>	Units	kW Equivalent	Cash Value (USD)
7,700,000	69.3%	10,668	4,267	\$9,195,488

Source: GSMA; World Bank; African Solar Designs analysis

### 2.3.3 Ability to Pay and Access to Finance

The above analysis illustrates that there is a sizeable off-grid solar cash market for productive use applications in Burkina Faso. However, more research needs to be done in each segment to better understand affordability of OGS appliances and equipment based on ability and willingness to pay as well as other factors such as access to finance and ultimately whether the expenditure for the equipment is justifiable given increased revenue/productivity in the long-term.

The value-added market for water pumping for irrigation indicates that increased revenues from the use of solar appliances would justify the expenditure for the equipment – although as mentioned, agricultural productivity also depends on other environmental and market factors that are specific to each country. Solar powered irrigation systems may require a financed solution to be profitable investments for farmers, as their cost may exceed benefits depending on how the systems are designed and what components are used.

With regard to microenterprises, further study would be needed to determine the impact of off-grid solar on this sector, especially as it relates to income and affordability of the sectors analyzed (phone charging, barbers and tailoring). Providing solar-kits through subsidized micro-credit schemes can lead to productive uses and boost household income. The focus group discussions yielded additional insights into the off-grid solar PUE sector from a consumer point of view:

- There is need to promote awareness through increase in availability of OGS solutions and highlighting successes of solar use so that communities as well as banks can invest and support the sector.
- Further, most companies cannot afford the up-front cost of solar solutions. A potential solution to this could be to implement consignment schemes to allow distributors to better engage retailers for solar appliances and power systems. Another solution would be support from programs such as the IFC’s recently instituted facility whereby it covers up to 50% of the risk of loans to Burkinabe SMEs that are investing in climate smart equipment including solar appliances.<sup>168</sup>
- Despite public and donor-led interventions to lower financial constraints, firms in rural areas still struggle to access financing solutions. This is especially the case for farmers that have invested in milling or solar drying but have not implemented irrigation schemes that would allow them to harvest crops year-round.
- There is also skepticism regarding the reliability and quality of solar powered appliances, and as such, more should be done to raise awareness and set appropriate standards for solar products.

<sup>165</sup> Estimated units, kW equivalent and cash value are annualized to reflect typical lifespan of OGS systems; see **Annex 2** for more details.

<sup>166</sup> “The Mobile Economy: Sub-Saharan Africa,” GSMA, (2017):

<https://www.gsmaintelligence.com/research/?file=7bf3592e6d750144e58d9dcfac6adfab&download>

<sup>167</sup> World Bank: Rural Population (% of total population) <https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS>

<sup>168</sup> Press Release: “IFC Invests in Bank of Africa to Expand SME Lending in Eight Countries,” (June 4, 2018):

<https://ifcextapps.ifc.org/ifcext/pressroom/ifcpressroom.nsf/0/947B76E4C106A246852582A200440E1C?OpenDocument>

## 2.4 Supply Chain

This section reviews the off-grid solar supply chain in Burkina Faso, including an overview of key actors, solar products and services, business models, and sales volumes. The section also analyzes the role of informal market players and the impact of uncertified products. The section concludes with an assessment of local capacity and the needs of the supplier market segment. The data presented in this section was obtained through desk research, interviews with local officials and industry stakeholders, focus group discussions and surveys of international and local solar companies (see **Annex 2** for more details). The tier system used to classify solar companies throughout this section is described in **Table 37**.

Table 37: Solar Company Tier Classification

Classification		Description
Tier 1	Startup companies	<ul style="list-style-type: none"> <li>• Less than 3 full time employees</li> <li>• Less than 300 SHS or Less than 1,500 lanterns sold</li> <li>• Less than USD 100,000 annual revenues</li> <li>• Does not have access to outside finance except personal loans and may have a business account</li> </ul>
Tier 2	Early stage companies	<ul style="list-style-type: none"> <li>• 3 to 25 full time employees</li> <li>• 300 to 30,000 solar home systems or 1,500 to 50,000 lanterns sold</li> </ul>
Tier 3	Growth/Mature	<ul style="list-style-type: none"> <li>• More than 25 full time employees</li> <li>• More than 30,000 solar home systems or 50,000 lanterns sold</li> <li>• More than USD 3 million annual revenues</li> <li>• Has a credit line at a bank and financial statements</li> <li>• Raising equity or other outside financing</li> </ul>

Source: ECOWAS Center for Renewable Energy and Energy Efficiency

### 2.4.1 Overview of Commercial Market for Solar PV Equipment

The off-grid solar supply chain in Burkina Faso is made up of a wide range of stakeholders – importers, distributors, wholesalers, retailers, NGOs, and end-users (**Figure 38**). The country’s solar market, although still in its nascent stages, is in a period of rapid growth. In fact, GOGLA sales figures from 2016-2017 indicate that Burkina Faso experienced the second highest sales volume and revenue in West Africa behind only Nigeria. Growth is being driven by increased demand for solar powered electrical appliances – phones, lighting products, refrigeration and water pumps.

The overall market environment and opportunity for solar companies is improving (**Figure 17**). A variety of solar products and systems are offered by companies in the market (by both the formal and informal sector) and, as examined in further detail below, there are a number of business models being utilized. Rural households make up the main market for off-grid lighting products in the country, as the demand for lighting products and household electrical appliances is growing. Nevertheless, urban households, both electrified and non-electrified, are also a key consumer market, as they may have greater ability to afford OGS products and systems. Moreover, power connections in urban areas of Burkina Faso are often not reliable (**Figure 5** and **Figure 6**), leading to expanded use of off-grid solutions.

The main business model deployed by local solar companies is cash/over-the-counter sales, while a few companies have started to utilize PAYG sales. Though large companies selling certified products play a central role in the market, the informal sector remains a key factor. Surveys of local industry players and focus group discussions noted that a clear regulatory framework was necessary to provide appropriate incentives for the private sector and to address the widespread sale of low-quality, uncertified products, which is hindering development of the OGS market in Burkina Faso.

Figure 38: Off-Grid Solar Market and Supply Chain Overview

*Source:* GreenMax Capital Advisors

#### 2.4.2 Overview of OGS Companies in Africa and Level of Interest in the Region

The African off-grid solar market has experienced rapid growth over the last five years. This growth can largely be attributed to the emergence of a progressively diverse, global pool of manufacturers and distributors, decreased system costs and an increase in three major product categories – pico solar, Plug-and-Play SHS, and component-based systems.<sup>169</sup> Leading solar companies such as Greenlight Planet, D.Light, Off-Grid Electric, M-KOPA Solar, Fenix International, and BBOXX represent the largest share of the African off-grid market and are joining other players in West Africa and the Sahel, including Lumos Global, PEG Africa, Barefoot Power, Yandalux, Schneider Electric, Azuri Technologies, Solarama, AD Solar, Enertec, SmarterGrid, GoSolar, Total, Oolu Solar, EnergenWao and SunTech Power to list a few.

Market entry into Africa began in East Africa for a majority of the leading companies, a trend that can be attributed to advancements in mobile money transfer systems such as M-Pesa that have facilitated the PAYG off-grid business model. As the East African market becomes more crowded and mobile money services spread across the Continent, many international off-grid solar companies have recently entered markets in West Africa and the Sahel. The regional market grew from being nearly non-existent in 2013 to accounting for 9% of worldwide sales (20% of SSA) with over 2 million systems sold in 2017.<sup>170</sup>

Over 500 solar companies have been identified operating across the region, many of which are small local players. These local distributors either operate independently or act as local affiliates of larger international companies operating in this space. The majority of companies in the region are primarily Tier 1 and Tier 2 companies, with relatively few Tier 3 companies. The highest concentration of Tier 3 companies was identified in Burkina Faso, Cameroon, Côte d’Ivoire, Ghana, Mali, Nigeria and Senegal.<sup>171</sup>

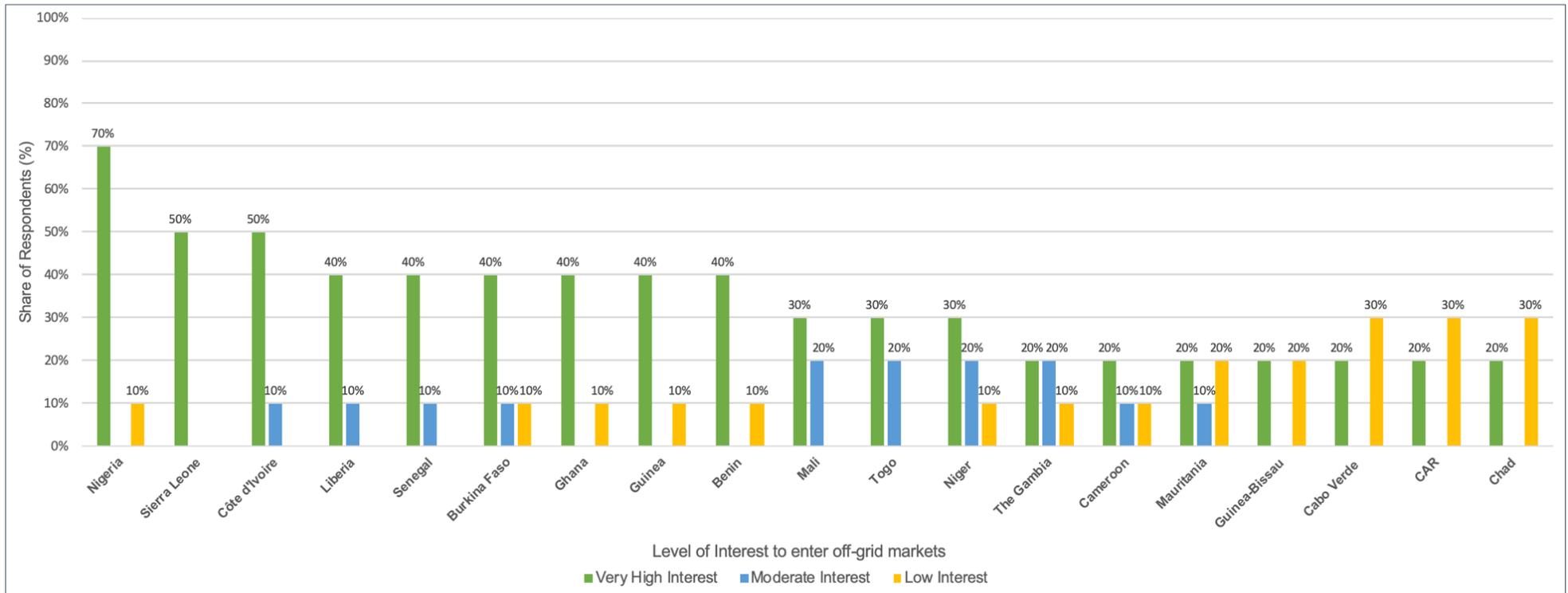
A survey of large international solar companies that assessed *inter alia* their level of interest in entering the off-grid markets of West Africa and the Sahel is presented in **Figure 39**. The survey found that among respondents, companies expressed the most interest in Nigeria, Sierra Leone, and Côte d’Ivoire, with at least half of respondents indicating a “very high level of interest” in these markets. There was also a relatively high level of interest in Liberia, Senegal, Burkina Faso, Mali and Togo, with at least half of respondents indicating a “very high” or “moderate” level of interest in these markets.

<sup>169</sup> “Off-Grid Solar Market Trends Report, 2018,” Dahlberg Advisors and Lighting Africa, (January 2018): [https://www.lightingafrica.org/wp-content/uploads/2018/02/2018\\_Off\\_Grid\\_Solar\\_Market\\_Trends\\_Report\\_Full.pdf](https://www.lightingafrica.org/wp-content/uploads/2018/02/2018_Off_Grid_Solar_Market_Trends_Report_Full.pdf)

<sup>170</sup> Ibid.

<sup>171</sup> “Insights from Interviews with Off-Grid Energy Companies,” ECREEE, (June 2018).

Figure 39: Level of Interest in Off-Grid Markets in West Africa and the Sahel among Major Suppliers<sup>172</sup>



Source: Stakeholder interviews; GreenMax Capital Advisors analysis

<sup>172</sup> NOTE: This is not a representative sample of respondents (sample size = 10 respondents). The figure is meant to provide feedback from “major suppliers” of off-grid solar products and services and gauge their level of interest in entering specific ROGEP country off-grid markets. Respondents are all GOGLA members and are either already active in the West Africa and Sahel region or seeking to enter it. The figures presented are the share of respondents (%) who indicated their level of interest in a given country.

### 2.4.3 Solar Market, Products and Companies in Burkina Faso

This section characterizes the current formal market (local and international companies) including recent sales trends, the main solar products, brands and prices.

#### ➤ The Formal Market – Local and International Companies

Focus groups and stakeholder interviews identified nearly 40 companies operating in Burkina Faso’s solar sector, offering a wide range of products and services to consumers throughout the country (see **Annex 2** for a complete list of identified companies). In addition to local firms, the formal market includes international players that enter the market to install systems for donor-funded projects. Formal market players are largely Lighting Global and GOGLA affiliated companies. Several of these firms have a regional presence in other West African markets and typically operate through partnerships with manufacturers and with local or international distributors.

BBOXX, Total, Benoo, Greenlight Planet, Benoo, Greenlight Planet, Yeleen Ba (FRES), Lagazel and Yandalux are the largest international Tier 3 companies operating in the market. French company, Total, has formed a partnership with US start up d.light to launch Awango pico lanterns, distributed through its established network of petrol stations in the region. London-based company, BBOXX, who operates across four continents, has formed a partnership with French telecommunications company, Orange, to develop its PAYG system in Burkina Faso and other West African countries (Nigeria, Cameroon, Côte d’Ivoire, Senegal and Togo).<sup>173</sup> Greenlight Planet has formed a partnership with manufacturer Sun King, selling its pico solar and solar home lighting systems. Other international and regional Tier 2 companies include Yandalux (headquartered in Germany with operations in eight West African countries) and Sahelia Solar (in Burkina Faso and Mali).

FGDs and stakeholder interviews identified about 12 companies as key players in the market. Five of these companies are manufacturer representatives, buying directly from a manufacturer outside the country, representing international brands and acting as local distributors for these brands (e.g. Africa Energy Solaire is the distributor of Victron). Other companies are vertically integrated and active in all areas of the supply chain (Africa Energy Solaire, Burkina Trading International and Sahelia Solar). With the exception of a few companies, most suppliers do not offer PAYG as an option, while larger companies offer consumer financing options. A small number of these companies also offer installation and O&M services for the products they sell to customers. The remaining seven companies are wholesalers and/or retailers that offer a wide range of products and services and are not specialized, with the exception of SIREA Afrique and PPI, two firms that mainly sell large solar systems. Most of these companies have access to finance through commercial loans or grants.

#### ➤ Sales Volumes and Revenue

Focus group participants indicated that it is challenging to assess the size of the current market due to a lack of standardization in pricing from one company to another and a shortage of sound statistical data. Moreover, during surveys and FGDs, companies were reluctant to share confidential data on sales volumes and market shares. Local industry stakeholders described the market as having significant volume of sales distributed between hundreds of larger installations (>1 kW) and tens of thousands of consumer product sales along with institutional system market activity.

<sup>173</sup> “Etat des lieux du PAYGO Solaire en Afrique,” Innogence Consulting, (2018): <https://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/Etat-Des-Lieux-Du-PayGo-Solaire-en-Afrique.pdf>

Using reports published by GOGLA, some basic market information is presented in **Table 38** and **Table 39**. It is important to note that this data only includes figures from GOGLA-affiliated companies and certified product sales and is therefore not fully representative of off-grid solar market activity in Burkina Faso.

Table 38: Total Sales Volume and Cash Revenue for Stand-alone Systems in Burkina Faso, 2016-2017<sup>174</sup>

Sales Volume / Revenue	2016	2017	Total
<b>Total Volume of Products Sold (Units)</b>			
Total Volume of Products Sold	54,006	170,526	<b>224, 532</b>
Pico Solar	45,905	160,294	<b>206,199</b>
SHS	8,101	10,232	<b>18,333</b>
<b>Total Cash Sales Revenue (USD)</b>			
Total Cash Sales Revenue	\$1,056,185	\$4,021,564	<b>\$5,077,749</b>
Pico Solar	\$1,013,938	\$3,458,545	<b>\$4,472,483</b>
SHS	\$42,247	\$563,020	<b>\$605,267</b>

Pico solar products categorized as 0-10W  
SHS products categorized as >10W

In 2016-2017, about 90% of the overall share of OGS products sold and 92% of total sales revenue in West Africa were pico solar products compared to 10% of products sold and 8% of sales revenue were SHS.

Source: GOGLA, Lighting Global and World Bank; GreenMax Capital Advisors analysis

Table 39: Cash and PAYG Sales Volume and Revenue for Pico Solar Products, H1 2018<sup>175</sup>

Sales Volume / Revenue	Cash	Share (%)	PAYG	Share (%)	Total
<b>Total Sales Volume Burkina Faso</b>	<b>22,331</b>	<b>97.9%</b>	<b>478</b>	<b>2.1%</b>	<b>22,809</b>
Total Sales Volume West Africa	194,521	65%	104,520	35%	299,041
% of Total Sales Volume in West Africa	11.5%	-	0.5%	-	7.6%
<b>Total Sales Revenue Burkina Faso</b>	<b>\$383,637</b>	<b>-</b>	<b>no data</b>	<b>-</b>	<b>no data</b>
Total Sales Revenue West Africa	\$14,972,591	50%	\$15,008,999	50%	\$29,981,590
% of Total Sales Revenue in West Africa	2.6%	-	no data	-	no data

NOTE: H1 = First half of year

Source: GOGLA, Lighting Global and World Bank; GreenMax Capital Advisors analysis

- **In 2016-2017, 224,532 units were sold in Burkina Faso for a total cash sale revenue of over USD 5 million.** Sales volume and revenue figures *tripled* between 2016 and 2017.
- **Sales figures remain volatile, as Burkina Faso is still a nascent off-grid solar market.** Despite robust growth in H1 2017 (Burkina Faso was ranked in the top 10 in products sold), sales dropped by

<sup>174</sup> “Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data,” GOGLA, Lighting Global and World Bank, (July – December 2017): [https://www.gogla.org/sites/default/files/resource\\_docs/gogla\\_sales-and-impact-reporth2-2017\\_def20180424\\_web\\_opt.pdf](https://www.gogla.org/sites/default/files/resource_docs/gogla_sales-and-impact-reporth2-2017_def20180424_web_opt.pdf); and

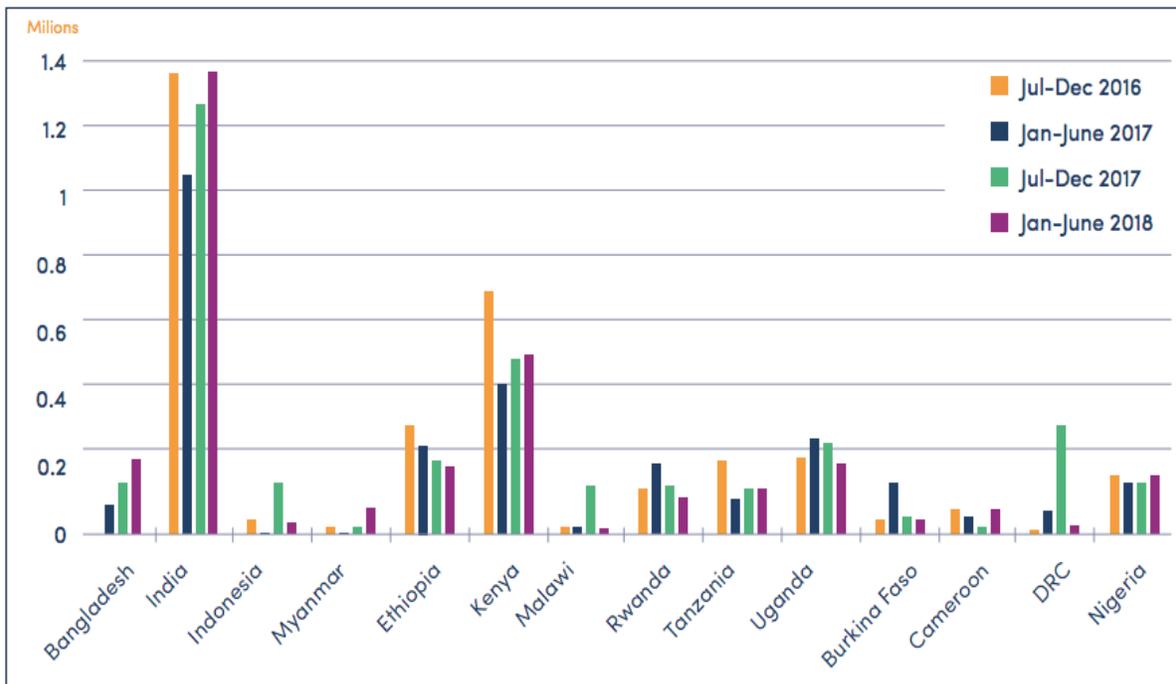
“Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data,” GOGLA, Lighting Global and World Bank, (January – June 2017): [https://www.gogla.org/sites/default/files/resource\\_docs/gogla\\_sales-and-impact-reporth12017\\_def.pdf](https://www.gogla.org/sites/default/files/resource_docs/gogla_sales-and-impact-reporth12017_def.pdf); and  
“Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data,” GOGLA, Lighting Global and World Bank, (July – December 2016): [https://www.gogla.org/sites/default/files/recource\\_docs/final\\_sales-and-impact-report\\_h22016\\_full\\_public.pdf](https://www.gogla.org/sites/default/files/recource_docs/final_sales-and-impact-report_h22016_full_public.pdf); and  
“Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data,” GOGLA, Lighting Global and World Bank, (January – June 2016): [https://www.gogla.org/sites/default/files/recource\\_docs/global\\_off-grid\\_solar\\_market\\_report\\_jan-june\\_2016\\_public.pdf](https://www.gogla.org/sites/default/files/recource_docs/global_off-grid_solar_market_report_jan-june_2016_public.pdf)

<sup>175</sup> “Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data,” GOGLA, Lighting Global and World Bank, (January – June 2018): [https://www.gogla.org/sites/default/files/resource\\_docs/global\\_off-grid\\_solar\\_market\\_report\\_h1\\_2018-opt.pdf](https://www.gogla.org/sites/default/files/resource_docs/global_off-grid_solar_market_report_h1_2018-opt.pdf)

64% (from 123,945 units to 46,581 units) in H2 2017, reflecting the dynamic nature of the country’s OGS market. In H1 2018, sales decreased further to 22,809. Despite this drop-off, Burkina Faso was still the ninth-ranked country in Sub-Saharan Africa and 14<sup>th</sup> globally from 2016-2018 (Figure 40).

- **Cash sale transactions remain the dominant model.** In H1 2018, product sales were almost entirely cash transactions, accounting for 98% of sales volume. These figures are consistent with the findings of this study, which suggest that there is limited penetration of PAYG to date.
- **Pico PV products represent the vast majority of products sold.** Based on regional sales data on product categories, pico solar products accounted for 92% of sales volume and 88% of total cash sales revenue over the period 2016-2017 in Burkina Faso.

Figure 40: Total Sales Volume for Stand-alone Solar Systems in Select Countries (USD million)<sup>176</sup>



Source: GOGLA, Lighting Global and World Bank

<sup>176</sup> “Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data,” GOGLA, Lighting Global and World Bank, (January – June 2018): [https://www.gogla.org/sites/default/files/resource\\_docs/global\\_off-grid\\_solar\\_market\\_report\\_h1\\_2018-opt.pdf](https://www.gogla.org/sites/default/files/resource_docs/global_off-grid_solar_market_report_h1_2018-opt.pdf)

➤ **Main Solar Products and Components**

**Table 40** lists the brands of common solar products and components in Burkina Faso. The list does not include non-certified brands that are also common in the country’s grey market.<sup>177</sup>

**Table 40: Off-Grid Solar Products and Components in Burkina Faso**

Products/Systems	Companies
Distributors of Pico Solar Lanterns	Total, Avelux, CB Énergie, Lagazel, Nafa Naana, BBOX
Single Module distributors	Energy station, Sahelia solar, Total, Lagazel, Zenith, Nafa Naana, Sysaid Faso, PPS, PPI, BTI, AES
Multiple Modular and Very large system supplier	EIA, Solarfor, Speedtech Energy Africa, Africa TIM, Enersolar Energy station, Sahelia solar, Total, Lagazel, Zenith, Nafa Naana, Sysaid Faso, PPS, PPI, BTI, AES
Products/Components	Brands
Lead Battery	Super-K (Ghana, Nigeria), Super Solar (France), Euro Solar (France), Golf Star (France), MCA (China)
Inverter	Cation-Tuff Bull, Sam-Lac (Nigeria), Sol Star, Must Power (China)
Solar module	SM-Solar (France), YIBF Solar (France), France Solar (France), Solar SM, Euro Solar (France), Baiwa Super Solar (France), OMAF (France), Special Solar (France), Super Solaire, Ameri-Solar (USA)
Solar panel	Yingli (China)
All (not indicated)	SMA, Victron, Photo Watt, BP Solar, MPP Solar, AEG, SMA, Yingli, Elios, STK, Xpower, BAE

Source: Stakeholder interviews

➤ **Market Prices**

**Table 41** presents average prices for off-grid systems and components in Burkina Faso’s solar market. The estimated costs of solar electrification using a fee-for-service business model are presented in **Table 42**. As sales volumes continue to grow rapidly, prices of solar products for consumers are comparable to prices in more mature markets.

**Table 41: Estimated Prices of Solar Systems and Components in Burkina Faso**

Off-Grid System / Component	Price range (USD / per unit)
Pico solar	\$17-\$26
Solar Module (150 Wp - 250 Wp)	\$16-\$174
Controller (5 kVA)	\$14-\$31
Inverter (180 Wp - 15,000 Wp)	\$30-\$1,250
Lead Acid Battery (40 Ah - 250 Ah)	\$13-\$434

Source: Stakeholder interviews

**Table 42: Estimated Solar Electrification Costs using Fee-for-Service Business Model**

Solar Home System	Installation fees		Monthly Fees	
	CFA	USD	CFA	USD
<b>Small</b> (2 lamps, 1 socket for TV / radio / phone charging etc.)	18,845	30	3,845	7
<b>Medium</b> (4 lamps, 1 socket for TV / radio / phone charging etc.)	20,940	35	5,940	10
<b>Large</b> (5 lamps; 1 socket for TV / radio / phone charging etc.)	24,050	40	9,050	15

Source: Stakeholder interviews

<sup>177</sup> In this context, “grey market” refers to products that are not Lighting Global or IEC certified that are typically sold over-the-counter at low prices. Some grey market products are counterfeit or replicas of certified products that undercut the markets of certified products.

➤ **Importation Clearance Processes**

For the importation of solar products, four government agencies are involved in Burkina Faso: (i) the Ministry of Finance, (ii) the General Directorate of Customs, (iii) the Ministry of Energy and (iv) the National Renewable Energy and Energy Efficiency Agency (ANEREE). All solar products are exempt from customs duties and solar equipment imports are exempt from VAT under the Law of Finance No. 051-2012/AN. It usually takes about four weeks to import solar products into Burkina Faso, depending on the type of freight used. If a Government agency’s approval is required, it would then take an additional one to three weeks for customs clearance. To date, there are no provisions to ensure the quality of products entering the country. However, the ANEREE is currently working to implement quality standards and make the importation clearance process more efficient. Quality standards are ensured through the Lighting Africa Program, although they only apply to select brands (e.g. Lagazel).

2.4.4 Overview of Business Models

➤ **Company Approach to Market**

Historically, solar companies in Burkina Faso have developed as vertically integrated companies, based on in-house design of solar systems, outsourcing of manufacturing and partnerships with international brands. Some companies have been in the market since the early 2000s, (e.g. MicroSow since 2002; Yandalux since 2004), while large international firms entered the market after 2010. While some suppliers continue selling a wide range of products, a few have started to specialize in order to focus on specific consumer segments. For example, larger companies such as Greenlight Planet, BBOX, Total, Benoo, and Lagazel utilize PAYG financing to target low-income households and base of the pyramid customers. For most formal solar companies, however, their most important clients are large institutional groups such as NGOs, schools, public health facilities or large high-income clients. Focus group participants estimated that households account for the majority of installed off-grid solar sales (about 60% of the market) with the remaining balance (40%) split between SMEs and institutional/social facilities.

➤ **Business Models**

There are four primary business models used in the market (**Table 43**), although in reality solar companies utilize a number of business models to reach a variety of clients:

- **Over-the-counter cash sales** include both informal and formal components. Many traders simply offer solar products over-the-counter. Formal sector solar companies also stock modules, batteries and balance of system and offer them over-the-counter to do-it-yourselfers and agents.
- **System integrators** handle large systems and projects. They design, procure and install systems which range from high-end residential sites, to institutional power to mini-grids. Local integrators represent international solar, inverter and battery brands with whom they partner with on projects.
- **Plug and play and pico suppliers** cooperate with many of the major OGS brands to distribute products in the country. Sellers of plug and play systems target customers who can afford more than simple pico lanterns (products are usually sold through PAYG).
- **The PAYG sector** is still in its early stages in Burkina Faso. Under this business model, suppliers are gradually building up client bases which number in the tens of thousands and are quickly evolving to develop credit mechanisms that fit with local income patterns. Margins are made from subscriptions of thousands of consumers who buy systems through created accounts. The task of installation and after sales services is undertaken by agents. Common products sold include plug and play systems that are fully designed. Very few major suppliers in Burkina Faso utilize this business model, and it is mostly limited to major international players.

Table 43: Overview of Off-Grid Solar Business Models

Business Model	Strategy and Customer Base	State of Development
Over-the-counter solar market	<b>Formal:</b> Retailers in Burkina Faso are both large-scale (acting as suppliers and distributors) and medium size and are mainly located in large cities and towns around the country. They sell lighting/electrical products, including solar, pico systems and also large panels for urban customers.	Mature commercial market
	<b>Informal:</b> Kiosks, street vendors form a key pico-product retailer segment (that has not been fully explored). They sell low-priced products which are often short-lived. They have been seen as the entry points for black market low quality solar products to the country.	Early stage commercial development
System integrator	Integrators operate out of central offices with small specialized staff. They do not typically carry stock for sale over-the-counter. Instead, they deal directly with consumers and institutional clients and provide as per orders. Integrators target the NGO/donor market and participate in procurement tenders for supply and installation of larger systems. In Burkina Faso, a majority of companies deal with social and institutional customers and utilize the procurement model.	Mature commercial market
Plug and Play system supplier	These suppliers distribute equipment to retailers' projects, rural agents, community groups and over-the-counter. Traders of plug and play often sell these devices as part of other businesses.	Early stage commercial development
PAYG Sales	PAYG companies seek to implement the rent-to-own payment-based models used successfully in other countries. The business model is data-driven and relies on mobile money services and a network of agents to meet last-mile customers. Innovative OGS PAYG collaborations between shop-owners, mobile-operators and other larger local businesses are being tested. The PAYG business model is still in its early stages of deployment in Burkina Faso.	Early stage commercial development

Source: Stakeholder interviews; African Solar Designs analysis

➤ **Company Financing**

Most companies have difficulty financing their operations to grow their business. Several companies utilize the PAYG model to sell off-grid products and systems on credit (sometimes with lengthy repayment periods). In addition to financing customer payment options, suppliers also require significant working capital to purchase equipment, conduct marketing campaigns, cover transportation costs field costs and face stiff competition among retailers in the market. Distributors of international OGS products receive basic trade finance and marketing support options, though typically limited.

While some of the companies surveyed in Burkina Faso are exclusively self-financed, several companies also have access to commercial loans and other forms of finance, including donor funding/grants and CSR. In general, local financiers have yet to develop an appetite for the solar sector. With the exception of a few banks,<sup>178</sup> most local banks are still conservative with regard to solar enterprises. Commercial financiers – including banks and MFIs – are not set up to service solar distributor financing requirements. Local SME financing is not widely available to support businesses in their growth phase. If it was available, companies would make use of cash-flow/credit line financing against the signed contracts with major commercial clients, large NGOs or donors.

When importing, companies are exposed to considerable FOREX risks because they must cover costs of equipment in foreign currency. When projects are delayed, during seasonal low-income periods or when products are delayed in port, dealers must bear FOREX losses. The lack of consumer financing

<sup>178</sup> Stakeholder interviews revealed that BOA, Ecobank and Coris have provided financing to the solar sector.

arrangements impedes the growth of the solar market because distributors must take all finance risks and cannot plan with commercial or MFI financing to grow their business.

➤ **Evolving Business Models**

As a nascent solar market, Burkina Faso presents a fertile ground for new business model innovations. New models will require partnerships between developers, solar distributors, telecommunications companies, commercial finance and the retail sector. One of the results of the FGD discussions was a list of potential partnerships that can be explored to enhance existing and new business models (**Table 44**).

**Table 44: Evolving Off-Grid Solar Business Models**

Partnership	Description
Solar Distributors	<ul style="list-style-type: none"> <li>Improve efficiency within the supply/distribution chain, positioning them to be able to manage distribution, seek potential for long-term credit lines and capital infusions</li> <li>Develop better contract terms between large local suppliers in Burkina Faso with foreign manufacturers</li> <li>Test new sales and distribution strategies that increase sales at minimum cost</li> <li>Prove solar market potential, ultimately attracting a strong group of competing players that scale up solar product access</li> </ul>
Commercial financiers	<ul style="list-style-type: none"> <li>Commercial financiers are key to unlocking working capital and consumer finance and enabling the market by providing both the funds and means of transferring these funds</li> <li>Develop financial products for both distributors (financing for working capital needs) and off-grid solar consumers (consumer financing for purchase of systems)</li> </ul>
Telecommunications companies and technology providers	<ul style="list-style-type: none"> <li>Bring together telecommunications operators, mobile service providers and technology companies and solar supplier/distributor companies to develop Pay-As-You-Go technology platforms</li> <li>Encourage telecommunications partners to distribute off-grid solar systems through their existing network of agents</li> </ul>
Business/Retail Sector	<ul style="list-style-type: none"> <li>Comprises networks of retail stores that cover the entire country and provide all types of domestic and agriculture goods for the rural community</li> <li>Encourage linkages between specialized solar companies and these networks so as to facilitate the increase of the distribution network at a lowest cost possible</li> <li>Provide promotional tools for local retailers to promote solar products to households/SMEs</li> <li>Facilitate microfinancing for the domestic market through these networks</li> </ul>
Advocacy Bodies	<ul style="list-style-type: none"> <li>Capitalize on GoBF and donor efforts to (i) facilitate interagency dialogue and oversee policy proposals on new business models and (ii) enhance legislative changes to support the sector</li> </ul>

Source: African Solar Designs analysis

**2.4.5 The Role of Non-Standard Players in the Market**

Stakeholder interviews and FGDs were not able to estimate the size of the over-the-counter informal market. Informal traders sell modules, inverters, batteries and pico-products. Given that informal sellers are largely unregulated and do not report sales figures, very little data is available on this sector. The sector, however, is very influential as it also controls the delivery of lighting products imported mainly from East Asia. Informal traders understand growing consumer interest in solar solutions and sell competitively-priced low-quality products. Informal traders do not actively cooperate with the GoBF or formal projects.

Informal traders play an important role in the market because they respond to consumer demand rapidly. Many traders do provide IEC-approved components – this means knowledgeable consumers and technicians can assemble quality systems from over-the-counter selections of components that informal traders sell. It is notable that some informal traders are gaining skills and improving product offerings. The presence of a large informal market, however, leads to issues with equipment quality that hamper development of the country’s OGS market.

#### 2.4.6 Equipment Quality and the Impact of Uncertified Equipment

Burkina Faso’s solar market is largely dominated by informal market players, selling equipment through electronics shops, hardware stores, kiosks and even street vendors. The over-the-counter sales strategies of this group is to provide low-cost, fast moving products. As a sector, informal retailers provide widely-used lighting products mainly from East Asia to rural customers. However, most of their product range does not meet Lighting Global standards. Moreover, given that the most of their lighting products are low-cost and short-lived, they also ignore and avoid regulations and their products lack warranties.

In Burkina Faso, surveyed stakeholders expressed concerns about the overall quality and reliability of equipment in the market. Poor-quality and/or counterfeit products negatively impact the entire market by creating a misperception about product quality, which in turn undermines consumer confidence in solar equipment. Moreover, grey-market traders significantly undercut the prices of registered businesses who are still subject to taxes and import duties. Low prices of over-the-counter products make compliant products uncompetitive as many customers opt to buy non-compliant goods that are cheaper. Feedback from focus group meetings suggested that the GoBF needs to establish standards and a certification body to assist in enforcement of standards and control the quality of solar equipment imported in the country.

#### 2.4.7 Local Capacity to Manage Business Development, Installation and Maintenance

Burkina Faso’s nascent solar market is poised to grow if requisite technical assistance (TA) is provided. The existing market environment is challenging for solar companies. To operate effectively, companies need a significant amount of both local and international technical and financial expertise, and an ability to make practical decisions about their operations. Companies face a number of technical competency requirements – the selection of approaches and solar PV technologies, the design of their associated marketing instruments and the implementation of related initiatives.

The synergy with formal training institutions has yet to be fully explored and most of the players in the industry are not adequately equipped with the skills needed to design and assess policies, understand and deploy technologies, grasp electricity user needs and ability to pay, and operate and maintain systems. Some of the other areas where TA and capacity building is needed to support growth of the solar market include (but are not limited to) the following:

- Provision of TA and training to public and private partners on the development of OGS power projects.
- Support in development of vocational training curricula for solar technicians by working with education institutions to adopt the curricula and implement training programs. This support could include development of community training materials to raise community awareness about the importance of solar PV technologies, the various uses ranging from household use, productive uses and institutional uses of energy, and related safety aspects.
- In order to ensure that interaction with local communities is seamless, the collaborating partners could develop a management training manual for villages addressing the different aspects of solar technologies as well. This could include supporting technicians with troubleshooting posters for on-site display that could help identify and tackle operational issues as they arise.
- Solar technicians were noted to be sparse for some areas and lacking in other areas; as a result, solar businesses send out teams from major cities/towns for any installation and maintenance work. Training people based locally in remote areas to support O&M of solar systems (e.g. battery replacement) could help address this issue and expedite market uptake.

#### 2.4.8 Capacity Building Needs of the Supplier Market Segment

An analysis of the supplier market segment revealed a number of interrelated challenges, including financial, capacity, awareness and regulatory challenges. The focus groups and supplier surveys found that:

- Local financing is largely not available (or affordable) to support the sector’s development, except for a minority of large local companies; as a result, many companies are self-financed and do not have the working capital they need to grow and expand their operations.
- Reasons for denied finance by financial institutions included lack of collateral, lack of expertise in finance, the high cost involved in small transactions, and risk aversion.
- An improved regulatory framework is necessary to ensure product quality. The lack of control of product quality and import process has led to an increase in low-quality equipment, which negatively impacts perceptions of solar. There are no standards in place to address this critical issue. Tackling this challenge also requires harmonization of pricing in the market.
- Capacity building efforts are also lacking. The main areas that would require capacity building are at the technical level (installation, operation and maintenance of systems), and also marketing and sales.
- Knowledge, technical capacity and expertise is possessed by a few professionals in the industry working for large established solar companies; the majority of vendors lack the expertise or knowledge necessary to adequately service the market.

**Table 45** presents various areas of support and associated capacity building for the OGS supply chain in Burkina Faso. Attention should be given to the following:

- **Importers/Suppliers:** Make financing available for importers and distributors to allow suppliers to more easily stock and renew inventory should be a priority. The way the market is currently structured inhibits their growth. Supporting this segment of the supply chain, could in turn improve financing conditions for distributors/retailers, who could in turn develop consumer financing solutions for end-users. Financing should also be made available to end-users to enable them to purchase OGS systems.
- **Over-the-counter/ System Integrators/PAYG:** Focus on growing the number of solar technicians who are adequately skilled to support the supplier network, especially in rural areas. Formalizing this through regulation to require only licensed technicians to design and install solar PV systems is critical. This should be complemented by equally robust efforts to build the capacity of all stakeholders.
- **Consumers:** Deal with sociotechnical barriers: Although PV technology has advanced tremendously in the last decades, there are still several sociotechnical barriers to adoption, including the local conditions of end-users and the political and financial arrangements of the market. Like most countries in the region, various counterfeit solar PV products have infiltrated the market. Implementation of the regulations and quality/standards to ensure product quality could significantly boost market growth.

Table 45: Capacity Building and Technical Assistance for the OGS Supply Chain in Burkina Faso<sup>179</sup>

Area of Support	Description	Rationale
Tax exemptions on solar technology	<ul style="list-style-type: none"> <li>Effective implementation of VAT and import duty exemption on all solar products and components (not only solar panels)</li> </ul>	<ul style="list-style-type: none"> <li>Costs of solar products are inflated by taxes, making the technology less affordable to end-users</li> </ul>
Quality control/certification center	<ul style="list-style-type: none"> <li>Ensure that imported products are suitable/relevant to the local context (local standards) in Burkina Faso</li> </ul>	<ul style="list-style-type: none"> <li>Ensure the quality of products and face the influx of low-quality products</li> <li>Maintain the trust established between solar industry and customers</li> </ul>
Consumer education programs	<ul style="list-style-type: none"> <li>Supplier and consumer education and benefit awareness campaigns, targeting both segments, distributors and retailers, with a focus on rural populations</li> </ul>	<ul style="list-style-type: none"> <li>Overcome negative perceptions and strengthen trust established over the years</li> <li>Influence purchase decisions, with a focus on rural areas and ease access to distribution channels</li> </ul>
Inventory financing facility	<ul style="list-style-type: none"> <li>Concessionary credit line so financial institutions can access liquidity for solar market lending; create frameworks that avail loans to solar companies (small household systems, larger PV installations, and mini-grids), pilot with aim of scaling out</li> </ul>	<ul style="list-style-type: none"> <li>Long inventory financing periods present a key challenge to growth for solar lantern and solar home system distributors</li> <li>High upfront financing requirements present a key challenge to distributors of larger PV systems (including pumps)</li> </ul>
Credit guarantee scheme for inventory financing	<ul style="list-style-type: none"> <li>Private sector lending portfolio is de-risked through guarantees and effect loss sharing agreements to cover irrecoverable inventory loans</li> </ul>	<ul style="list-style-type: none"> <li>De-risking encourages private sector lending to solar sector</li> <li>Initial security until the proof case of economic viability of lending to solar businesses has been established</li> </ul>
Market entry and expansion grants	<ul style="list-style-type: none"> <li>Combination of upfront grants and results-based financing to invest in infrastructure and working capital</li> </ul>	<ul style="list-style-type: none"> <li>Significant upfront investment to build distribution network and source inventories to serve household market</li> </ul>
Technical assistance	<ul style="list-style-type: none"> <li>Help solar companies set up technology platforms for PAYG</li> <li>Incubation and acceleration of early-stage businesses</li> <li>Capacity building for solar technicians to enable installation and O&amp;M of equipment</li> <li>Assess rural communities needs to inform the right business model case by case</li> <li>Capacity building for suppliers in rural areas</li> </ul>	<ul style="list-style-type: none"> <li>Make the business environment more conducive and profitable</li> <li>Strengthen the overall ecosystem surrounding the solar market</li> <li>Strengthen capacity across the sector</li> <li>Ensure knowledge transfer from abroad for faster, more cost-efficient progress</li> </ul>

Source: Focus Group Discussions and Stakeholder interviews; African Solar Designs analysis

<sup>179</sup> Capacity building interventions are proposed for all ROGEP countries at national and regional level under ROGEP Component 1B: Entrepreneurship support, which includes TA and financing for companies in the solar product value chain. Through this component, TA to solar companies can build on existing ECREEE training programs as well as through a new regional business plan competition. Technical assistance can leverage national solar ecosystem stakeholders, and operational national service providers identified and mobilized through this component. The market entry and expansion grants suggested here would also align with Component 1B planned financing interventions for matching grants, repayable grants, co-investment grants, and be connected to the technical assistance interventions.

## 2.5 Key Market Characteristics

This section reviews the main characteristics of the off-grid solar market in Burkina Faso, including a summary of key barriers to and drivers of market growth and an overview of gender considerations. The synopsis presented below is largely based on feedback obtained from interviews with local officials and industry stakeholders, as well as focus group discussions and surveys assessing the demand and supply side of the market (see **Annex 2**).

### 2.5.1 Barriers to Off-Grid Solar Market Growth

**Table 46** examines the key barriers to OGS market growth from the perspective of both the demand and supply side of the market. See **Section 1.3.5** for an overview of the gaps in the country’s off-grid policy and regulatory framework.

Table 46: Key Barriers to Off-Grid Solar Market Growth in Burkina Faso

Market Barrier	Description
<b>Demand<sup>180</sup></b>	
Consumers are unable to afford solar systems	<ul style="list-style-type: none"> <li>Low-income consumers, particularly in rural areas, lack of access to finance</li> <li>Purchasing solar products of all varieties among end-consumers remains relatively low.</li> </ul>
Lack of initial funding by HHs, businesses and institutions for the initial capital investment	<ul style="list-style-type: none"> <li>Consumers rather choose cheaper one-off solutions – like generators and fuel – rather than more expensive up-front solutions that will be cheaper long-term (especially with incremental payments, e.g. PAYG)</li> </ul>
A lack of understanding of and trust in solar solutions among consumers impedes development of the market	<ul style="list-style-type: none"> <li>There is still considerable lack of general awareness about solar solutions</li> <li>There is an inability to distinguish between solar products or product quality</li> <li>Consumers lack information about the most suitable design options, funding options, PAYG benefits and options, points of sales and support, etc.</li> <li>Products are still not widely available in rural areas, so consumers are unfamiliar with them</li> <li>Any poor history / track record with OGS will deter consumers from taking expensive risks</li> </ul>
Informal sector competition and market spoilage	<ul style="list-style-type: none"> <li>The non-standard / unlicensed market still accounts for a majority of OGS product sales</li> <li>Consumers need to understand the quality and value issues of quality solar products vis-a-vis inferior over-the-counter lighting products and generators. Educated consumers drive markets.</li> </ul>
Lack of experience in maintaining the systems and sourcing qualified technicians	<ul style="list-style-type: none"> <li>A sustainable approach to O&amp;M is critical for long-term success</li> </ul>
<b>Supply</b>	
Technical capacity	<ul style="list-style-type: none"> <li>Technical skills lack through the supply chain within the sector, affecting both the upstream, midstream and downstream, thus adversely affecting the ability of the sector to pick up and grow. Majority of the firms decry lack of adequate number of technicians to support the downstream side of the market</li> </ul>
Transportation costs	<ul style="list-style-type: none"> <li>High transportation costs of inventory deter new entrants; devices and equipment are shipped either from China or from Europe, creating long delivery lead times of up to three months and long inventory holding times once products have arrived in country</li> <li>Typical supplier payment terms are 30% upon placement of the production order and the remaining 70% upon shipment before any cargo has even left its port of origin.</li> <li>Transport by container would reduce the costs dramatically; however, this requires purchases in bulk, which local solar distributors aren't able to make without financing</li> </ul>

<sup>180</sup> The barriers described here apply to some combination of the Household, Institutional, and SME / Productive Use market segments

Poor sales and performance history of the sector	<ul style="list-style-type: none"> <li>A lack of investment into the sector prevents growth; this is due to perceived high risks resulting primarily from lack of track record of sales</li> <li>Solar distributors have limited alternative financing options. Solar suppliers are unwilling to provide trade financing while commercial financiers in Burkina Faso, including banks and MFIs, are currently not positioned to service the financing requirements of solar distributors.</li> </ul>
Company finance	<ul style="list-style-type: none"> <li>Entrants into the sector require significant working capital, which is not readily available</li> <li>Equity investments are needed into the local distribution/sales companies. It is quite easy to obtain debt financing and other loans once the solar companies have sufficiently grown and reached the “level of interest” of the larger funds; however, until the number of customers and sales volumes are reached, they need some equity investors to share higher risks with the original founders of the companies</li> </ul>
Informal sector competition and market spoilage	<ul style="list-style-type: none"> <li>Several informal entrepreneurs have taken advantage of high import duties by illegally importing low-quality solar products ranging from solar lanterns to larger home installations</li> <li>Black-market traders are able to significantly undercut the prices of registered businesses who are still subject to high taxes and import duties</li> <li>These products are largely low-grade, failure-prone counterfeits with short lifespans</li> <li>Damaged perceptions of solar systems durability and reliability hinders market uptake</li> </ul>
Lack of data	<ul style="list-style-type: none"> <li>No clear figures on the actual needs, actual usage or experience of consumers</li> <li>The data for the private market players on the available opportunities is very limited and not concise due to fragmented data</li> </ul>
High ‘transaction costs’ for solar installations	<ul style="list-style-type: none"> <li>Cash-flow and bureaucratic hurdles for the local suppliers</li> <li>Sales and O&amp;M services in remote areas can be costly, especially for small businesses</li> </ul>

Source: Focus Group Discussions; Stakeholder interviews; African Solar Designs analysis

### 2.5.2 Drivers of Off-Grid Solar Market Growth

Table 47 is a summary of the key drivers of OGS market growth in the country.

Table 47: Key Drivers of Off-Grid Solar Market Growth in Burkina Faso

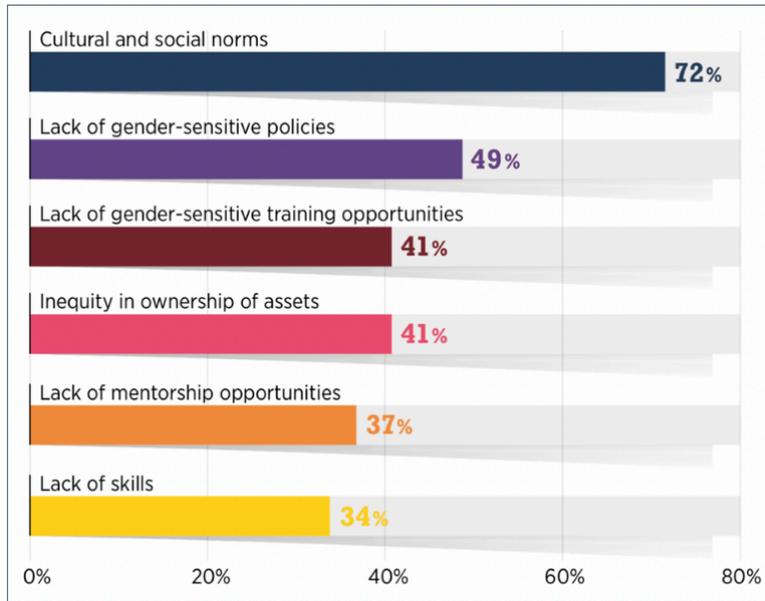
Market Driver	Description
Strong off-grid electricity demand	<ul style="list-style-type: none"> <li>Consumers from every market segment are aware of the high costs associated with energy access and consumption and are willing to take on quality, cost-effective alternatives</li> </ul>
Willing government to support the industry	<ul style="list-style-type: none"> <li>The Government is viewed by sector players as forward-leaning and action-oriented, creating and supporting momentum and positive attention for the solar sector, which helps attract substantial and sustained investment to the market</li> </ul>
Increased utilization of PAYG	<ul style="list-style-type: none"> <li>While Burkina Faso’s OGS market is only starting to utilize PAYG financing solutions, this model has the ability to grow rapidly by leveraging increasing rates of mobile phone ownership and mobile internet usage in rural areas</li> </ul>
Engaged and open-minded private sector	<ul style="list-style-type: none"> <li>Local OGS suppliers are actively engaged in efforts to improve / reform the sector, accept new business models and strategies and take measures to attract external investment</li> </ul>
Strong donor/NGO presence	<ul style="list-style-type: none"> <li>The presence and wide range of donor-funded activities in the country’s off-grid sector provides confidence that the market will continue to receive financial and policy support to develop</li> </ul>

Source: Focus Group Discussions; Stakeholder interviews; African Solar Designs analysis

2.5.3 Inclusive Participation<sup>181</sup>

Given that the off-grid market is only beginning to emerge in Burkina Faso, women are not yet highly engaged in the sector. The overall lack of inclusive participation in the off-grid space is attributable to a wide range of factors. In a 2018 survey that assessed barriers to women’s participation in expanding energy access, nearly three-quarters of respondents cited cultural and social norms as the most common barrier, which reflects the need for gender mainstreaming (**Figure 41**). More than half of the women surveyed in Africa identified a lack of skills and training as the most critical barrier, compared to just one-third of respondents globally.<sup>182</sup>

Figure 41: Key Barriers to Women’s Participation in Expanding Energy Access



Source: International Renewable Energy Agency

As a starting point, electrification (whether grid-connected or off-grid) increases access to information, which can help challenge gender norms and increase the autonomy of women.<sup>183</sup> Access to electricity can save women time and/or enable them to complete domestic activities in the evening, thus allowing them to participate in paid work during the day. Many opportunities also exist for women in the productive use of energy, including solar-powered machinery that can support productive applications, particularly in the agricultural sector in the areas of irrigation, water pumping, and milling/food processing.<sup>184</sup>

Women, who are often the primary energy users in households, have a strong influence on the energy value chain. Women can take on different roles, including as engaged end-users, community mobilizers,

<sup>181</sup> See **Annex 4** for more details

<sup>182</sup> “Renewable Energy: A Gender Perspective,” International Renewable Energy Agency, (2019): [https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA\\_Gender\\_perspective\\_2019.pdf](https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA_Gender_perspective_2019.pdf)

<sup>183</sup> “Productive Use of Energy in African Micro-Grids: Technical and Business Considerations,” USAID-NREL and Energy 4 Impact, (August 2018): [https://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/productive\\_use\\_of\\_energy\\_in\\_african\\_micro-grids.pdf](https://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/productive_use_of_energy_in_african_micro-grids.pdf)

<sup>184</sup> “Turning promises into action: Gender equality in the 2030 Agenda for Sustainable Development,” UN Women, (2018): <http://www.unwomen.org/-/media/headquarters/attachments/sections/library/publications/2018/sdg-report-fact-sheet-sub-saharan-africa-en.pdf?la=en&vs=3558>

technicians, and part time and full-time employees and entrepreneurs.<sup>185</sup> Women also have unique social networks that typically offer greater access to rural households, which can be important to deploying energy access solutions.

Despite these opportunities, women are typically not part of key decision-making processes at nearly all levels of society. Women tend to have limited access to land and capital, as these are often determined by traditional and religious customs that remain deeply rooted in patriarchal traditions. Women also have more difficulty accessing finance due in part to lack of collateral required to guarantee payment and often resort to obtaining loans from money lenders who charge exorbitant interest rates.<sup>186</sup>

The gender analysis undertaken in Burkina Faso corroborated many of these trends, and revealed several interrelated challenges that women face in the off-grid sector:

- Women lack access to skills, technical capacity, and education/training
- Women broadly lack access to capital, asset ownership, collateral and credit (e.g. to start a business)<sup>187</sup>
- Extensive household responsibilities reduce their ability to generate income and service credit
- Financial literacy among women remains low and there is a lack of education and information available to women on access to financial resources

The gender assessment found that there are generally very few women-led businesses and female professionals in senior-level positions in the energy sector. A number of initiatives exist that seek to address some of these challenges and improve the rate of participation among women in energy and off-grid market development. For example, NGOs such as the Women Environmental Programme are working to promote gender equality.<sup>188</sup>

In 2018, ECREEE partnered with AfDB to launch a regional workshop to advance the participation of women in the renewable energy sector. The program intends to address the lack of inclusion of women in the energy value chain – only 2% of energy sector entrepreneurs in West Africa today are women. The joint initiative ultimately seeks to develop a pipeline of investment-ready, women-owned energy businesses across the region, including in Burkina Faso.<sup>189</sup>

<sup>185</sup> “Renewable Energy: A Gender Perspective,” International Renewable Energy Agency, (2019): [https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA\\_Gender\\_perspective\\_2019.pdf](https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA_Gender_perspective_2019.pdf)

<sup>186</sup> See **Section 3.2** for more details.

<sup>187</sup> This is a huge challenge for women in the country, particularly in rural areas, where the population depends on seasonal income from the agricultural sector for their livelihood, which makes loans inaccessible or only available at extremely high interest rates. This issue is examined in further detail in **Section 3.2**.

<sup>188</sup> “WEP Burkina Faso,” Women Environmental Programme: <http://wepnigeria.net/index.php/wep-burkina-faso/>

<sup>189</sup> “Feasibility study promotes women’s participation in energy transition,” ESI Africa, (7 May 2018): <https://www.esi-africa.com/feasibility-study-promotes-womens-participation-in-energy-transition/>

### III. ANALYSIS OF THE ROLE OF FINANCIAL INSTITUTIONS

This section begins with an introduction to financial products for the off-grid sector, including for end-users and stand-alone solar companies (**Section 3.1**). This is followed by a comprehensive overview of the country's financial market and commercial lending environment (**Section 3.2**), including an assessment of financial inclusion and a summary any off-grid solar lending activity/programs. **Section 3.3** examines other financial institutions (in addition to commercial banks) that are active in the country. **Section 3.4** presents a summary of key findings from the Task 3 analysis. The data presented in this section was obtained through desk research as well as interviews with/surveys of key officials and representatives from local financial institutions. **Annex 3** provides an overview of the Task 3 methodology.

#### 3.1 Introduction to Financial Products for the Off-Grid Sector

A wide range of financial products can be utilized to support development of the stand-alone solar sector in West Africa and the Sahel. These may include instruments such as matching grants, contingent loans, results-based financing (grants reimbursing cost after completion of work), equity investment (seed capital and later stages), concessional debt (subsidized interest or forgiveness of a portion of principal repayment), short-term commercial credits for inventory purchases and working capital, trade finance solutions (from export credit agencies or private trade funders) and medium-term loans secured on assets or receivables from a portfolio of installed projects. This “financial supply chain” consists of capital delivered at different stages of stand-alone solar enterprise development, by financial sector players that have risk appetites well matched to each specific stage. This section focuses on the roles of commercial financial institutions (FIs) and microfinance institutions (MFIs) in providing debt financing to off-grid solar consumers and enterprises.

##### 3.1.1 Financial Products for End-Users

In order to determine what kinds of debt instruments are available to support stand-alone solar purchases for end-users, it is important to identify the different end-users.

##### ➤ **Households**

Households represent the majority of end-users in the West Africa and Sahel region and the level of cash flow this market segment has available for energy access depends heavily upon the formal and/or informal economic activity they are engaged in. In general, the ability for households to pay from their own internal resources declines as their distance from urban centers increases and their opportunity to participate in the formal economy with regular cash income declines. Meanwhile, external funding is typically not available for rural households as they remain largely off of the radar of mainstream FIs (with the exception of households where members have regular sources of income from urban centers). MFIs in fact are generally more appropriate sources of household finance. Most of a given country's households can access external funding typically only through microfinance or informal financial services such as local money lenders, cooperative societies and rotating savings and credit associations.

##### ➤ **Public Institutions**

The main public institutional facilities that require funding for off-grid electrification are directly linked to national, provincial or local administrations and budgets, including schools, health facilities, and other public buildings/lighting systems. Sustainable energy finance for community facilities is typically provided through a ministry, department or agency if the facility falls under the purview of the national or provincial

budget. The challenge is that budget resources are severely limited and constantly face competing priorities; as a result, many public community facilities are left without access to energy.

In order to implement financial products targeting public institutional projects, a few critical questions need to be answered, such as who would be the borrower and whether there are sufficient financial resources available in the budget to pay for the service over a long period of time. This question is also important if these public community facilities end up being included alongside households as part of a local mini-grid.

➤ **Productive Use**

Financial instruments for SMEs as end-users of sustainable energy represent a very important category of products in that they tend to be commercially viable and are thus important for the long-term sustainability of energy systems. While households and community facilities use energy primarily for consumption, often resulting in other sources of income or budget being allocated to cover the cost of service, SMEs use energy for income-generating activities and can therefore cover electricity costs through the income generated by their business. An enterprise with positive cash flows gives financiers more comfort as well as an opportunity to design financial instruments that are commercial in nature. A loan product with parameters that match the company's ability to service the debt would be a strong and commercially viable option. MFIs often provide short-term loans to micro enterprises on this basis while FIs often limit their lending to SMEs with strong balance sheets and available collateral.

➤ **Commercial and Industrial**

Commercial and industrial (C&I) facilities such as industrial plants, mining operations, shopping malls, logistics and distribution centers or commercial office buildings generally have considerable power consumption requiring energy supply from much larger solar systems that can range from several hundred kW to several MW in capacity. Where there is particularly high cost advantage for stand-alone solar systems over existing energy supply (i.e. vs. diesel generators), some C&I facility owners may find the payback of these investments so attractive that they will seek to purchase the solar power plant outright, often requiring debt financing to complete the transaction. This entails a corporate loan backed by the full faith and credit of the company, a pledge on the installed assets and usually supplemented by additional collateral and personal guarantees posted by the C&I facility owners. Many commercial FIs will offer credits to their existing C&I customers for this purpose but the C&I facility loan applicants are often unable or unwilling to post the required collateral for this specific purpose as their assets may already be encumbered for other business needs.

3.1.2 Financial Products for Suppliers/Service Providers

The stand-alone solar sector remains nascent in most markets across West Africa and the Sahel. The companies offering standalone solar products and energy services are therefore often at start-up or early development stage. Overall by number of players, small indigenous entrepreneurs are well in the majority; however, a few international companies dominate the overall market share. Most equipment is imported with purchases denominated in hard currency, while sales to consumers – whether on a direct purchase, lease-to-own (LTO) or pay-as-you-go (PAYG) basis – are almost always in local currency. At start-up or early stages of operation, local entrepreneurs, although in need of funding, are usually not ready to take on debt financing and should rely more on seed capital investment and grants until they are able to generate an initial book of business. Once orders begin to materialize, these enterprises have growing funding needs suitable for debt financing instruments which may include the following:

➤ **Working Capital**

All entrepreneurs need working capital to fuel their business growth and cover basic overheads for operations, marketing and sales. Throughout West Africa and the Sahel, there is a dearth of working capital financing for businesses in all sectors, and the situation is no different for stand-alone solar companies. When available, working capital loans have very short tenors of 3-12 months, must be secured on confirmable cash flows, have difficult-to-meet collateral requirements and carry high interest rates. Since their costs and income are in local currency, local entrepreneurs are best served by working capital loans also denominated in local currency. However, due to high cost of local currency debt, many companies will see advantages in borrowing at much lower interest rates in hard currency as the perceived risk of currency fluctuations across such short tenors is relatively low. Some international companies operating in the West African off-grid solar sector may prefer hard currency financing at the offshore holding company level, depending on how they have structured their local subsidiaries or affiliates in the region.

➤ **Inventory and Trade Finance**

To fulfill orders, solar system providers need inventory on hand. Equipment suppliers to the off-grid sector in West Africa and the Sahel are usually unwilling or unable to offer generous terms, often requiring down payments with balance due in full at cash-on-delivery (COD). Therefore, these businesses are in dire need of short-term loans of up to 12 months duration to finance inventory purchases. Yet, such loans are hard to come by for developing off-grid enterprises. Since equipment purchase arrangements are usually denominated in hard currency, loans also in hard currency over such short tenors are often acceptable. Trade finance from export credit agencies (ECAs) and private trade funders may also provide good solutions, but these lenders are often unwilling to finance orders under a few million USD or EUR in value.

➤ **Asset-Based or Receivables Financing**

Once stand-alone solar system providers achieve a portfolio of operating PAYG or LTO installations, the system assets and revenues from customer payments can be used to leverage debt financing to fund business activities and expansion. Typically, a Special Purpose Vehicle (SPV) is established to house the asset portfolio, which is sold by the solar provider to lenders. This form of financing has been widely deployed in East Africa and is also increasingly available in West Africa through a variety of regionally focused specialized debt funds that are focused on portfolio financings in the range of USD 1-10 million.<sup>190</sup>

➤ **Crowd Funding**

Crowd funding platforms have played an important role in offering working capital, inventory financing and smaller increment asset or receivables-backed loans to off-grid entrepreneurs. Loans of two-five years have been provided to both locally-owned and international solar enterprises with a good number of financings in the USD 150-500K range occurring in Nigeria, Ghana and Côte d’Ivoire.<sup>191</sup>

<sup>190</sup> A total of 11 such specialized debt funds were identified, including those managed by: Sunfunder, responsAbility, Lendable, Sima Funds, Solar Frontier, Neot, Deutsche Bank, Triple Jump, Crossboundary, Lion’s Head, Shell and Solar Connect. Only a handful of these have vehicles that are fully funded and deploying capital but as of mid-2018 they reported expectations for financial closings that would make roughly USD 1.5 billion in off-grid focused debt available across Sub Saharan Africa by mid-2019.

<sup>191</sup> The most active crowd funding platforms in the off-grid space have been Kiva, TRINE, Lendahand and Bettervest with the latter two most focused on West Africa.

## 3.2 Financial Market Overview

### 3.2.1 Market Structure

As a member of the West African Economic and Monetary Union (WAEMU, or Union Économique et Monétaire Ouest Africaine, UEMOA), Burkina Faso shares a currency with seven other countries in the economic community, the West African CFA Franc, which is pegged to the euro. FIs in Burkina Faso are regulated by the Central Bank of West African States (Banque Centrale des États de l'Afrique de l'Ouest, BCEAO) and supervised by the WAEMU Banking Commission. Within this macroeconomic environment, Burkina Faso has experienced relatively low rates of inflation and low interest rates, especially compared to non-WAEMU countries. Between 2009 and 2014, the average inflation rate for WAMEU countries was approximately 1%, while the average inter-bank interest rate during the same period was about 4%.<sup>192</sup>

The country's financial market is dominated by the banking sector, which accounts for 84% of total assets and includes 14 commercial banks (**Table 48**). The banking sector is predominantly private, although the state is also present (directly and indirectly) in the capital structure of most banks. The sector is highly concentrated, with five banks controlling three-quarters of total assets (**Table 49**).<sup>193</sup>

The commercial banking sector is dominated by subsidiaries of foreign groups, including Société Générale - Burkina Faso, the International Bank for Trade and Industry (BICIAB) – a subsidiary of BNP Paribas – and Moroccan banks, including the Bank of Africa - Burkina Faso (BOA Burkina), Atlantique Banque of Burkina Faso (BABF) and the Banking Company of West Africa (Compagnie Bancaire de l'Afrique de l'Ouest, CBAO-Burkina). Pan-African groups are represented by Ecobank, Orabank, the Sahelo-Saharan Bank for Investment and Trade (BSIC-Burkina Faso), and the “Banque de Union” (BDU-Burkina). Local investors control Coris Bank International (CBI), Banque Commerciale Du Burkina (BCB) and Banque de l'Habitat du Burkina Faso (BHBF).<sup>194</sup>

The microfinance sector plays a critical role in the overall financial system, as it provides a source of financing to the country's rural population as well as to individuals and businesses that are unable to obtain funding from commercial banks. The sector includes 27 licensed MFIs<sup>195</sup> and is largely comprised of a network of credit unions – Burkina Faso Credit Unions (Burkina Faso Caisses Populaires, RCPB) – that have about 2 million customers.

<sup>192</sup> “The Landscape for Impact Investing in West Africa: Understanding the current trends, opportunities and challenges,” Dalberg and Global Impact Investing Initiative, (December 2015):

[https://thegiin.org/assets/upload/West%20Africa/RegionalOverview\\_westafrica.pdf](https://thegiin.org/assets/upload/West%20Africa/RegionalOverview_westafrica.pdf)

<sup>193</sup> Coris Banque International, Ecobank, BOA Burkina Faso, Société General Burkina Faso, and Atlantic Bank Burkina Faso

<sup>194</sup> “Burkina Faso: Dynamic Banking Sector,” Emouaten, (April 10, 2018): [https://www.emouaten.com/Burkina-Faso%C2%A0-Secteur-bancaire-dynamique-%C2%A0\\_a118614.html](https://www.emouaten.com/Burkina-Faso%C2%A0-Secteur-bancaire-dynamique-%C2%A0_a118614.html)

<sup>195</sup> BCEAO also categorizes MFIs as “Decentralized Financial Systems” <https://www.bceao.int/en/content/decentralized-financial-systems>

Table 48: Licensed Financial Institutions, 2017<sup>196</sup>

License Type	Number of FIs
Foreign Exchange Offices	6
Commercial Banks	14
Other financial institutions	4
Development finance institutions	2
Electronic money institutions	2
Business banks	1
Micro-credits banks	133

Source: BCEAO

Table 49: Market Shares of the Largest Banks

Commercial Banks	Total Assets	Deposits	Credits
Five largest banks	73 %	72 %	76 %
Largest bank	21.8 %	18.8 %	21.1 %
Second largest bank	17.2 %	16.7 %	14.7 %

Source: BCEAO

As of 2017, Burkinabe FIs accounted for the third largest share (14.7%) of the WAEMU market, behind only Côte d'Ivoire and Senegal (Table 50).<sup>197</sup>

Table 50: Market Share of Financial Institutions in WAEMU, 2017

Country	Number of Commercial Banks	Number of Non-Bank Financial Institutions	Total Balance Sheet (CFA million)	Market Share (%)
Benin	15	0	3,486,329	9.8%
<b>Burkina Faso</b>	14	4	5,198,407	14.7%
Côte D'Ivoire	28	2	11,095,578	31.2%
Guinea-Bissau	5	0	245,921	0.7%
Mali	13	3	4,501,702	12.7%
Niger	12	1	1,572,520	4.4%
Senegal	25	4	6,788,590	19.1%

Source: UEMOA

### ➤ Banking Sector Financial Soundness Indicators

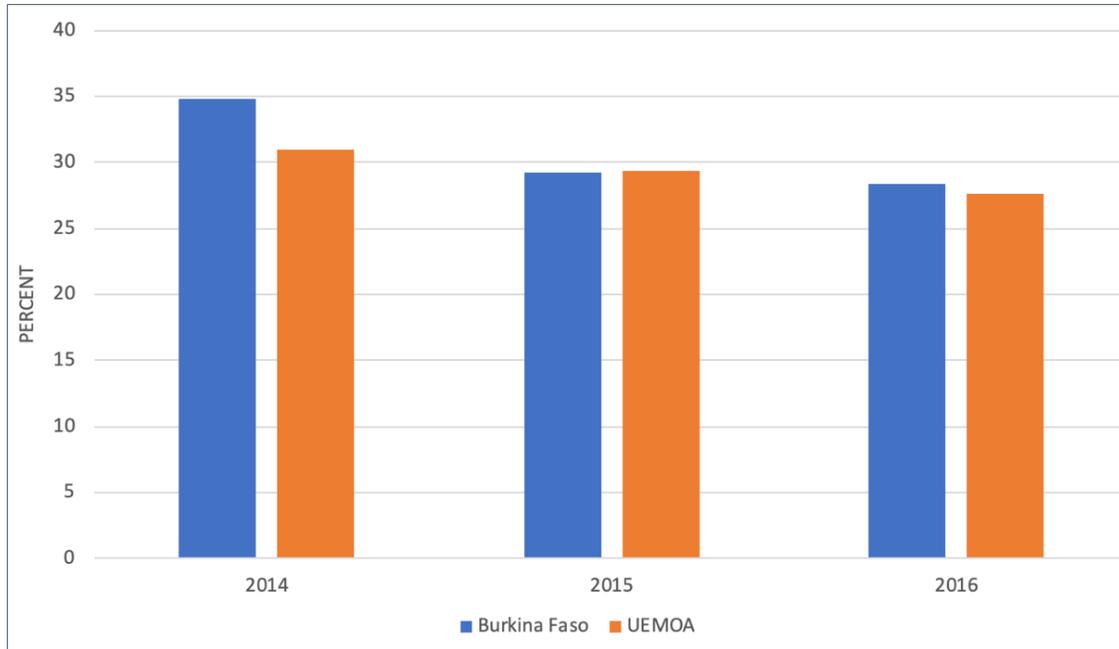
**Asset-Based Indicators:** Robust economic growth led to an increase in the quantity of assets as well as the quality of assets between 2015 and 2017. Assets grew by about 27% during this period, largely due to a corresponding increase in the quantity of loans, which increased by 18.1% between 2016 and 2017. The quality of assets also improved and was accompanied by a decrease in outstanding receivables and a significant decrease in provisions. The ratio of NPLs among commercial banks in Burkina Faso has consistently been among the lowest in the WAEMU region; in 2017, the share of non-performing loans to

<sup>196</sup> "Rapport Annuel de la Commission Bancaire de l'UMOA – 2017," BCEAO, (2018): [https://www.bceao.int/sites/default/files/2019-01/Rapport\\_Annuel\\_CB\\_2017.pdf](https://www.bceao.int/sites/default/files/2019-01/Rapport_Annuel_CB_2017.pdf)

<sup>197</sup> "Rapport annuel de la Commission Bancaire de l'UMOA – 2017," Commission Bancaire - Union Monétaire Ouest Africaine, (2017): [https://www.bceao.int/sites/default/files/2019-01/Rapport\\_Annuel\\_CB\\_2017.pdf](https://www.bceao.int/sites/default/files/2019-01/Rapport_Annuel_CB_2017.pdf)

total loans was 8.8%.<sup>198</sup> The banking sector has also consistently performed well in measures of liquidity vis-à-vis the regional average (Figure 42).

Figure 42: Banking Sector Liquidity Ratios



Source: BCEAO

**Capital-Based Indicators:** Credit institutions are required to hold, at any time, core capital equal to at least the legal minimum capital of CFA 10 billion (USD 17 million) for banks and CFA 3 billion (USD 5 million) for assimilated financial institutions (i.e. leasing companies). The risk coverage ratio of credit institutions in Burkina Faso was 12.2% as of December 2017 – slightly above the WAEMU average, and well above the regulatory minimum of 8%. Capital adequacy ratios (CAR) and NPLs to Total Loans in Burkina Faso, as well as corresponding averages across WAEMU and ECOWAS, are presented in Table 51 and Table 52, respectively.<sup>199</sup>

Table 51: Banking Sector Capital Adequacy Ratios

Indicator	2012	2013	2014	2015	2016
Burkina Faso	11.1%	9.6%	9.8%	10.4%	10.8%
WAEMU	13.4%	12.6%	12.3%	10.5%	11.6%
ECOWAS	17.1%	16.8%	16.5%	15.8%	16.2%

Source: West African Monetary Agency

<sup>198</sup> “Burkina Faso: Country Report No. 19/15,” International Monetary Fund, (January 2019): <https://www.imf.org/en/Publications/CR/Issues/2019/01/22/Burkina-Faso-2018-Article-IV-Consultation-First-Review-Under-the-Extended-Credit-Facility-46533>

<sup>199</sup> “Financial Sector Developments and Stability in ECOWAS, 2016 Report,” West African Monetary Agency, (2017): <https://amao-wama.org/wp-content/uploads/2017/11/Financial-Stability-2016-Report.pdf>

Table 52: Non-Performing Loans to Total Loans

Indicator	2012	2013	2014	2015	2016
Burkina Faso	10.3%	9.9%	8.6%	8.9%	9%
WAEMU	16.8%	17.6%	19.1%	14.5%	15.4%
ECOWAS	15.3%	15.8%	16.6%	14.8%	15.1%

Source: West African Monetary Agency

As of June 2017, slightly more than half of banks in Burkina Faso were compliant with BCEAO guidelines. For MFIs, the average capitalization ratio stood at 20%, 5% higher than the WAEMU average and regulatory minimum of 15%.<sup>200</sup>

**Income and Performance-Based Indicators:** The banking sector’s profitability indicators remained relatively consistent between 2015 and 2017 (Table 53).

Table 53: Banking Sector Profitability Indicators

Indicator	2015	2016	2017
Profitability of Assets	1.3%	1.4%	1.4%
Interest-free fees on Gross Income	79.7%	61.3%	63.6%
Staff costs at non-interest expense	42%	42.1%	42.5%

Source: BCEAO

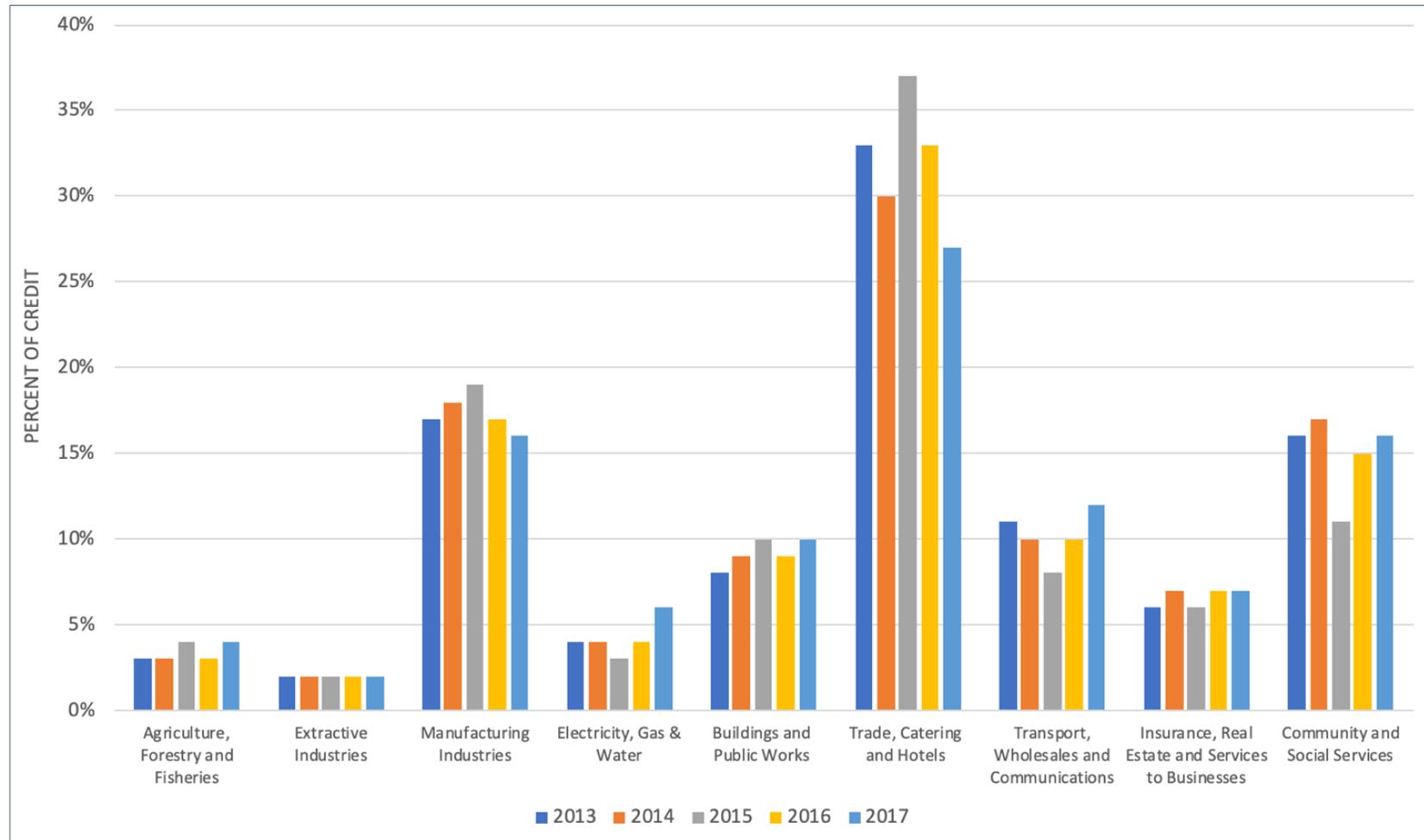
➤ **Distribution of Credit by Sector**

Like other WAEMU member countries, the economy in Burkina Faso is generally underfunded, while most banks are overly-liquid. Commercial banks are often unable to meet customer needs for loans. In 2017, loans to customers amounted to CFA 1.8 trillion (USD 3 billion). Between 2013 and 2017, the largest share of credit has gone to the tertiary sector (Figure 43). According to the WAMU Banking Commission, between 2010 and 2015, around 50% of bank loans went to businesses, restaurants and hotels compared to around 5% for the agricultural sector, which employs three-quarters of Burkinabe and is a key driver of the country’s economy.<sup>201</sup>

<sup>200</sup> BCEAO, 2018

<sup>201</sup> Ibid.

Figure 43: Distribution of Credit by Sector



Source: BCEAO

### 3.2.2 Financial Inclusion

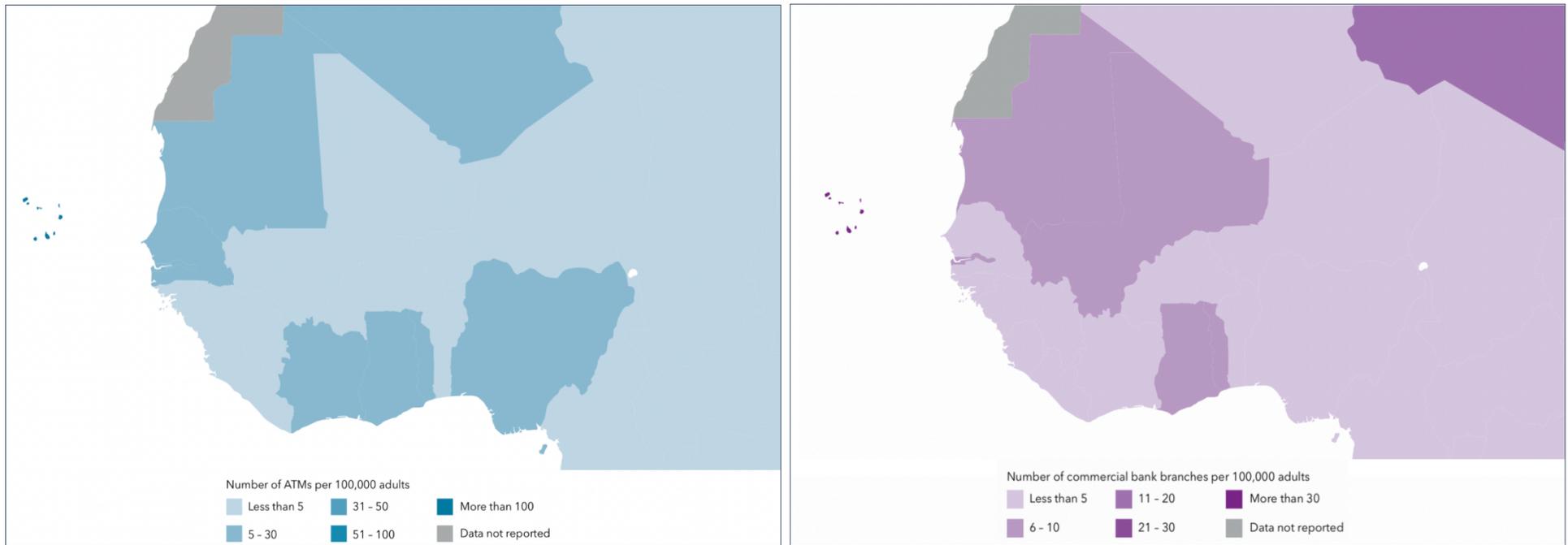
#### ➤ Access to Financial Services

Access to financial services represents an ongoing challenge in West Africa and the Sahel. Overall, about three-quarters of the region’s population remains financially excluded, lacking access to banking and financial services through formal institutions (**Figure 44**).<sup>202</sup> There are, however, notable signs of progress. Between 2011 and 2017, the share of the population covered by formal financial institutions increased by nearly 10%.<sup>203</sup> Many countries across the region, including Burkina Faso, have also seen a sharp increase in mobile money account ownership (**Figure 45**) and transaction volume (**Figure 46**).

<sup>202</sup> “Le secteur bancaire en Afrique De l’inclusion financière à la stabilité financière,” European Investment Bank, (October 2018): [https://www.eib.org/attachments/efs/economic\\_report\\_banking\\_africa\\_2018\\_fr.pdf](https://www.eib.org/attachments/efs/economic_report_banking_africa_2018_fr.pdf)

<sup>203</sup> Demircuc-Kunt, A., Klapper, L., Singer, D., Ansar, S., and Hess, J., “The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution,” World Bank, (2017): <http://documents.worldbank.org/curated/en/332881525873182837/pdf/126033-PUB-PUBLIC-pubdate-4-19-2018.pdf>

Figure 44: ATMs and Branches of Commercial Banks per 100,000 Adults in West Africa and the Sahel, 2017<sup>204</sup>

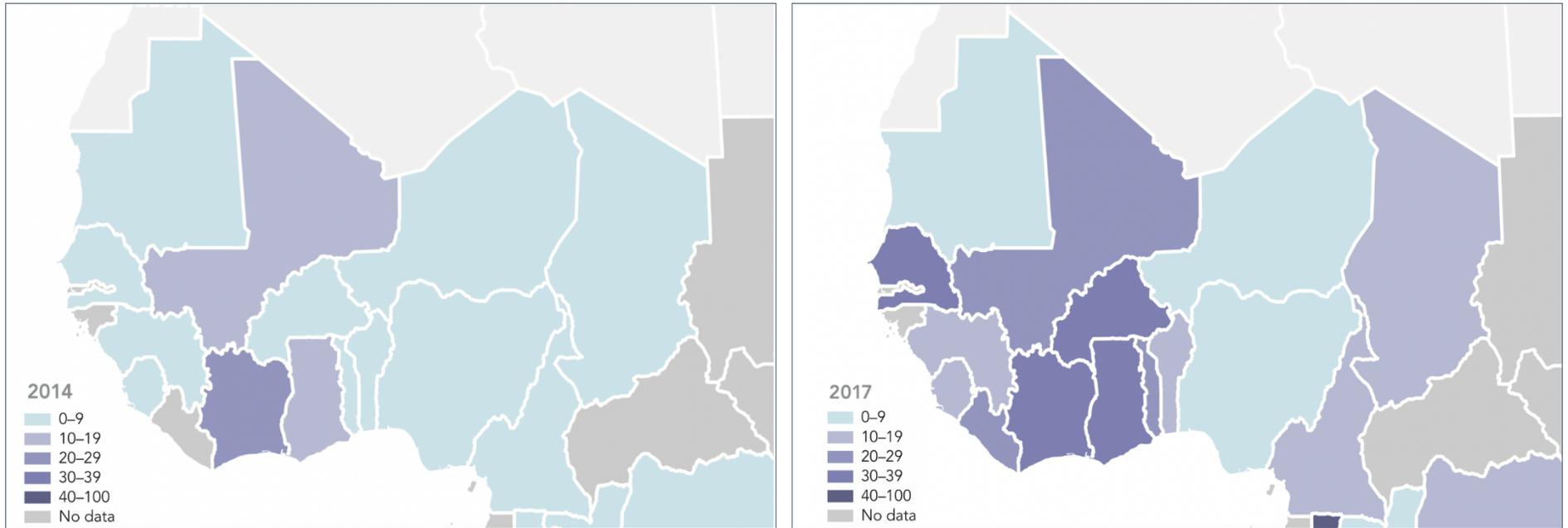


Source: International Monetary Fund

**Figure 44** shows the number of ATMs (left) and commercial bank branches (right) per 100,000 adults across West Africa and the Sahel. The shade of the country corresponds to the magnitude of the indicator; the darker the shade, the higher the value. As of 2017, Côte d’Ivoire, Ghana, Mauritania, Nigeria, Senegal and Togo had a relatively higher number of ATMs per 100,000 adults compared to the rest of the region, while The Gambia, Ghana, Mali, Mauritania and Togo had a relatively higher number of commercial bank branches per 100,000 adults. Cabo Verde ranked above all countries in the region on both indicators.

<sup>204</sup> International Monetary Fund – Financial Access Survey: <http://data.imf.org/?sk=E5DCAB7E-A5CA-4892-A6EA-598B5463A34C&slid=1460054136937>

Figure 45: Share of Adults with a Mobile Money Account in West Africa and the Sahel (%), 2014 and 2017<sup>205</sup>

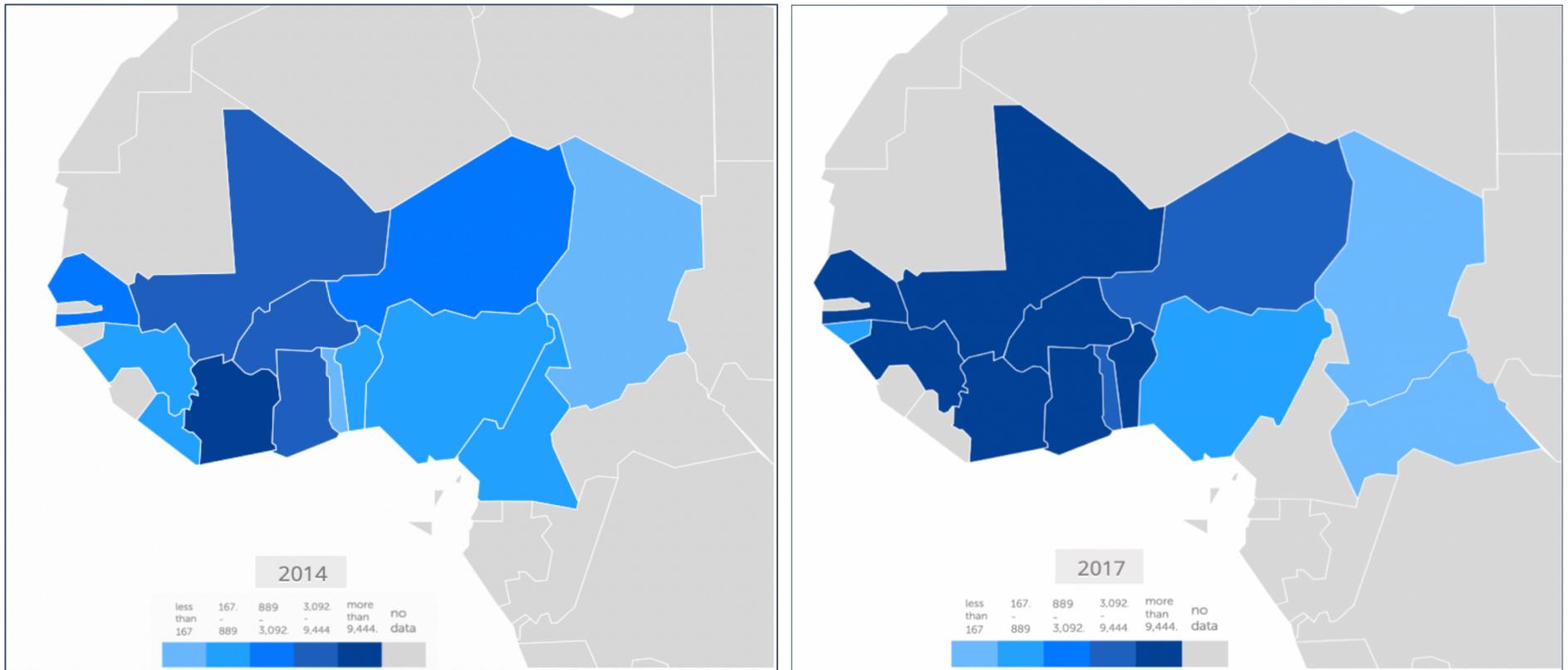


Source: World Bank Global Findex Database

**Figure 45** shows the increase in the share of adults (%) owning a mobile money account across West Africa and the Sahel between 2014 and 2017. The shade of the country corresponds to the magnitude of the indicator; the darker the shade, the higher the value. As of 2017, the share of adults owning a mobile money account is about 33% in **Burkina Faso**, Côte d'Ivoire, and Senegal, and 39% in Ghana. Between 2014 and 2017, mobile money account ownership also increased significantly in Benin, Cameroon, Chad, Guinea, Mali, Sierra Leone and Togo, while growth in account ownership was slower in Niger, Nigeria and Mauritania. There was either no data or insufficient data available to assess account ownership in Cabo Verde, Central African Republic, The Gambia, Guinea-Bissau, and Liberia.

<sup>205</sup> Demircuc-Kunt et al., 2017.

Figure 46: Mobile Money Transactions per 1,000 Adults in West Africa and the Sahel, 2014 and 2017<sup>206</sup>



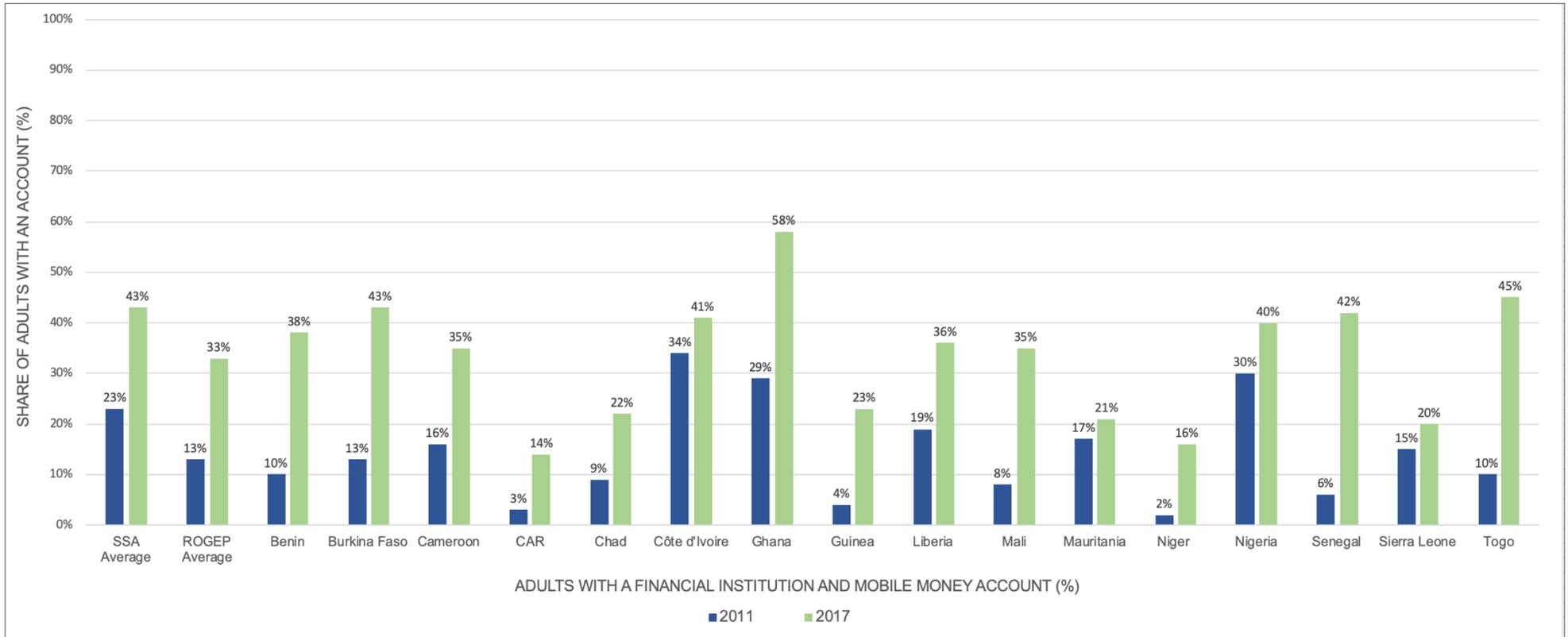
Source: International Monetary Fund

**Figure 46** shows the increase in the number of mobile money transactions across West Africa and the Sahel between 2014 and 2017. The shade of the country corresponds to the magnitude of the indicator; the darker the shade, the higher the value. Between 2014 and 2017, mobile money transaction volume increased significantly in Benin, **Burkina Faso**, Côte d’Ivoire, Ghana, Guinea, Mali, Niger, Senegal and Togo, while growth in transaction volume was slower in Nigeria and Chad. There was either no data or insufficient data available to assess transaction volume in Cabo Verde, Cameroon, Central African Republic, The Gambia, Guinea-Bissau, Liberia, Mauritania and Sierra Leone.

<sup>206</sup> International Monetary Fund – Financial Access Survey: <http://data.imf.org/?sk=E5DCAB7E-A5CA-4892-A6EA-598B5463A34C&slid=1460054136937>

In 2017, 43% of Burkina Faso’s adult population had an account at a financial institution or with a mobile money service provider, up from 13% in 2011. In 2017, the country had among the highest rates of financial inclusion in West Africa and the Sahel, 10% above the regional average and equivalent to the average for Sub-Saharan Africa (**Figure 47**).

Figure 47: Share of Adults with Access to Financial Services in West Africa and the Sahel (%), 2011 and 2017<sup>207</sup>



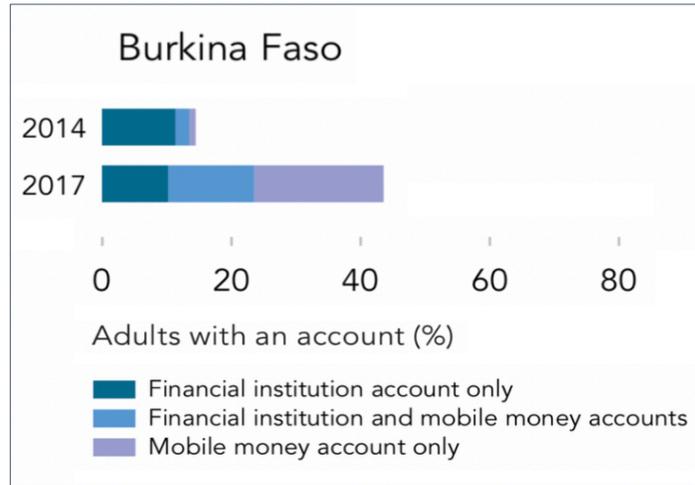
NOTE: Cabo Verde, Guinea-Bissau and The Gambia excluded (no data); data for Côte d'Ivoire is from 2014 and 2017

Source: World Bank Global Findex Database

<sup>207</sup> Demircuc-Kunt et al., 2017.

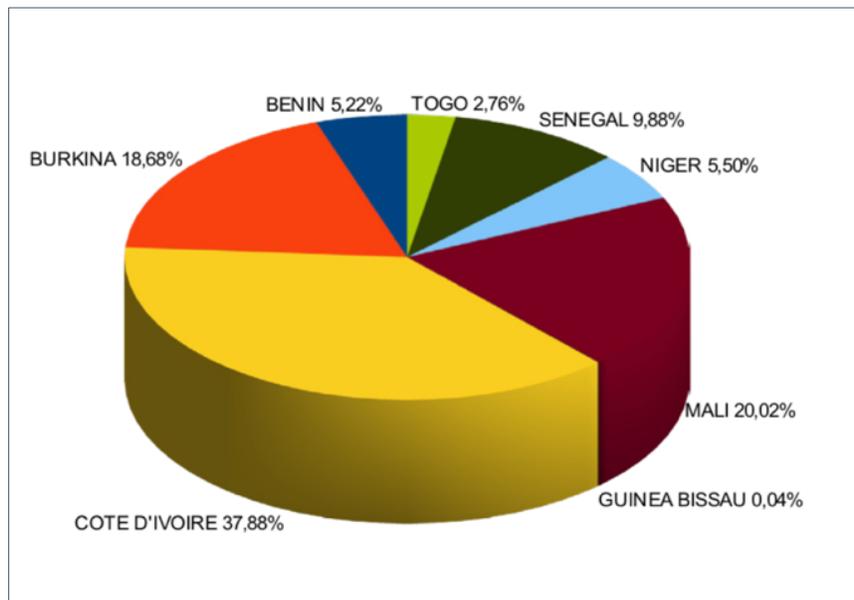
Financial inclusion has improved drastically in Burkina Faso over just a three-year period, from 14% in 2014 to 43% in 2017, representing the largest increase in the West Africa and Sahel region over this period. This growth has been driven by the proliferation of mobile money services; more adults in Burkina Faso have an account with a mobile money service provider than at a financial institution (**Figure 48**). Burkina Faso represented the third largest mobile money market in the WAEMU zone, accounting for about 19% of mobile money transaction volume in 2016 (**Figure 49**).

Figure 48: Financial Institution Account Ownership<sup>208</sup>



Source: World Bank Global Findex Database

Figure 49: WAEMU Mobile Money Market – Share of Transaction Volume by Country, 2016<sup>209</sup>



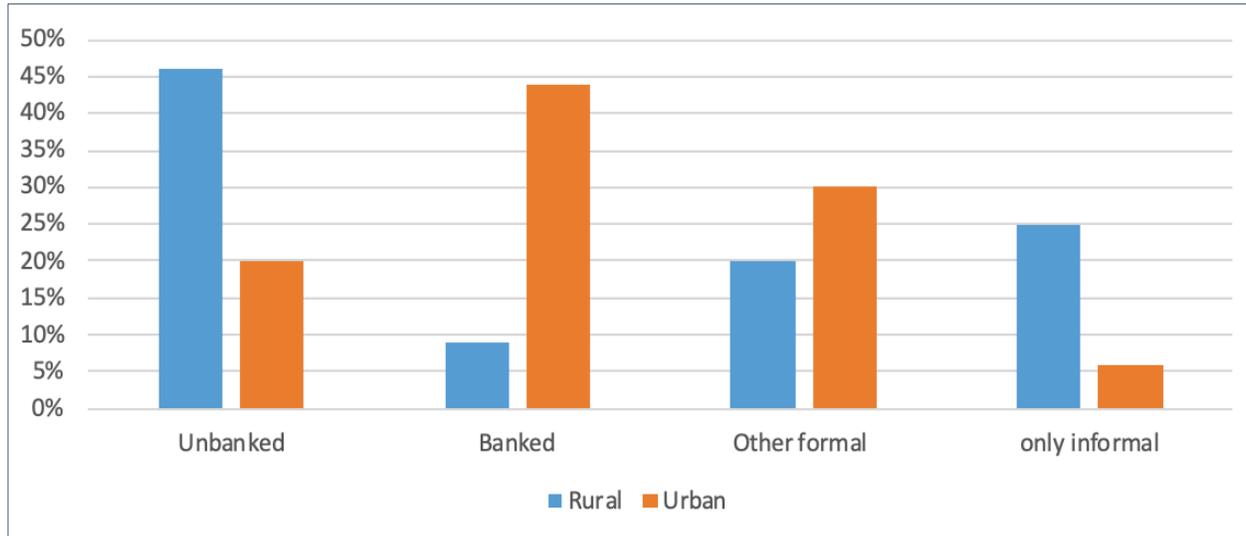
Source: BCEAO

<sup>208</sup> Demircuc-Kunt et al., 2017.

<sup>209</sup> "Overview of Mobile Financial Services Data in the West African Economic and Monetary Union in 2016," BCEAO, (2016): [https://www.bceao.int/sites/default/files/inline-files/3etat\\_des\\_services\\_financiers\\_uemoa\\_2016\\_anglais\\_.pdf](https://www.bceao.int/sites/default/files/inline-files/3etat_des_services_financiers_uemoa_2016_anglais_.pdf)

There are wide disparities in rates of access to financial services between urban and rural populations in Burkina Faso; in 2016, the average rate of access to bank financial services was 9.2% in rural areas compared to 44.1% in urban areas (Figure 50). The exclusion rate in the country also varies by region, with smaller proportions of exclusion in urbanized areas and those with high economic potential, such as the Center and Hauts-Bassins regions (Figure 51).

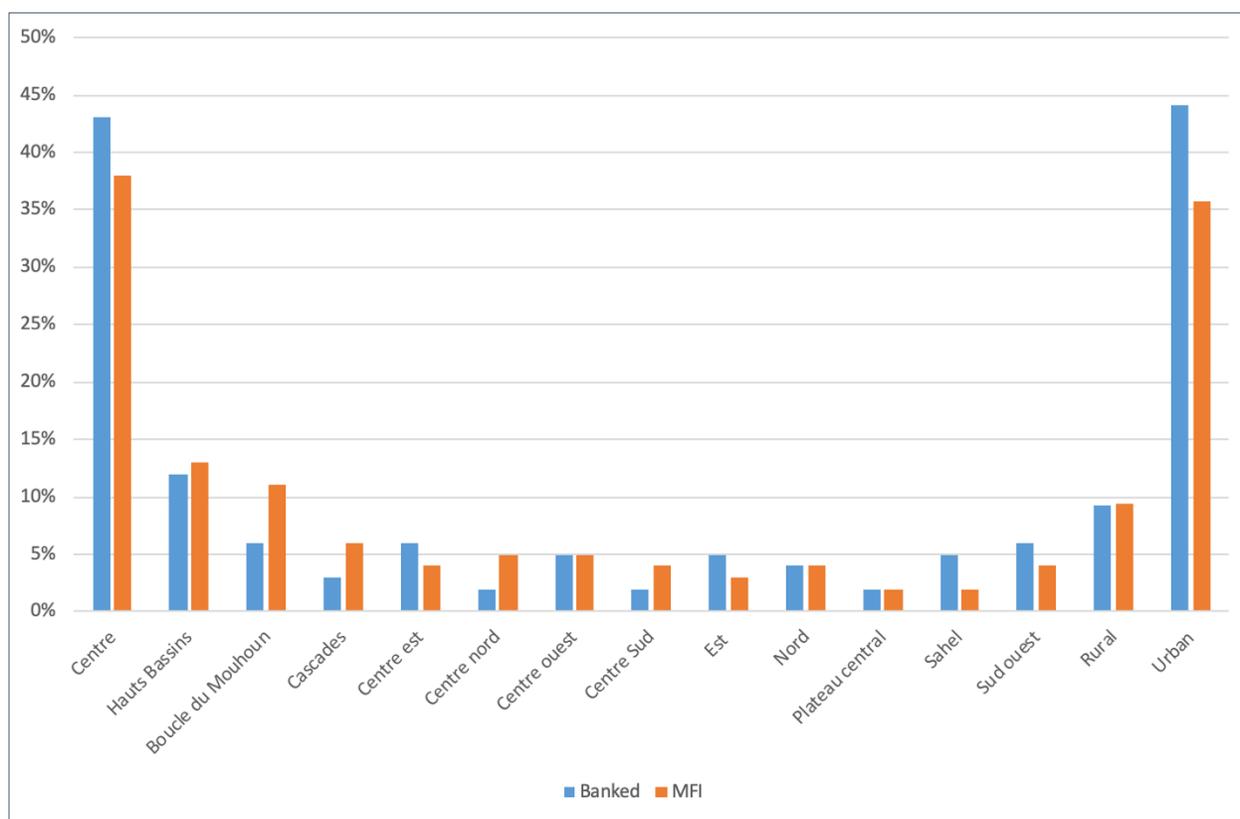
Figure 50: Access to Financial Services among Rural and Urban Population, 2016<sup>210</sup>



Source: FinScope

<sup>210</sup> "FinScope Consumer Survey Highlights: Burkina Faso 2016," Finmark Trust and the UN Capital Development Fund, (2017): <http://www.finmark.org.za/wp-content/uploads/2017/04/finscope-pocket-guide-burkina-faso-en.pdf>

Figure 51: Access to Financial Services by Region, 2016<sup>211</sup>



Source: FinScope

Widespread mobile phone ownership (Figure 20), rapidly growing mobile internet usage (Figure 19) and extensive network coverage (Figure 37), have led to the proliferation of mobile money services and platforms in the country. These dynamics are collectively increasing usage of mobile banking services, expanding overall access to financial services and driving financial inclusion in Burkina Faso. Mobile money technology also plays a critical role in the application of off-grid solar solutions, particularly for PAYG systems that rely on the interoperability between digital financial services and stand-alone solar devices.

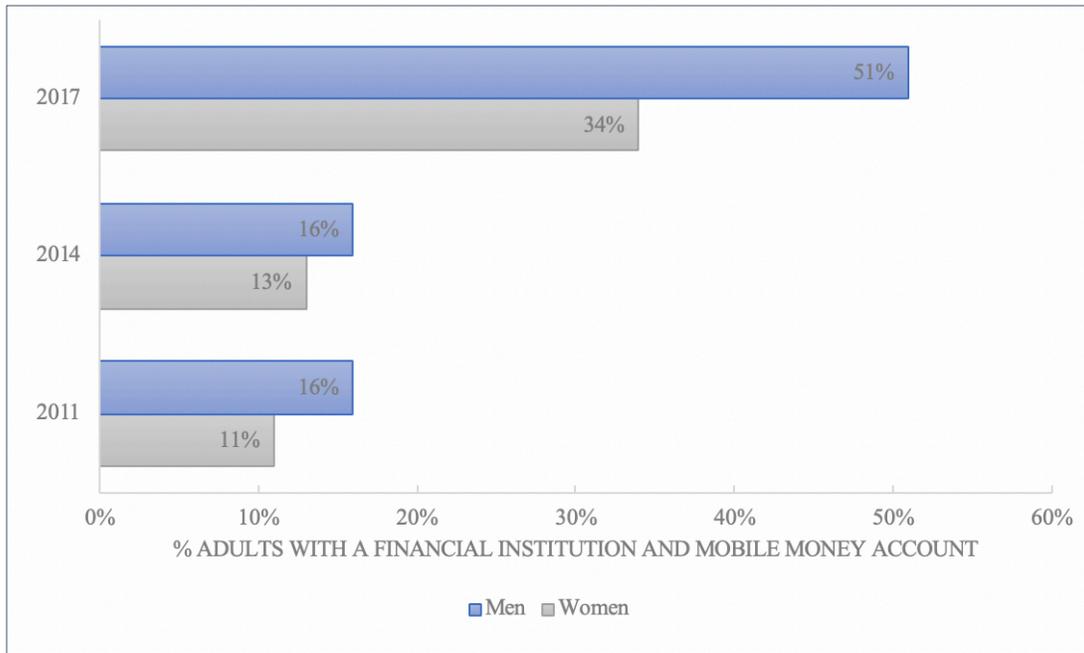
➤ **Gender and Women’s Financial Inclusion**

According to data from the World Bank’s 2017 Global Findex survey – which examines, among many things, the extent of financial inclusion in Sub-Saharan Africa (SSA) – women in the region are about 10% less likely to have an account at a financial institution or with a mobile money service provider than men. In Burkina Faso, the gender gap is significantly higher at 17% (Figure 52).<sup>212</sup> The expansion of digital financial services, especially mobile money, has created new opportunities to better serve women, the lower-income population and other groups that are traditionally excluded from the formal financial system.

<sup>211</sup> “FinScope Consumer Survey Highlights: Burkina Faso 2016,” Finmark Trust and the UN Capital Development Fund, (2017): <http://www.finmark.org.za/wp-content/uploads/2017/04/finscope-pocket-guide-burkina-faso-en.pdf>

<sup>212</sup> Demirguc-Kunt et al., 2017.

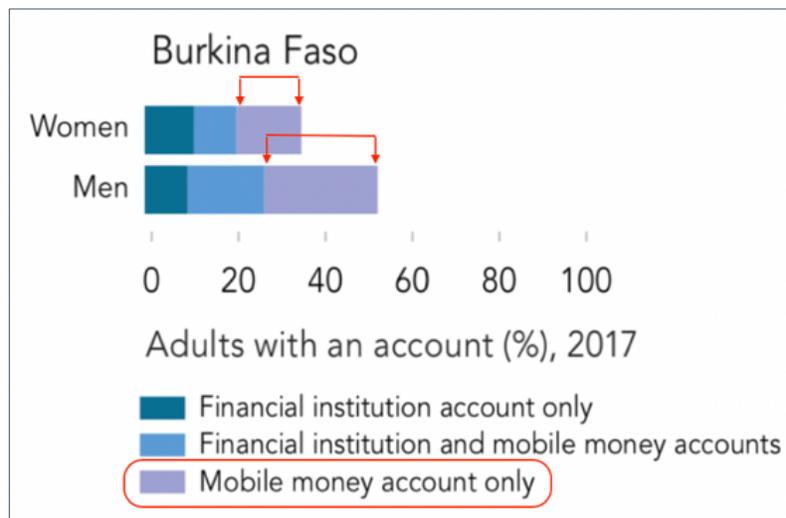
Figure 52: Financial Inclusion Gender Gap in Burkina Faso<sup>213</sup>



Source: World Bank Global Index Database

Despite the country’s overall progress, as illustrated in **Figure 52**, the gender gap in financial inclusion increased by 14% from 2014-2017, which matched Benin for the largest increase over this period. There is also still a sizeable gender gap (17%) in the share of adults owning a mobile money account (**Figure 53**). This was in fact the largest discrepancy in the West Africa and Sahel region and well above the Sub-Saharan Africa average of 6%.<sup>214</sup>

Figure 53: Gender Gap in Mobile Money



Source: World Bank Global Index Database

<sup>213</sup> Demirguc-Kunt et al., 2017.

<sup>214</sup> Ibid.

Women in Burkina Faso experience financial exclusion mainly due to low or irregular sources of income and limited access to land and credit. Currently, women borrow plots of land from men for farming and are obliged to return parcels when the owners require, which sometimes happens unexpectedly. Despite this uncertainty, women are enterprising both in agriculture and in the livestock sector. They are often the initiators of small income projects in these sectors, including for the cultivation of peanuts, millet, corn, sesame, vegetables, and even cotton.<sup>215</sup>

A direct consequence of women's lack of access to land and rural organizations in Burkina Faso is their lack of access to credit. Land is often an indispensable requirement for a loan and credit schemes are often provided to members of rural populations through a loan. This is a significant barrier to improving female agricultural productivity because, without credit, women farmers cannot buy inputs such as seeds, fertilizers, and improve technologies or rent labor.

Throughout the country, 76% of women are the mainstay of small-scale agriculture, agricultural labor, processing of agricultural products, and daily subsistence of families.<sup>216</sup> Efforts to eradicate rural poverty and improve food security will be rewarded only if women's issues and their role in food production and provision are taken into consideration. These issues include female contribution to the food supply and household income, access to productive resources, and the impact of policy reforms on women's economic and social roles, as well as household food security.

Studies have found that increasing financial inclusion can significantly empower women by increasing savings, reducing levels of inequality, and improving decision-making power in the household. Supportive government programs, policies and regulations are therefore critical to overcoming the barriers that women face and driving overall progress towards financial inclusion.<sup>217</sup>

Examples of GoBF programs to facilitate access to financial services in the country include:

**Women's Income Support Fund (FAARF):**<sup>218</sup> A government institution under the supervision of the Ministry of Economy and Finance, with the aim of promoting women's access to credit by granting them loans or offering them a guarantee while providing women with training that allows for better management of their business.<sup>219</sup> The potential beneficiaries of FAARF include rural and urban women's groups and associations; women working in the informal sector in solidarity groups of three to six members; certain SMEs; and young girls from Production and Training Centers for Young Girls. The credits granted range from CFA 5,000 to CFA 500,000 (USD 8 to USD 850) for individual loans and CFA 50,000 to 2,000,000 (USD 85 to USD 3,450) for groups. Credit is granted at an interest rate of 10% per annum, with a duration ranging from 6 to 12 months for the following activities: livestock (33.83%); processing local products (24.71%); and trade (35.21%). The main strength of FAARF is its network of field workers (facilitators) who go to women in their place of residence to build credit files. Training sessions are conducted periodically or at the request of groups or women's organizations.<sup>220</sup>

<sup>215</sup> Hein, M., "Women's access to land, a guarantee of development in Burkina Faso," (11 April 2008).

<sup>216</sup> Finmark Trust and the UN Capital Development Fund, 2017.

<sup>217</sup> El-Zoghbi, M., "Measuring Women's Financial Inclusion: The 2017 Findex Story," Consultative Group to Assist the Poor (CGAP), (30 April 2018): <https://www.cgap.org/blog/measuring-womens-financial-inclusion-2017-findex-story>

<sup>218</sup> Fonds d'Appui aux Activités Remuneratrices des Femmes (FAARF)

<sup>219</sup> "Liste des bénéficiaires du Programmed Autonomisation Economique des Jeunes et des Femmes," PAE/JF, (2017): <https://www.paejf.bf/resultats/>

<sup>220</sup> "Ministere De L'Economie Et Des Finances," Ministry of Finance, Government of Burkina Faso, (2017):

[http://www.finances.gov.bf/index.php?option=com\\_content&view=article&id=447:programme-d-autonomisation-economique-des-femmes-environ-17-000-dossiers-recus-au-faarf&catid=9&Itemid=371](http://www.finances.gov.bf/index.php?option=com_content&view=article&id=447:programme-d-autonomisation-economique-des-femmes-environ-17-000-dossiers-recus-au-faarf&catid=9&Itemid=371)

**The Microfinance Sector Strengthening Program in Burkina Faso (PRESEM):** A joint program of UNDP and the Burkina Faso Caisses Populaires Network aimed at stimulating the local economy through access to local financial services, especially income-generating activities for women. PRESEM financed the construction of five new credit unions and a microfinance cooperative institution, and it strengthened four existing credit unions. Each credit union hired a facilitator who accompanies women from the first awareness to taking a microcredit, activities and reimbursement. For micro-credit efficiency, women are grouped together through village banks such that every woman has her own generative activities, but the loan is collective. If a woman does not pay back her portion, the other members of her group are also accountable. Since the opening of the first “caisses populaires” of the PRESEM in June 2009, 3,500 women have benefited from microcredit through 269 village funds.<sup>221</sup>

In view of a broader vision of financial inclusion, the GoBF, with the support of the West Africa Regional Office, initiated the development of the National Strategy for Inclusive Finance (La Stratégie Nationale de Finance Inclusive) following the Making Access to Financial Services Possible (MAP) approach. This approach is based on a comprehensive analysis of demand, supply and regulatory environment to identify the main factors that can either prevent or promote better financial inclusion in the national economy. Recognizing the importance of credit as a lever for development and an essential factor in the fight against poverty, successive Burkinabe governments have set up various funds for financing projects, such as The Informal Sector Support Fund (FASI),<sup>222</sup> which provides refundable credits of a maximum amount of CFA 1.5 million (USD 2,500) at an interest rate of 13% for five years with a deferral period of six months. FASI is an employment assistance program, supporting entrepreneurs, promoting the access of informal sector operators to the traditional banking system. Since its creation in 1999, it has granted more than CFA 7 billion (USD 12.1 million) to project sponsors in the informal sector.

The GoBF also intends to build upon the financial inclusion policies that are being pursued at a regional level. In 2016-2017, the BCEAO, in partnership with the UN Capital Development Fund and the IMF, organized a series of high-level meetings of key West African policymakers to develop a regional policy and strategic framework to improve financial inclusion. Ultimately, the West African Monetary Union (WAMU) Council of Ministers adopted an action plan that aimed to expand access to financial services to 75% of the WAEMU adult population over a five-year period. The implementation of this strategy is expected to benefit from financial support from various DFIs as well as technical assistance from the World Bank.<sup>223</sup>

### 3.2.3 Commercial Lending Environment

#### ➤ Maturity Structure of Bank Deposits and Credit

By the end of 2017, deposit liabilities of banks amounted to CFA 1.6 trillion (USD 2.7 billion) down 13.8% from 2016, with a prevalence of short-term deposits (**Figure 54**). The instruments utilized in maturity structures (current accounts, paid or unpaid deposit accounts) do not have a contractual maturity date, and offer the depositor the option to withdraw or increase all or part of assets without notice or real penalty. This deposit structure may be an obstacle in the process of granting loans and financing the economy,

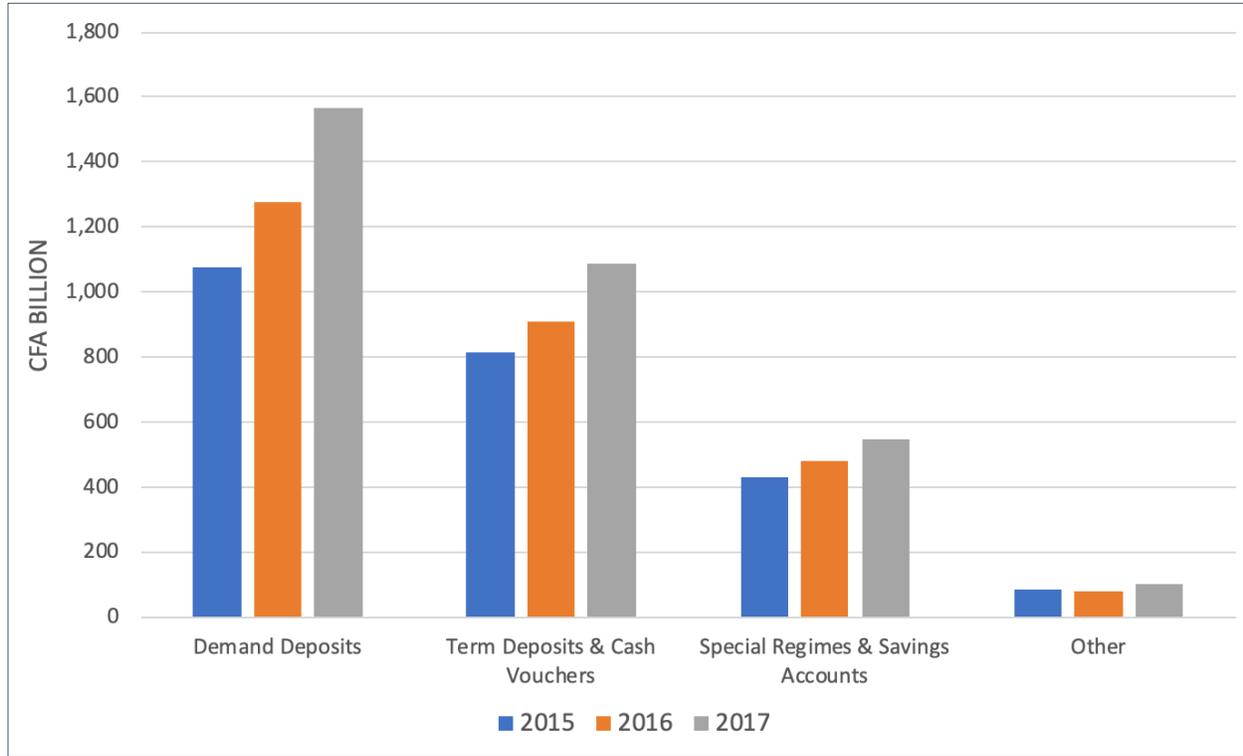
<sup>221</sup> “Evaluation Finale: Programme du renforcement du Secteur de la Microfinance (PRESEM),” UNCDF, (2018): <http://www.uncdf.org/article/3416/valuation-finale-programme-de-renforcement-du-secteur-de-la-microfinance-presem---burkina-faso>

<sup>222</sup> “FONDS D’APPUI AU SECTEUR INFORMEL,” (2013): <http://www.burkinapmepmi.com/spip.php?article17525>

<sup>223</sup> “West African Economic and Monetary Union: Common Policies of Member Countries,” International Monetary Fund, (April 2018): <https://www.imf.org/en/Publications/CR/Issues/2018/04/25/West-African-Economic-and-Monetary-Union-WAEMU-Common-Policies-for-Member-Countries-Press-45815>

because it limits the ability of banks to grant long-term loans. Indeed, the mobilization of resources for the financing of the economy requires the availability of savings adapted to the need of long-term financing.<sup>224</sup>

Figure 54: Maturity Structure of Bank Deposits



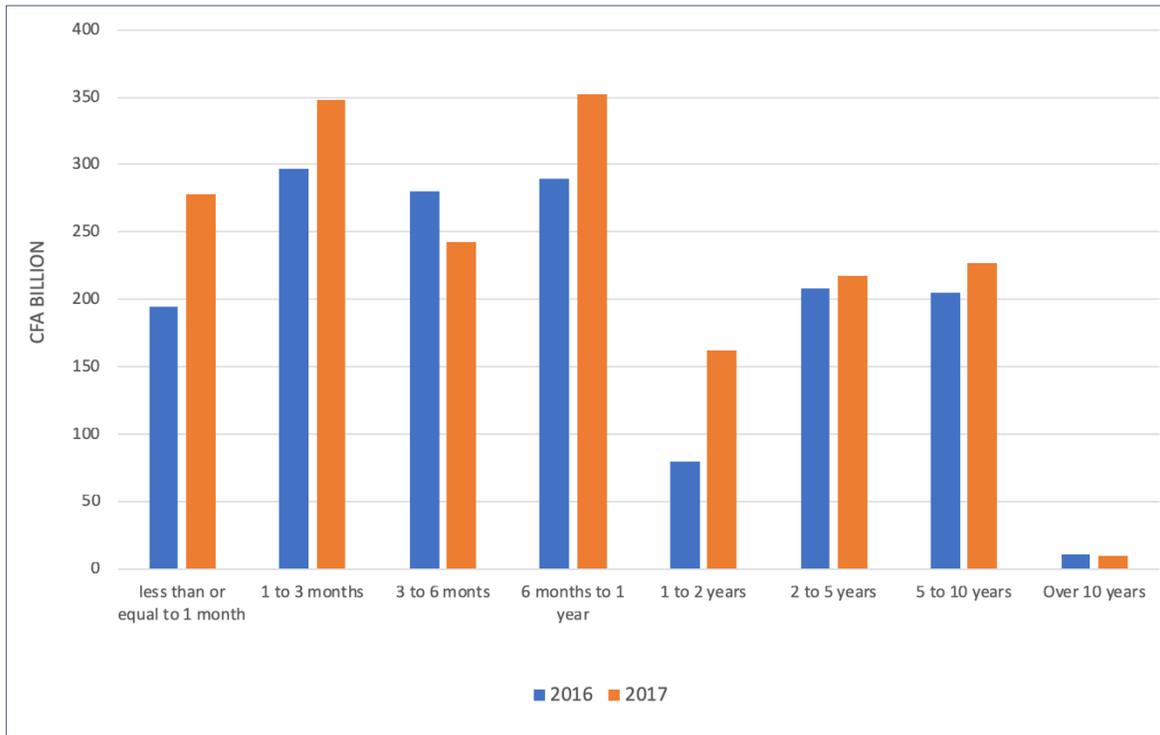
Source: BCEAO

The proportion of overnight deposits in total deposits increased slightly from 45% in 2015 to 48% by the end of 2017. The dominance of short-term resources theoretically reflects the banks’ inability to give priority to long-term credit demands. The banks do, however, seek to transform some of their short-term resources into long-term uses and reconcile between long-term and short-term rates. Of the banking sector’s CFA 2.6 trillion (USD 4.4. billion) in loans in 2017, short-term and medium-term loans accounted for 45% and 50% of the total, respectively (**Figure 55**).<sup>225</sup>

<sup>224</sup> BCEAO, 2018.

<sup>225</sup> Ibid.

Figure 55: Maturity Structure of Bank Loans



Source: BCEAO

➤ **Interest Rates**

As a member state of WAEMU, Burkina Faso’s monetary policy is decided by the BCEAO. The BCEAO regional monetary policy is heavily dependent on two types of open market operations: (i) refinancing for one week, and (ii) refinancing for one month, allocated at variable rates.<sup>226</sup> In 2017, the weighted average rates for refinancing for one week and one month were around 3.75%. The BCEAO central benchmark rate, or central bank rate, has sustained around 2.5% since 2013, while the marginal lending rate, has hovered around 4.5% in recent years.<sup>227</sup>

The annual average inflation rate in Burkina Faso was 0.4% in 2017, compared to -0.2% in 2016.<sup>228</sup> This evolution was mainly driven by an increase in prices of petroleum products, which have been trending upward since the end of 2016.<sup>229</sup>

The average lending rate in Burkina Faso decreased from 7.54% in 2016 to 7.25% in 2017 (**Figure 56**). The country has consistently recorded one of the lowest lending rates in WAEMU, with only Côte d'Ivoire (6.42%) and Senegal (5.98%) having lower rates.<sup>230</sup>

<sup>226</sup> IMF, 2018.

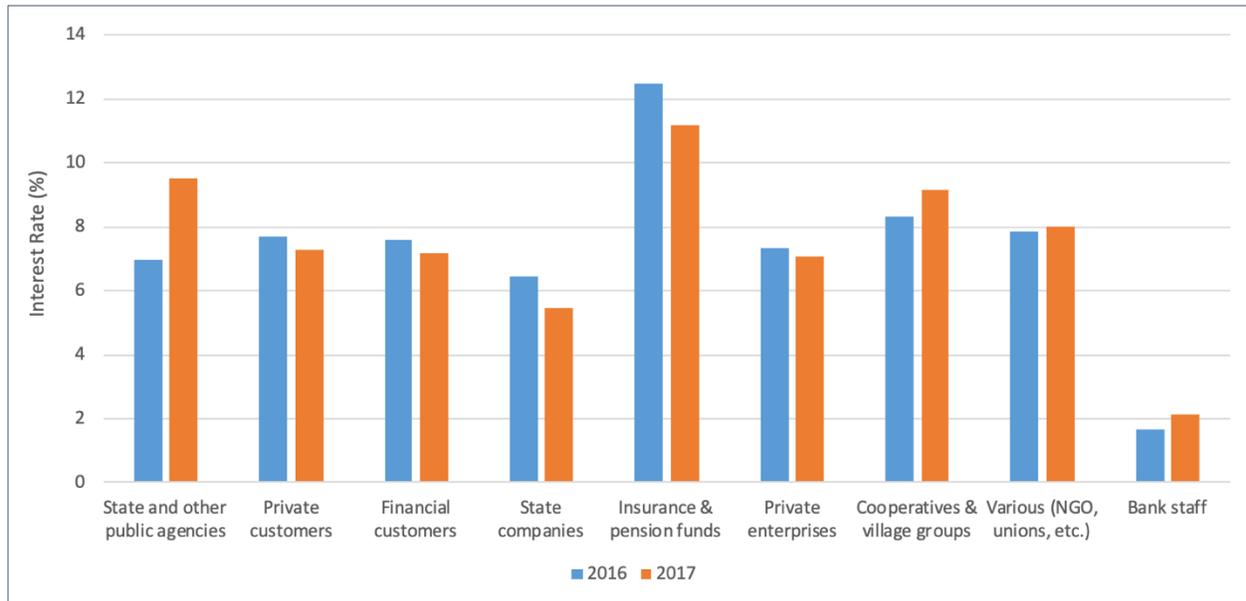
<sup>227</sup> BCEAO, 2018.

<sup>228</sup> Ibid.

<sup>229</sup> “Burkina Faso Interest Rate,” Trading Economics, 2017: <https://tradingeconomics.com/burkina-faso/interest-rate>

<sup>230</sup> BCEAO, 2018.

Figure 56: Interest Rates on Loans by Sector

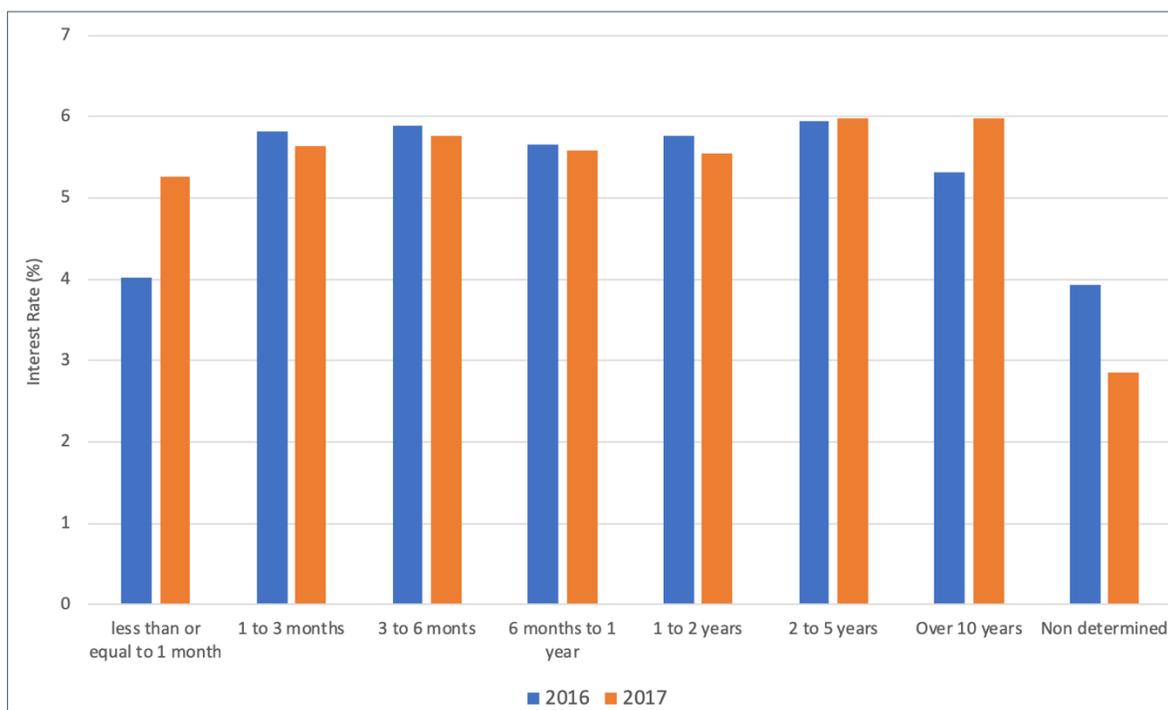


Source: BCEAO

The WAEMU term deposit rate decreased from 5.37% in 2016 to 5.28% in 2017. This change mirrored the rate of return on deposits made by the public sector, private enterprises and individuals in the economy. The average deposit rate in Burkina Faso increased from 5.4% in 2016 to 5.67% in 2017. Burkina Faso has one of the highest interest rates in WAEMU; only Benin (5.85%) and Niger (5.70%) have higher rates. Burkina Faso also has the most profitable rates relative to deposits older than two years (**Figure 57**).<sup>231</sup>

<sup>231</sup> Ibid.

Figure 57: Interest Rates on Deposits



Source: BCEAO

➤ **Foreign Exchange Market**

As a member state of WAEMU, Burkina Faso’s currency, the CFA franc, is pegged to the euro. The BCEAO therefore follows the monetary policy of the European Central Bank, which effectively sets interest rates for the CFA franc zone. This pegged exchange rate system limits the ability of member states to quickly respond to shocks. At the same time, CFA zone countries survived the recent collapse of oil prices and commodities without suffering from currency collapse, inflation and fiscal distress like other West African countries.<sup>232</sup> In general, the CFA franc monetary zone consistently outperforms other Sub-Saharan countries in terms of inflation rate and overall macroeconomic stability.

The CFA franc is backed by a guarantee from the French treasury for the convertibility of the CFA franc into euros at the fixed exchange rate at the Paris Stock Exchange.<sup>233</sup> This provides stability and credibility to the currency. The common currency also expedites trade by removing foreign exchange between the eight member states of WAEMU as well as the six countries in the Economic and Monetary Community of Central Africa (Communauté Economique et Monétaire de l’Afrique Centrale, CEMAC). On a regional level, there are plans to implement a single currency across all of West Africa by 2020, although there are many hurdles to overcome before this degree of macroeconomic convergence can be achieved.<sup>234</sup>

<sup>232</sup> Cappola, F., “In Africa: Understanding the CFA Franc and its Foreign Exchange Rate Impact,” <https://www.americanexpress.com/us/foreign-exchange/articles/cfa-franc-and-its-foreign-exchange-rate-impact/>

<sup>233</sup> Hallet, M., “European Economy: The role of the Euro in Sub-Saharan Africa and in the CFA franc zone,” European Commission Directorate-General for Economic and Financial Affairs, (2008): [http://ec.europa.eu/economy\\_finance/publications/pages/publication13478\\_en.pdf](http://ec.europa.eu/economy_finance/publications/pages/publication13478_en.pdf)

<sup>234</sup> Liedong, T., “Could West Africa introduce a single currency?” CNN, (August 8, 2017): <https://www.cnn.com/2017/08/08/africa/single-currency-west-africa/index.html>

Table 54: Official Exchange Rate (CFA-USD)<sup>235</sup>

Exchange Rate	2013	2014	2015	2016	2017	2018
End of Period	475.64	540.28	602.51	622.29	546.95	572.89
Period Average	494.04	494.41	591.45	593.01	582.09	555.72

Source: International Monetary Fund

➤ **Collateral Requirements**

A common problem in the West African Economic and Monetary Union is poor judicial processes regarding collateral registry and recovery, as well as a lack of available credit information about the borrower. Hence, most commercial banks require high amounts of collateral in order to mitigate consumer credit risk. As a result, a majority of firms in the country are unable to obtain loans due to high costs of credit, insufficient funds offered, the short maturity of the loans, and/or the amount of required collateral.

The collateral system (guarantees, sureties and mortgages) is governed by the Organization for the Harmonization of Business’s Law in Africa (L’Organisation pour l’Harmonisation en Afrique du Droit des Affaires, OHADA). In Burkina Faso, a Financial Guarantee Company (Société Financière de Garantie Interbancaire du Burkina or Interbank, SOFIGIB) was established by state and credit institutions in order to support the sustainable growth of businesses in the country by facilitating access to financing through the provision of guarantees. SOFIGIB supports companies by offering a single guarantee of up to 50% of the amount of the loan, through three types of products: (i) the guarantee of short, medium and long-term credits; (ii) the study and elaboration of bankable projects; and (iii) investment monitoring and follow-up support for projects.<sup>236</sup>

➤ **Banking Supervision**

The corporate financial regulatory framework is determined by legislation issued by WAEMU and OHADA. In 2016, the WAEMU Council of Ministers adopted measures to implement the Basel II and Basel III rules into the monetary union, designed to further preserve resilience in the banking sector by increasing capital requirements and controlling risk profiles. In addition, BCEAO adopted regulations to establish Credit Information Bureaus (Bureaux d’Information sur le Crédit, BICs) within the monetary union, which were designed to reduce asymmetric information between customers and banks by providing economic and financial information to customers.

The central bank also implemented regulations to improve its ability to enforce existing regulations. The instructions focused on how to set up internal audit systems, compliance audit systems and provisional administration for BICs. The provisions also defined the sanctions applicable to BICs and established the amounts required to set up a special reserve to ensure their long-term viability. Reporting systems and procedures were also put in place to ensure that financial statements of credit institutions were reliable and also prepared in a timely manner.<sup>237</sup> Burkina Faso adopted these regulations in 2016.

<sup>235</sup> International Financial Statistics (IMF): <http://data.imf.org/?sk=4C514D48-B6BA-49ED-8AB9-52B0C1A0179B>

<sup>236</sup> Société Financière de Garantie Interbancaire du Burkina: <http://www.sofigib.com/>

<sup>237</sup> “2016 Annual Report,” Banque Centrale des Etats de l’Afrique de l’Ouest (BCEAO), [https://www.bceao.int/sites/default/files/2017-12/2016\\_annual\\_report\\_2.pdf](https://www.bceao.int/sites/default/files/2017-12/2016_annual_report_2.pdf)

### 3.2.4 Lending to the Off-Grid Solar Sector

While there are several donor and DFI-funded programs and initiatives that have provided financing to support development of Burkina Faso’s off-grid solar market, these funds have not been channeled through local commercial banks or MFIs to finance the sector. ROGEP is therefore a pioneering initiative in the country, as it endeavors to boost OGS lending via engagement with local financial partners. Local FIs are increasingly becoming more aware of the opportunities in the off-grid space, and interviews FIs revealed a willingness to participate in providing financing to the sector.

**Microcrédit Solaire:** FONDEM (see **Section 1.4.3**) has been operating for more than five years and has distributed more than 900 solar kits to about 10,000 users.<sup>238</sup> These kits were purchased thanks to micro-credits granted by the country’s MFI and credit union network. The kits were bought locally from Burkinabe supplier K&K International and another local company, BETA Energy, who performs the installation and maintenance.<sup>239</sup> Other major distributors such as Station Energy and APB Energy are present but are not supported by local financial institutions.

#### 3.2.4.1 Programs Supporting Financial Institutions in Off-Grid Solar Lending

##### ➤ **AFD Sustainable Use of Natural Resources and Energy Finance (SUNREF)**

SUNREF is a credit line provided by AFD for financial institutions and their clients that aim to fund clean energy projects. SUNREF includes TA and credit facilities to provide banks with the necessary long-term financing to overcome financial barriers met by project sponsors. The program is open to companies seeking to obtain easier access to green finance and banks seeking to develop their green finance portfolios. In 2014, Orabank, Société Générale and AFD signed a partnership agreement to launch SUNREF’s West Africa program, which makes a EUR 30 million (CFA 19.6 billion) credit line available to banks in WAEMU (Benin, Burkina Faso, Côte d’Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo).<sup>240</sup> The SUNREF West Africa program has been active in Burkina Faso since 2016, with several projects being assessed for financing in the agriculture, construction and services industries – most of which will utilize stand-alone solar technology.<sup>241</sup>

#### 3.2.4.2 Key Barriers to Off-Grid Solar Lending

##### ➤ **Unfamiliarity with the Off-Grid Solar Sector**

Much like other African markets, local FIs in Burkina Faso are unfamiliar with lending to off-grid solar projects and companies and have a limited understanding of the nascent sector. During stakeholder interviews, many of the FIs noted a lack of expertise in assessing OGS risks and in structuring/developing customized products for the sector. While programs such as SUNREF have supported participating FIs, there remains a significant gap in overall local capacity. Nearly all of the interviewed FIs stressed that technical assistance would be necessary to facilitate off-grid solar lending.

##### ➤ **Maturity Structure of Bank’s Funding**

The sizable share of short-term deposits limits the ability of banks to offer longer-tenor consumer financing, which is necessary to accelerate OGS market growth. Lease-to-Own and Pay-As-You-Go payment models

<sup>238</sup> FONDEM: <http://www.fondem.org/>

<sup>239</sup> “Microcrédit Solaire (MICRÉSOL),” *Energies Pour Le Monde*, (2016): <http://www.fondem.org/projets/micresol/>

<sup>240</sup> SUNREF: <https://www.sunref.org/en/sunref-elue-meilleure-solution-financiere-pour-lenergie-durable-en-afrique-de-louest/>

<sup>241</sup> “Burkina Faso’s Solar Ambitions,” *Sunref*, (5 May 2017): <https://www.sunref.org/en/les-ambitions-solaires-du-burkina-faso/>

reduce entry barriers for consumers by allowing for small, incremental payments for electricity which are more affordable, rather than demanding a high up-front cost for installation and service.

➤ **Low Private Sector Credit**

Commercial bank credit to the private sector remains weak and continues to constrain development of the OGS sector. As described in **Section 3.2.2**, access to finance remains a key barrier for businesses in the country. The use of bank loans for working capital and investment is extremely low. This hinders solar companies from investing in the growth of their business and expansion of their operations.

➤ **Lack of Credit History/ High Collateral Requirements**

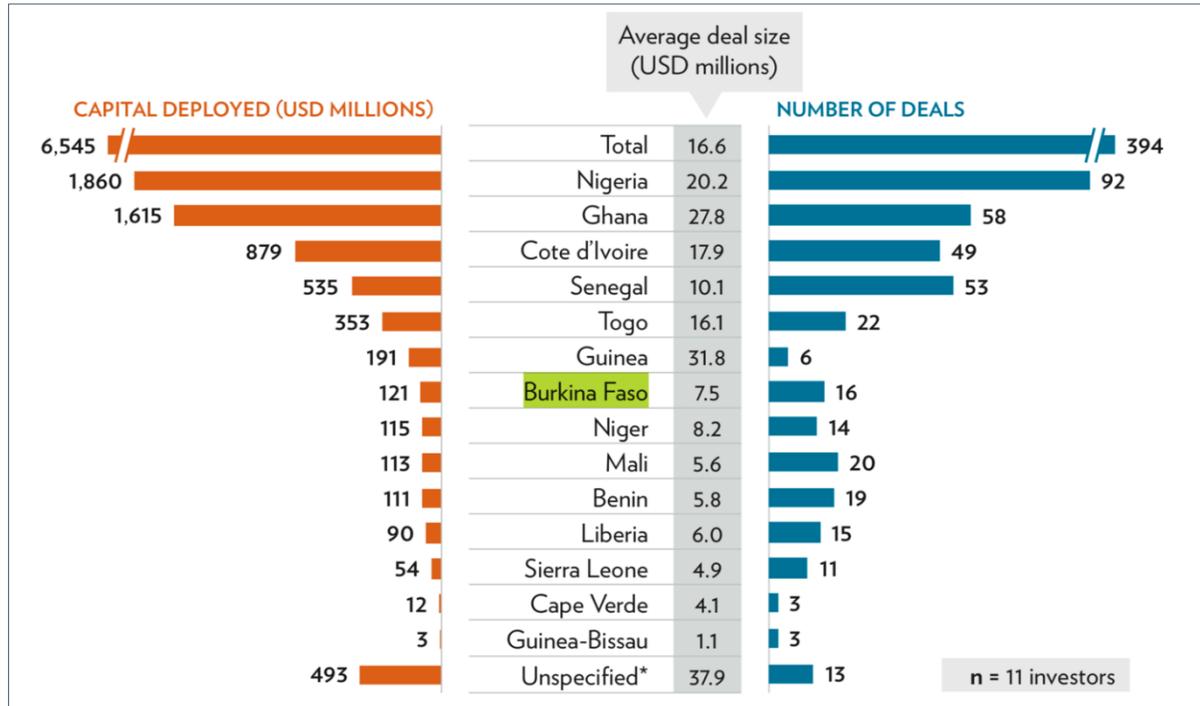
As described in **Section 3.2.3**, consumers in Burkina Faso face very strict collateral requirements. Many consumers also lack basic financial literacy and knowledge about the terms and conditions of financial products and therefore struggle to obtain loans. The lack of credit history/track record and the weak balance sheet of most off-grid solar enterprises is a critical barrier that often prevents these firms from meeting the collateral requirements of banks. When compared to domestically-owned enterprises, foreign-owned firms are typically more likely to obtain financing. All of the interviewed commercial banks indicated that credit guarantees would be necessary to encourage lending to the off-grid sector.

### 3.3 Financial Institutions<sup>242</sup>

#### 3.3.1 Development Finance Institutions

Between 2005 and 2015, Burkina Faso received a total of USD 121 million in DFI funds with an average deal size of USD 7.5 million; the amount comprised about 2% of the total DFI investment across West Africa over this period (Figure 58).<sup>243</sup>

Figure 58: DFI Investment in West African Countries, 2005-2015



Source: Global Impact Investing Network and Dahlberg

Apart from the above-mentioned AFD/PROPARCO SUNREF program, DFI programs that are relevant to the OGS sector in Burkina Faso are described below.

➤ **African Development Bank Sustainable Energy Fund for Africa / Facility for Energy Inclusion**

The **Sustainable Energy Fund for Africa (SEFA)** is a USD 60 million multi-donor trust fund administered by the African Development Bank with the objective of supporting sustainable private sector led economic growth in African countries through the efficient utilization of clean energy resources and support small- and medium-scale renewable energy project development.<sup>244</sup>

<sup>242</sup> Excluding commercial banks, which are reviewed in detail in **Section 3.2**.

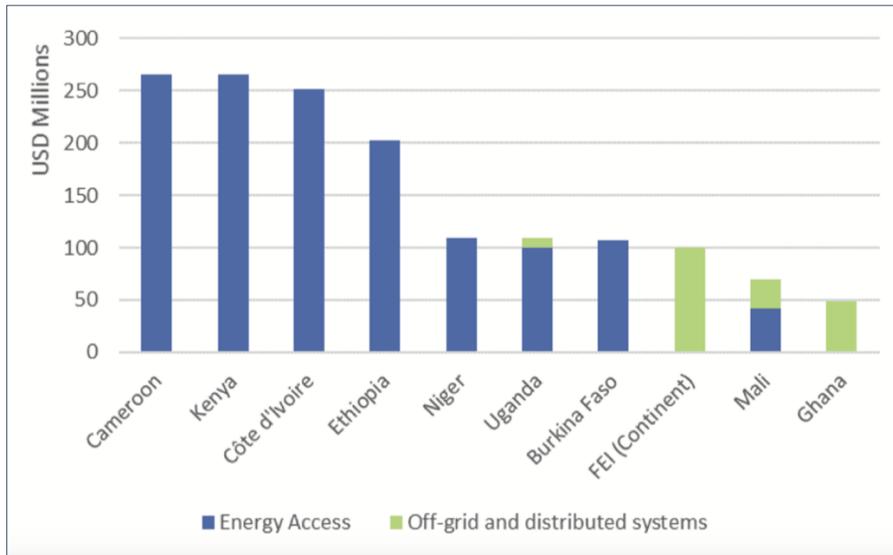
<sup>243</sup> "The Landscape for Impact Investing in West Africa: Understanding the Current Status, Trends, Opportunities and Challenges," Global Impact Investing Network and Dahlberg, (2015):

[https://thegiin.org/assets/upload/West%20Africa/RegionalOverview\\_westafrica.pdf](https://thegiin.org/assets/upload/West%20Africa/RegionalOverview_westafrica.pdf)

<sup>244</sup> "Sustainable Energy Fund for Africa," African Development Bank, (2018): <https://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/sustainable-energy-fund-for-africa/>

The **Facility for Energy Inclusion (FEI)** is a USD 500 million Pan-African debt facility created by the AfDB to support the achievement of its access to energy goals by providing debt capital to SHS companies, small independent power producers and mini-grid developers. The launch of the FEI in 2016 led to a significant increase in AfDB financing for distributed renewable energy throughout Sub-Saharan Africa. Burkina Faso received approximately USD 100 million in energy access financing from AfDB between 2014 and 2017 (**Figure 59**).

Figure 59: Distribution of AfDB Energy Access Financing in Sub-Saharan Africa, 2014-2017<sup>245</sup>



Source: Oil Change International and Friends of the Earth U.S.

The FEI Off-Grid Energy Access Fund (OGEF), structured by Lion’s Head in partnership with the Nordic Development Fund, supports transaction structuring, provides local currency options to reduce risk for borrowers and their customers, and also offers technical assistance to companies to support off-grid market development.<sup>246</sup> The FEI OGEF, which launched in 2018, will initially focus on East Africa, Côte d’Ivoire, Ghana and Nigeria.<sup>247</sup>

➤ **International Finance Corporation**

In June 2018, the IFC announced it had invested USD 60 million in a regional risk-sharing facility to support Bank of Africa Group’s lending to SMEs in eight African countries, including Burkina Faso. Half of the facility is earmarked for women-run businesses, and for climate-related improvements, such as energy efficient equipment upgrades, small solar systems, and climate-smart agricultural supply chains. IFC’s investment will cover up to 50% of the risk on these SME loans.<sup>248</sup>

<sup>245</sup> Lee, A. Doukas, A. and DeAngelis, K., “The African Development Bank and Energy Access Finance in Sub-Saharan Africa: Trends and Insights from Recent Data,” Oil Change International and Friends of the Earth U.S., (November 2018): <http://priceofoil.org/content/uploads/2018/11/AfDB-Energy-Access-Finance-report-high-quality.pdf>

<sup>246</sup> Facility for Energy Inclusion – Off-Grid Energy Access Fund: <https://www.ogefafira.com>

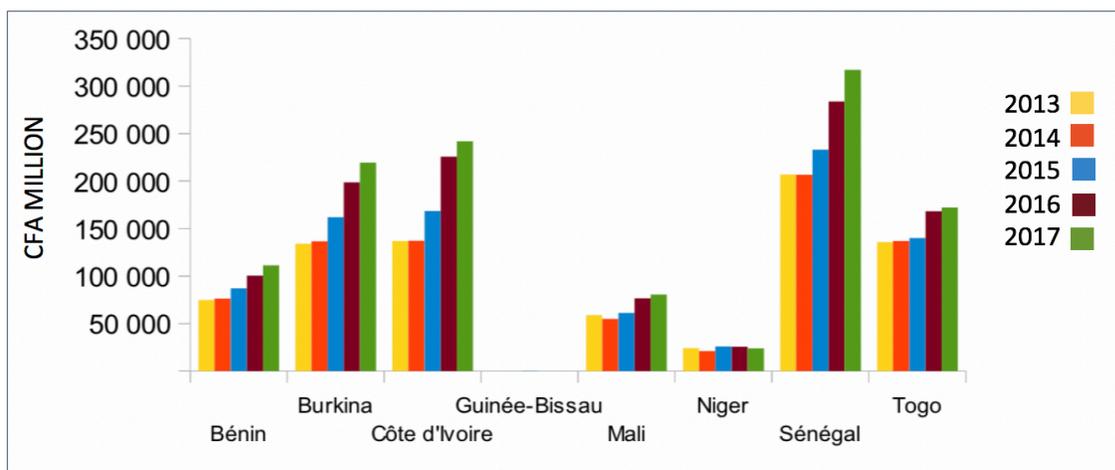
<sup>247</sup> “African Development Bank, Nordic Development Fund and Partners launch Off-Grid Energy Access Fund with US\$ 58 million,” African Development Bank Group, (August 27, 2018): <https://www.afdb.org/en/news-and-events/african-development-bank-nordic-development-fund-and-partners-launch-off-grid-energy-access-fund-with-us-58-million-18432/>

<sup>248</sup> “IFC Invests in Bank of Africa to Expand SME Lending in Eight Countries,” International Finance Corporation, (4 June 2018): <https://ifcextapps.ifc.org/ifcext/pressroom/ifcpressroom.nsf/0/947B76E4C106A246852582A200440E1C?OpenDocument>

### 3.3.2 Microfinance Institutions

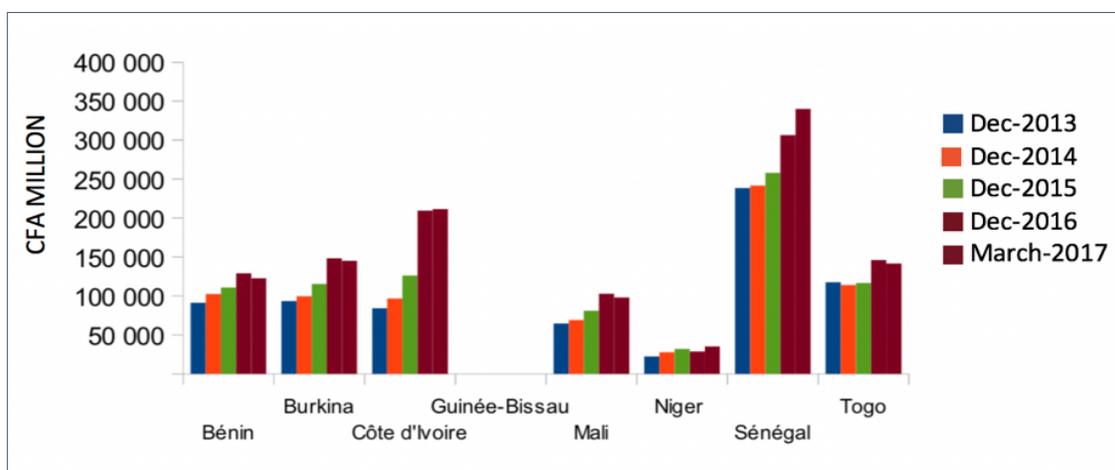
The microfinance sector in the WAEMU region was formally organized under the Regulatory Program for Mutual Support (Programme d'Appui à la Réglementation des Mutuelles d'Epargne et de Credit, PARMEC), which authorized BCEAO to regulate MFIs through the WAEMU Banking Commission. MFIs with deposits greater than CFA 2 billion (USD 3.4 million) are regulated under PARMEC, while all others are governed through local institutions. As of 2017, there were over 650 MFIs active in WAEMU countries, with 13 million individuals as direct beneficiaries.<sup>249</sup> **Figure 60** and **Figure 61** illustrate trends in MFI deposits and loans, respectively, in WAEMU between 2013 and 2017. Burkina Faso has witnessed a particularly strong increase in MFI deposits, up 12.4% in 2017 from 2016.

Figure 60: Microfinance Deposits in WAEMU



Source: BCEAO

Figure 61: Microfinance Loans in WAEMU



Source: BCEAO

<sup>249</sup> "Situation du Secteur de la Microfinance dans L'UMOA au 31 Mars 2017," BCEAO (2017): [https://www.bceao.int/sites/default/files/2017-11/situation\\_de\\_la\\_microfinance\\_a\\_fin\\_mars\\_2017\\_1.pdf](https://www.bceao.int/sites/default/files/2017-11/situation_de_la_microfinance_a_fin_mars_2017_1.pdf)

Burkina Faso has 27 MFIs and a total balance sheet of CFA 297 billion (US 46.7 million). The country has 17.8% of the MFI market share in WAEMU after Senegal and Côte Ivoire. The credits allocated in 2017 by these 27 institutions amounted to about CFA 140 billion (USD 242 million), of which CFA 62.5 billion (US 107 million) were short-term loans and CFA 74.5 billion (US 130 million) were medium and long-term loans. The deposits of these same MFIs amounted to approximately CFA 126.3 billion (US 218 million). **Table 55** details some of the sector’s performance indicators in 2016.<sup>250</sup>

Table 55: MFI Sector Performance Indicators and Prudential Standards (%)

Ratios / Criteria	Standard	March-16	June-16	Sep-16	Dec-16
<b>Performance indicators</b>					
Return on equity ratio	>15%	1.1%	1.2%	0.7%	5.2%
Operational self-sufficiency	>130%	108.4%	105.1%	102.5%	107.1%
Operating margin	>20% Operating profit	7.7%	3.9%	2.3%	11.5%
<b>Prudential standards</b>					
Capitalization standard	≥15%	-	-	-	200%
Limitation of transactions other than savings and credit activities	≤5%	-	-	-	113%
General reserve	≥15%	-	-	-	15%
Covering medium and long-term uses with stable resources	≥100%	-	-	-	69%

Source: Department of Supervision and Control of Decentralized Financial Systems, Government of Burkina Faso

### 3.3.3 Informal Financial Institutions

A 2017 World Bank study found that 38% of adults in Africa had borrowed money from an informal FI as opposed to 5% who borrowed from a formal FI. Although informal borrowing occurs at different rates across Africa, roughly 100 million adults in Sub-Saharan Africa use informal sources of finance.<sup>251</sup> The informal financial sector often serves as a major source of savings and credit services for women, the low-income population and others who lack access to formal institutions. Informal financial institutions typically include individual money lenders as well as collective entities such as Rotating Savings and Credit Associations and Accumulated Savings and Credit Associations, among other groups.<sup>252</sup>

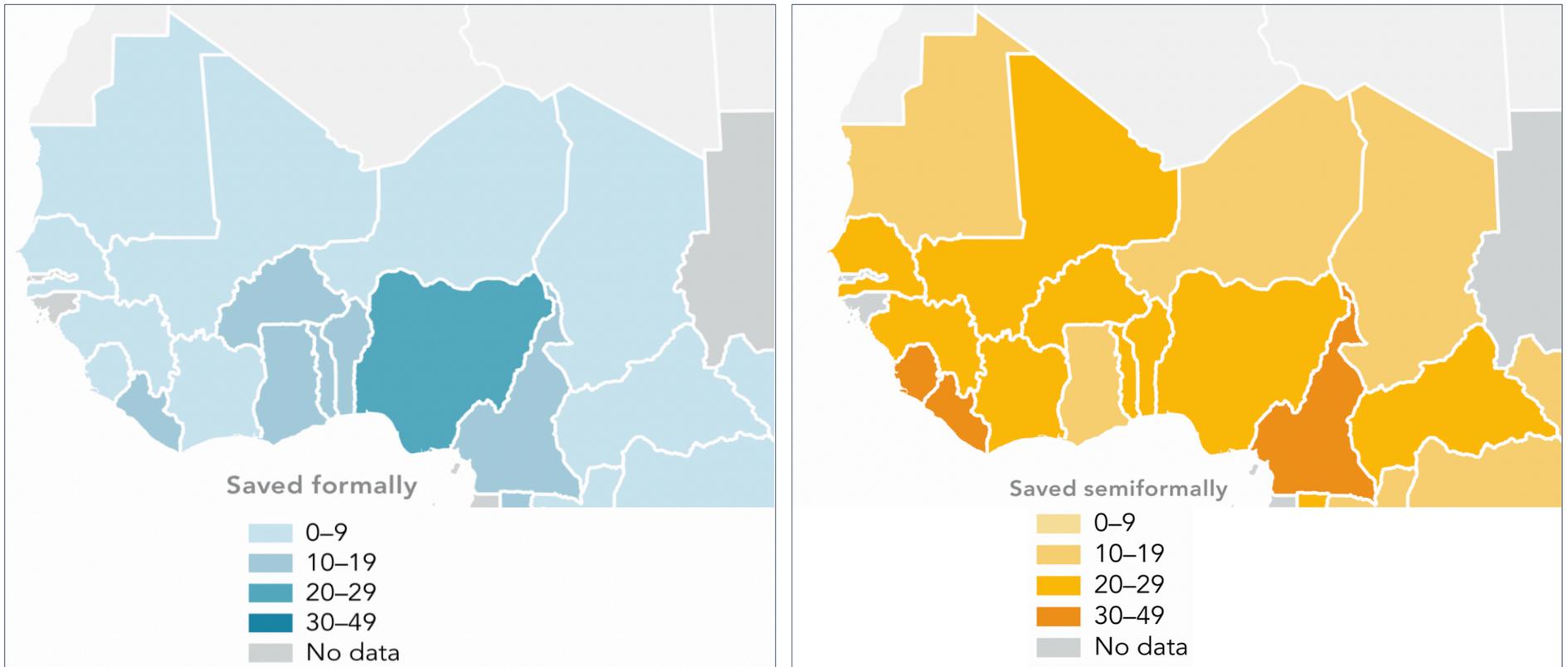
Much like in other African states, there is a large informal financial sector in Burkina Faso (**Figure 62**). Data from this sector remains limited, largely due to the informal nature of these institutions, which does not facilitate access to information on their practices, cost standards and transaction levels. The World Bank’s Findex survey found that between 2011 and 2014, borrowing from FIs increased while borrowing from informal lenders decreased slightly over the same period (**Figure 63**).

<sup>250</sup> “Rapport 2017 de la Direction de la Surveillance et du Contrôle des SFD” DGTCP,” (June 2017), General Directorate of the Treasury and Public Accounting, Government of Burkina Faso.

<sup>251</sup> “Demirguc-Kunt, A., Klapper, L., and Singer, D., “Financial Inclusion and Inclusive Growth: A Review of Recent Empirical Evidence,” World Bank Policy Research Working Paper 8040, (April 2017): <http://documents.worldbank.org/curated/en/403611493134249446/pdf/WPS8040.pdf>

<sup>252</sup> Klapper, L., Singer, D., “The Role of Informal Financial Services in Africa,” Journal of African Economies, (24 December 2014): [https://academic.oup.com/jae/article-abstract/24/suppl\\_1/i12/2473408?redirectedFrom=fulltext](https://academic.oup.com/jae/article-abstract/24/suppl_1/i12/2473408?redirectedFrom=fulltext)

Figure 62: Share of Adults Saving in the Past Year (%), 2017<sup>253</sup>



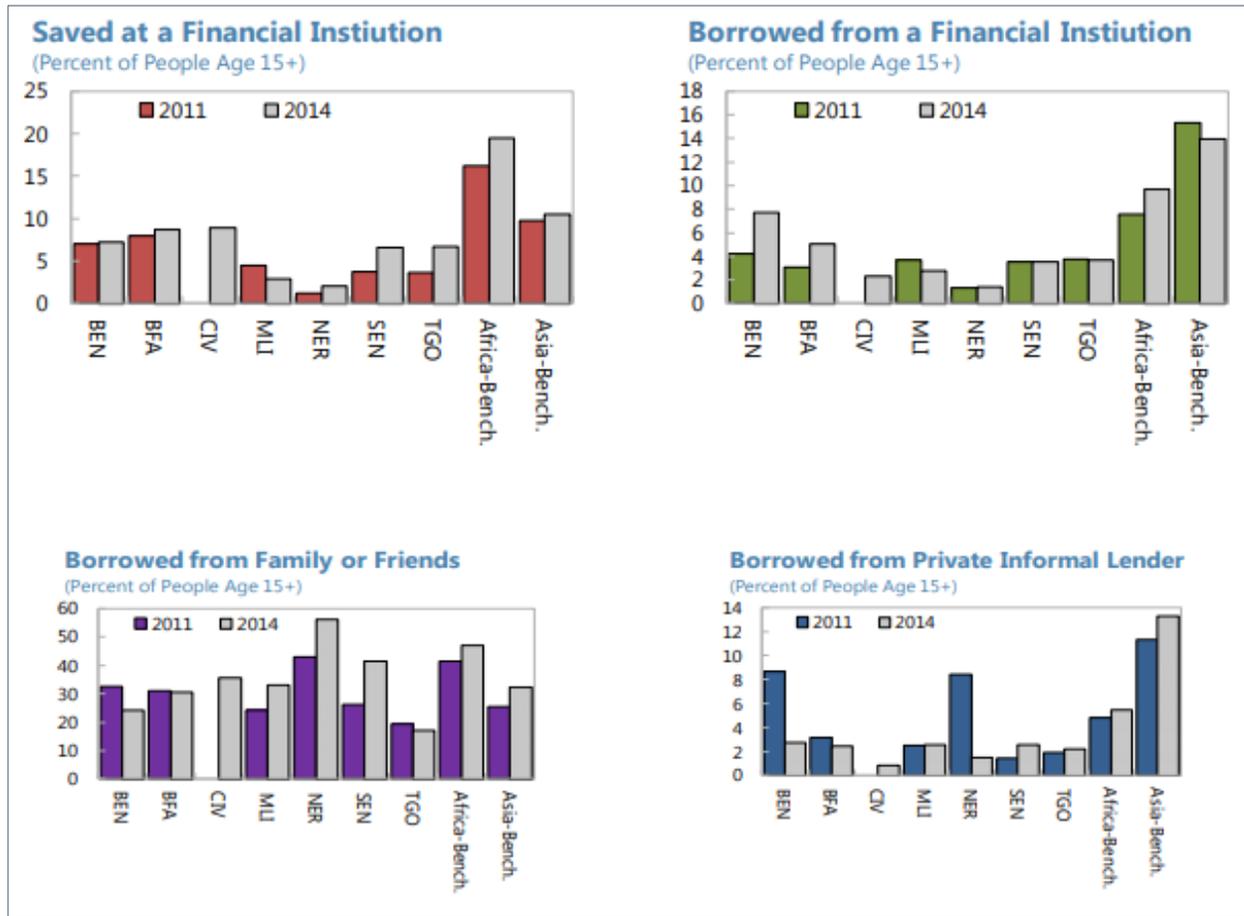
NOTE: Maps exclude Cabo Verde (no data)

Source: World Bank Global Findex Database

**Figure 62** shows how the savings behavior of adults varies in West Africa and the Sahel. The shade of the country corresponds to the magnitude of the indicator; the darker the shade, the higher the value. Saving semi-formally is much more common than saving formally across the region, including in Burkina Faso.

<sup>253</sup> Demircuc-Kunt et al., 2017.

Figure 63: Informal Financial Sector Indicators in WAEMU, 2011 and 2014<sup>254</sup>



Source: International Monetary Fund

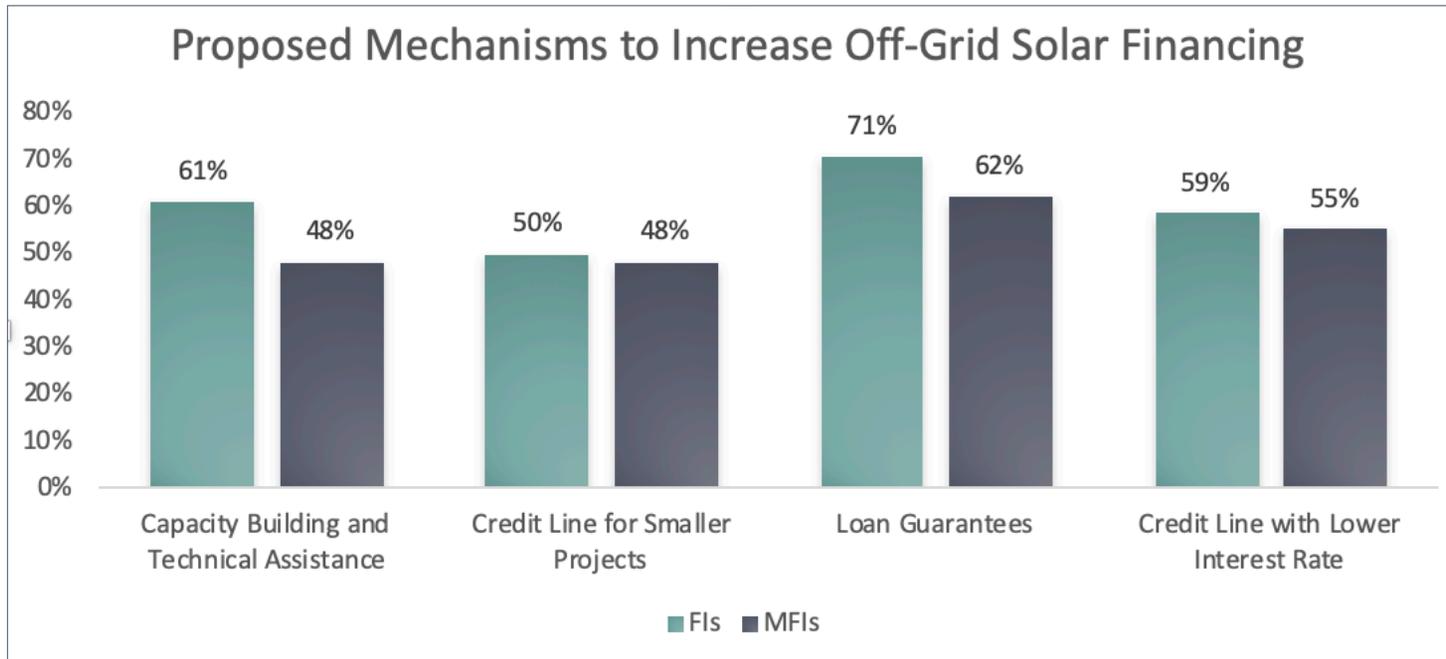
<sup>254</sup> "West African Economic and Monetary Union," International Monetary Fund, (2016): [https://www.imf.org/~media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/scr/2016/\\_cr1698.ashx](https://www.imf.org/~media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/scr/2016/_cr1698.ashx)

### 3.4 Summary of Findings

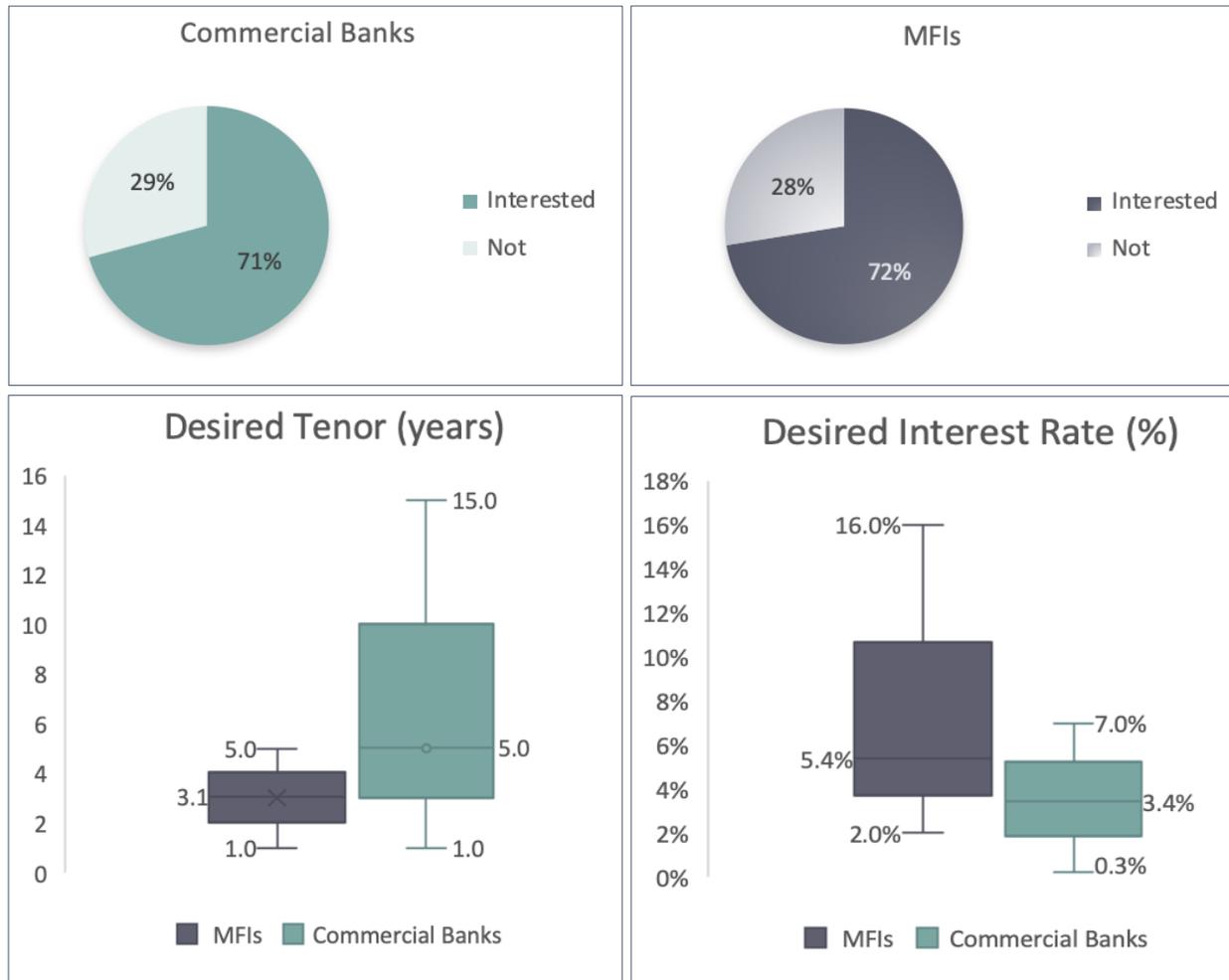
- **Opportunity for ROGEP Credit Lines:** Burkinabe banks lack access to funding with the interest rates and tenors required to make off-grid solar projects attractive to end-users and SMEs. Local currency cost of capital remains very high for FIs, which in turn results in prohibitively high pricing for typical loans. Furthermore, loans are usually short-term, as customer deposits (mostly short-term) remain the largest source of funding for banks. This dynamic severely constrains OGS market growth. Stakeholder interviews revealed that there is indeed an opportunity for ROGEP credit lines to provide liquidity to local commercial banks and MFIs to support lending to the off-grid solar sector.
- **Local Currency and Pricing:** Most loans to off-grid enterprises and all loans for consumer purchases of stand-alone solar devices must be denominated in local currency. However, taking up hard currency denominated credit lines presents challenges for local lenders who would have to bear the FX risk. This risk is somewhat mitigated in Burkina Faso, however, as the CFA franc is pegged to the euro, which shields it from volatile currency fluctuations. As a result, even after pricing in a hedge to cover this risk, many hard currency denominated credit lines can stay attractive, as the all-in cost of capital to local FIs is manageable to provide competitive offers to borrowers.
- **Collateral Requirements:** The collateral requirements of commercial banks in Burkina Faso are extremely high, particularly for small firms. Moreover, lenders already in the space are deeply constrained from originating loans where the borrower cannot meet these requirements. Hence, the use of third-party *pari-passu* guarantees as an alternative form of collateral would enable banks to extend loans to borrowers without such high collateral requirements. Accordingly, many of the interviewed commercial banks emphasized the need for partial credit guarantees to encourage lending to the OGS sector (50% coverage is helpful; 70-80% coverage could be transformative). However, pricing from most available third-party guarantors can be in the range of 3%+ per annum, which some lenders view as too high to remain competitive. This creates an opportunity for ROGEP to either provide low-cost guarantees directly or to subsidize the premiums offered by existing third-party guarantors such as GuarantCo, Afrexim and Africa Guarantee Fund.
- **Risk Perception of New Lenders:** In order to attract additional lenders into the off-grid solar market segment, there is need for strong, reasonably priced credit enhancement mechanisms. In order to cover “market entry” risks for lenders unwilling to enter this market, guarantee instruments that cover first loss are needed. However, first-loss coverage, while necessary for attracting new lenders to the off-grid sector, does not address the key issue of collateral and is therefore likely insufficient on its own to stimulate growth in FI engagement unless coupled with third-party guarantee coverage.
- **Technical Assistance:** A well designed TA intervention is critical to accelerating OGS lending in the country. Stakeholder interviews revealed the following key areas of support: training of bank credit department and account representative personnel to originate deals and appropriately assess the credit risk of stand-alone solar firms and projects; extensive due diligence support to qualify products and approving vendors; and targeted support for new lenders to the sector with product structuring and development as well as building deal-flow. The TA intervention should build upon previous and existing programs such as SUNREF to avoid duplication of efforts. Special attention should also be paid to offering advisory services on the side of the stand-alone solar enterprises. Lenders opine that these entrepreneurs often do not have proper financial management and accounting systems in place, are unable to present quality financial models and lack the expertise required to structure their companies to take on debt obligations.

- **Digital Financial Services:** The advent of digital financial services and mobile money is one of the most important developments in off-grid solar market development to date, as it has allowed new and innovative business models to emerge that are now driving unprecedented growth in the sector. Mobile communication technology facilitates payments for solar products and systems (lease-to-own, pay-as-you-go) and/or for electricity usage (energy-as-a-service) and enables monitoring for operations and maintenance of equipment. Expanding access to mobile money services also creates new opportunities to better serve women, the lower-income population, and other groups that are traditionally excluded from the formal financial system. The Government should take steps to support capacity building of and foster linkages between off-grid solar companies operating in the market and key stakeholders from various sectors, including energy access policymakers and regulators, financial and telecommunications companies, mobile network operators, financial service providers (commercial banks and microfinance institutions), mobile money service providers, international organizations, NGOs and civil society groups involved in financial inclusion etc.

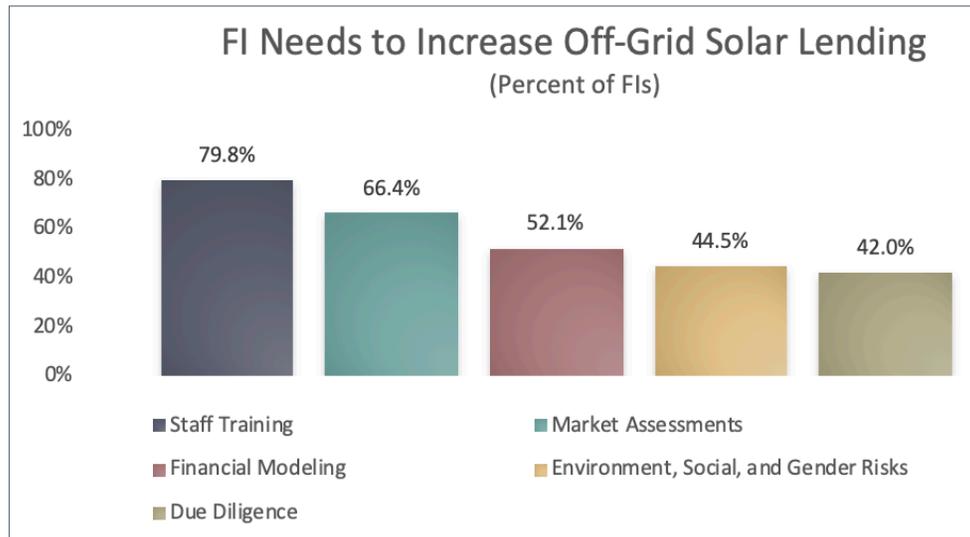
Key findings from the Task 3 FI survey activity are presented below. The results are based on feedback from a total of 121 FIs (including commercial banks, microfinance institutions and other non-bank FIs) that were interviewed across the 19 ROGEP countries. This summary only focuses on responses from commercial banks and MFIs, which together account for 92% of all respondents. See **Annex 3** for more details.



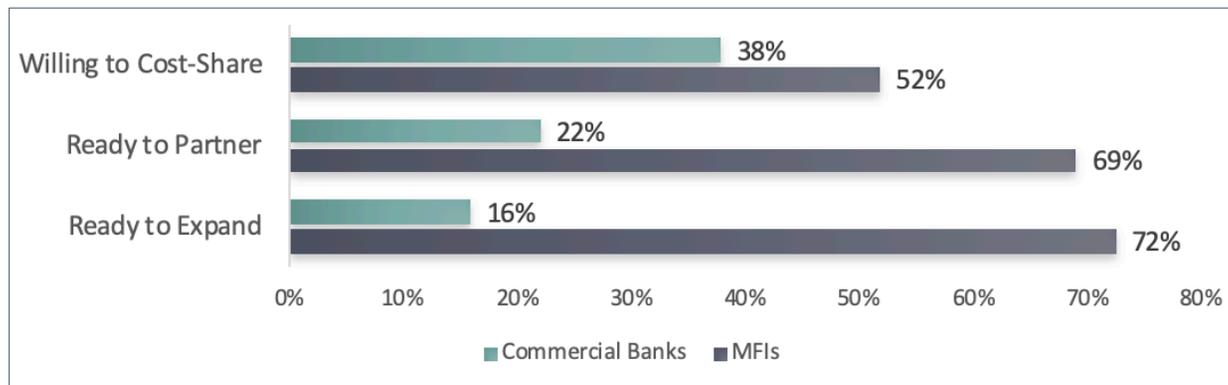
According to the survey, there is strong financial-sector interest across ROGEP countries to finance renewable energy projects, especially in off-grid solar. Commercial banks and MFIs identified loan guarantees as the most important measure that could improve their capacity to lend to the renewable energy sector. Most of the surveyed institutions also identified clear interest in credit lines.



More than 70% of surveyed commercial banks and MFIs are interested in a credit line to finance off-grid solar projects. Commercial banks want tenors of 1-15 years and interest rates from 0.25-7%. MFIs are seeking tenors of 1-5 years with interest rates from 2-16%. On average, commercial banks want a credit line with a 5-year tenor and 3.4 % interest rate, and MFIs want a 3.1-year tenor with 5.4% interest rate.



In addition to their clear interest in credit lines and loan guarantees to finance off-grid projects, surveyed financial institutions (commercial banks and MFIs) in ROGEP countries also identified several areas of internal capacity that require improvement in order to lend (or increase lending) to the off-grid solar sector.



Compared to commercial banks, MFIs reported a greater willingness to cost-share capacity building activities and a higher level of readiness to partner with solar companies and expand operations to serve rural and off-grid areas.

## ANNEX 1: TASK 1 METHODOLOGY

### STATE OF ENERGY ACCESS AND ENABLING MARKET ENVIRONMENT

Data presented in this section was collated from a range of public documents and reports as well as primary source documents either provided by ECREEE or obtained through supplemental market research (desk research and interviews with local public officials and industry stakeholders). These findings were subsequently corroborated by attendees of national validation workshops held in each country at the conclusion of the market assessment. Information obtained from the Task 2 focus group discussions and surveys of industry stakeholders (see **Annex 2**) was also used to support the Task 1 analysis.

### GIS DATA ANALYSIS APPROACH / METHODOLOGY

#### 1. Categorizations, key definitions and datasets for geospatial least-cost analysis

The main steps of the GIS analysis are as follows:

- (i) Categorization/definition of settlements: scenario 2023;
- (ii) Categorization/definition of settlements: scenario 2030;
- (iii) Definition of un-electrified settlements within grid areas; and
- (iv) Determination of population per settlement

##### 1.1. Categorization/definition of settlements: Scenario 2023

- 1.1.1. *Electrification by grid extension* – settlements which are located within 5 km of the current electrical grid network<sup>255</sup> (according to WAPP densification plans).
- 1.1.2. *Electrification by mini-grid* – settlements that:
  - Are located within 15 km of areas that have a high night-lights value (above 50/225 on grayscale raster)<sup>256</sup> and are outside the buffer area established for electrification by grid extension.
  - Are located within areas that have a population density of more than 350 people per km<sup>2</sup> (as defined by Eurostat for rural areas),<sup>257</sup> plus an additional 50 people per km<sup>2</sup> for greater feasibility of mini-grids<sup>258</sup> and are within 1 km<sup>259</sup> of a social facility (education center or health facility) and existing mini-grids of 2018.
- 1.1.3. *Electrification by off-grid stand-alone systems* – settlements that do not fall into the above categories

##### 1.2. Categorization/definition of settlements: Scenario 2030

- 1.2.1. *Electrification by grid extension* – settlements which are located within 15 km of the current electrical grid network (average distance mentioned by energy utilities in West Africa) or within 5 km of planned future line extensions<sup>260</sup>

<sup>255</sup> NOTE: Low-voltage distribution lines were not considered in this analysis (data was unavailable)

<sup>256</sup> The 50/225 classification represents the areas emitting light of the country with reduction of scattering light. The classification was first introduced in the USAID report ZAMBIA ELECTRIFICATION GEOSPATIAL MODEL and evaluated in cross-checks throughout the country. USAID: [https://pdf.usaid.gov/pdf\\_docs/PA00T2JC.pdf](https://pdf.usaid.gov/pdf_docs/PA00T2JC.pdf)

<sup>257</sup> <http://ec.europa.eu/eurostat/web/rural-development/methodology>

<sup>258</sup> Identified in discussions with different international mini-grid developer.

<sup>259</sup> Preferred maximum distance for mini-grids from discussions with different international developer.

<sup>260</sup> NOTE: Low-voltage distribution lines were not considered in this analysis (data was unavailable)

1.2.2. *Electrification by mini-grid* – settlements that:

- Were defined as mini-grid settlements in scenario 2023
- Are located within 1 km of the above mini-grid settlements, which is the preferred distance of mini-grid developers for their grid according to discussions with several international developers.
- Are located within 15 km of economic growth centers – airports, mines and urban areas; average worker distance in Africa is 10 km, a distance of 5 km is added to include the growth of businesses in the periphery of the growth centers.<sup>261</sup>

1.2.3. *Electrification by off-grid stand-alone systems* – settlements that do not fall into the above categories

**1.3. Definition of un-electrified settlements within grid areas**

To identify settlements that are located close to the national electrical grid but are not served by it, the following criteria were used:

- Within the main grid line zones (see buffer zones for *electrification by grid extension* above)
- Outside 15 km night-lights of buffered areas to capture the densification within 5 years
- Within areas of less than 1,000 people

**1.4. Determination of population per settlement**

A key component of the least-cost analysis was the number of people living in each settlement (city, town, village, hamlet) of a given country. While there are different publicly available sources of information on total population (e.g. World Bank demographic data), a more granular view of the population distribution was necessary to perform the geospatial analysis.

Another difficulty was the identification of locations of settlements. The exact location of each settlement (with given coordinates) was not available / accessible in many of the countries. As a result, the least-cost analysis had to revert to other studies of population distribution – such as the population distribution developed by WorldPop. WorldPop utilizes a range of geospatial datasets to develop accurate population data:

*“New data sources and recent methodological advances made by the WorldPop program now provide high resolution, open and contemporary data on human population distributions, allowing accurate measurement of local population distributions, compositions, characteristics, growth and dynamics, across national and regional scales. Statistical assessments suggest that the resultant maps are consistently more accurate than existing population map products, as well as the simple gridding of census data.”<sup>262</sup>*

A Voronoi polygon analysis<sup>263</sup> was used to create boundaries for each identified settlement. These boundaries were then used in combination with the population density layer to estimate the total settlement population of the given year. The current annual national population growth rate of 2.9%<sup>264</sup> was applied to the geospatial analysis to project populations for the Scenario 2023 and 2030 analyses.

<sup>261</sup> Lall, Somik Vinay; Henderson, J. Vernon; Venables, Anthony J. 2017. Africa's Cities: Opening Doors to the World. Washington, DC: World Bank. © World Bank. <https://openknowledge.worldbank.org/handle/10986/25896> License: CC BY 3.0 IGO.

<sup>262</sup> <https://www.worldpop.org>

<sup>263</sup> To learn more about Voronoi polygons, see wikidot: <http://djjr-courses.wikidot.com/soc128:qgis-voronoi-polygons>

<sup>264</sup> <https://data.worldbank.org/indicator/SP.POP.GROW?locations=BF>

## 2. Summary of Key Datasets

The table below summarizes the key datasets used for scenarios 2023 and 2030 as well as the criteria applied, and sources used.

Overview of Key Datasets of the Least-Cost Electrification Analysis								
Dataset	Description	Criteria used by technology						Source and Year
		Scenario 2023			Scenario 2030			
		On-grid	Mini-grid	Off-grid	On-grid	Mini-grid	Off-grid	
Electricity grid network (current)	Current national grid network (HV & MV lines)	≤ 5km distance	≥ 5km distance	≥ 5km distance	≤ 15km distance	≥ 15km distance	≥ 15km distance	SONABEL, 2014 <sup>265</sup>
Electricity grid network (planned)	Future network planned to be built (HV & MV lines)	Not considered	Not considered	Not considered	≤ 5km distance	≥ 5km distance	≥ 5km distance	SONABEL, 2014 <sup>266</sup>
Mini-grids	Existing mini-grids in 2018	Not considered	≤ 1km distance	≥ 1km distance	Not considered	≤ 1km distance from all identified mini-grids in Scenario 2023	≥ 1km distance from all identified mini-grids in Scenario 2023	ECOWREX, 2018 <sup>267</sup>
Night-lights	Night-time light emissions used to identify electrified areas	Not considered	≤ 15km distance	≥ 15km distance	Not considered	Not considered	Not considered	NASA Earth Observatory, 2016
Population density	Population distribution in people per km <sup>2</sup> .	Used	Used	Used	Used	Used	Used	Facebook Lab and CIESIN, 2015 <sup>268</sup>
Settlements	Settlement layer giving location of settlements across Burkina Faso	≥ 1,000 people per settlement	≥ 1,000 people per settlement	≤ 1,000 people per settlement	Not considered	≥ 1,000 people per settlement	≤ 1,000 people per settlement	GMG Market Assessment, 2017 <sup>269</sup>

<sup>265</sup> Societe Nationale D'electricite du Burkina Faso; digitized by SEforALL Africa Hub & AFDB, Green Mini-grid Market Development Programme, Mini-grid Market Opportunity Assessment: Burkina Faso, June 2017.

<sup>266</sup> Ibid.

<sup>267</sup> <http://www.ecowrex.org/mapView/index.php?lang=eng>

<sup>268</sup> Facebook Connectivity Lab and Center for International Earth Science Information Network - CIESIN - Columbia University. 2016. High Resolution Settlement Layer (HRSL). Source imagery for HRSL © 2016 DigitalGlobe.

<sup>269</sup> SEforALL Africa Hub & AFDB, Green Mini-grid Market Development Programme, Mini-grid Market Opportunity Assessment: Burkina Faso, June 2017.

**ECREEE: OFF-GRID SOLAR MARKET ASSESSMENT AND PRIVATE SECTOR SUPPORT FACILITY DESIGN**

Social facility: education centers	All education centers with GPS coordinates of 2012; Indicator of active local economy	Not considered	≤ 1km distance <sup>270</sup>	≥ 1km distance	Not considered	Not considered	Not considered	IGB <sup>271</sup> , 2012
Social facility: health centers	All health centers with GPS coordinates of 2012; Indicator of active local economy	Not considered	≤ 1km distance <sup>272</sup>	≥ 1km distance	Not considered	Not considered	Not considered	IGB, 2012
Growth center: airport, mines, urban areas	Economic growth centers for the analysis up to 2030 - defined for mini-grid areas; Urban areas as defined by Electricity Demand	Not used	Not used	Not used	Not considered	≤ 15km distance	≥ 15km distance	airports: Humanitarian Data Exchange (HDX), 2017 mines: HDX, 2015 urban areas: ECOWREX website, 2015 <sup>273</sup>

<sup>270</sup> Preferred maximum distance for mini-grids from discussions with different international developer.

<sup>271</sup> Institut Géographique du Burkina

<sup>272</sup> Preferred maximum distance for mini-grids from discussions with different international developer.

<sup>273</sup> <http://www.ecowrex.org/mapView/index.php?lang=eng>

## ANNEX 2: TASK 2 METHODOLOGY

### OFF-GRID SOLAR PV MARKET ASSESSMENT METHODOLOGY

Focus Group Discussions (FGDs) were held in Ouagadougou and Bobo-Dioulasso in June 2018 with key stakeholders from each of the four off-grid market segments analyzed under Task 2: (i) household, (ii) institutional, (iii) productive use, and (iv) supplier. Focus group participants included representatives from government, the donor community, NGOs, solar companies, business and industry associations, academia, community groups, and women's groups. Each market segment had its own dedicated meeting, although some stakeholders attended more than one discussion. Each FGD lasted approximately 90 minutes and covered a range of topics related to demand for off-grid solar vis-à-vis each market segment.

In addition to the FGDs, three additional survey activities were undertaken to support the Task 2 analysis: (i) a survey of large-scale international solar companies to gauge their level of interest in the country and wider region; (ii) a survey of local small-scale retail suppliers of solar equipment; and (iii) an assessment of an off-grid village to better understand how solar was being utilized for productive uses. The FGDs and surveys largely yielded qualitative inputs to supplement the quantitative analysis that was undertaken.

The methodology and assumptions utilized to assess each market segment under Task 2 is presented below.

#### 1. HOUSEHOLD DEMAND

##### 1.1 Household market segments

- 1.1.1 Total population without access to electricity was calculated using World Bank total population figures,<sup>274</sup> multiplied by electricity access rates from the International Energy Agency (IEA),<sup>275</sup> and translated to households using World Bank open data average household size. This method is used to align population data throughout the report, with IEA seen as an overarching source for energy access data and the World Bank providing important population and household income data. See **Annex 1** for more details.
- 1.1.2 Based on the country demographic and income data, the household solar market was broken down into segments by income quintile, as shown in **Section 2.1.1**. For the purpose of this analysis, income quintiles were aligned with energy tiers, as indicated by the Multi-Tier Energy Access Framework, which is roughly determined by household ability to pay for tier levels of energy. Quintiles were also aligned roughly with geographic segments.
- 1.1.3 World Bank demographic data used does not provide household income data broken down by rural, urban, on-grid or off-grid. For example, the data shows the total population falling under a certain poverty line, shows the total population that does not have access to electricity, and shows the total population that is rural, but does not cross reference any of these indicators to e.g. show the total rural population without access to electricity living under the poverty line. For this reason, assumptions were made regarding the number of households per income quintile that are off-grid (detailed in section 1.3.1 of these assumptions). It was assumed that the majority of off-grid households are rural. The data gap prevents the presentation of an overlapping map of the traditional poverty line income pyramid with electricity access.

<sup>274</sup> World Bank Open Data, 2017: <https://data.worldbank.org/>

<sup>275</sup> IEA Energy Access Outlook, 2017:

[https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport\\_EnergyAccessOutlook.pdf](https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport_EnergyAccessOutlook.pdf)

1.1.4 Tier 4 is not included in this analysis since the off-grid solar systems that can provide a Tier 4 level of service are beyond the reach of the vast majority of the population.

## 1.2 Household energy expenditure and potential savings

1.2.1 Current household expenditure on energy-related items (believed to be candidates for replacement with solar products) was estimated using information from the Focus Group Discussions (FGDs).

1.2.2 From the existing household expenditures, “typical” monthly costs were estimated that households would incur in order to receive a standard level of electricity service according to the Multi-Tier Energy Access Framework.

1.2.3 The unit monthly costs were used for each of the energy-related items identified above.

1.2.4 The cumulative monthly expenditure was then determined for each tier.

1.2.5 Monthly expenditure by tier was compared with monthly cost associated with OGS products by tier to estimate potential household cost savings. Monthly cost for OGS products was based on representative data from the West African region.

1.2.6 In the process of this analysis, the following assumptions were made:

1.2.6.1 Solar system sizes and costs:

- Cost per watt on solar systems vary greatly and have changed rapidly in the past five years. Smaller pico and plug and play systems have a much higher per cost per watt. The USD/Watt prices are based on sample cost ranges from Lighting Global equipment available on the open market.
- Average system size by watts: values are chosen as representative values for solar systems from each of the Tier values. They are intended to represent system sizes that typical members of each group would purchase.
- Average system life values represent typical expected operating life of Lighting Global products.

1.2.6.2 Current household energy usage:

Current Household Energy Usage (# Units/HH)				
Technology	Tier 1	Tier 1.5	Tier 2	Tier 3
Torch lights/Lanterns	1	2	3	
Mobile Phone Charging	1	1	2	
DC Radio	-	1	-	-
DC Music Player/Radio	-	-	1	-
Small Generator	-	-	-	1

- Numbers of units of torch lights/lanterns, cell phones, dc radio, and small generator represent the numbers of appliances that are demonstrated to be in use in typical households of each tier based on FGDs and multiple survey documents.

1.2.6.3 Current household energy costs

- Typical purchase and operation costs of HH off-grid appliances were based on FGDs, field energy surveys and reports.

### 1.3 Total Cash and Financed Market for Off-Grid Solar

1.3.1 Beginning with World Bank demographic and population data for Burkina Faso, the number of off-grid households by income quintile was derived. For this, a percentage of off-grid households by quintile was assumed, as follows:

Quintile	% Off-Grid
Highest 20%	26%
Fourth 20%	85%
Third 20%	90%
Second 20%	99%
Lowest 20%	100%

It was assumed that there is a general correlation between income and access to electricity. The highest quintile has the highest percentage of population that are both urban and connected to the grid. Evidence indicates that the vast majority of households connected to the grid are from the top two quintiles. Similarly, it was assumed that virtually all people in the bottom two quintiles are off-grid.

1.3.2 From this, average household energy expenditure was determined based on income, with the assumption that all households spend an average of 10% of their income on energy.

Average rural household expenditure on energy varies considerably. A study from Sierra Leone found that the “cost of lighting, on average, occupied between 10-15% of household incomes. Households using generators were found to spend a greater proportion of their income (upward of 20%) on lighting.”<sup>276</sup> Other research has shown household energy spending between 6-12% for low income segments in sub-Saharan Africa.<sup>277</sup> For the purpose of this research, we have assumed that households can allocate 10% of their income on average to energy.

1.3.3 The monthly energy budget for each household per quintile was calculated by multiplying monthly Household income by the assumed 10% of Household income spent on energy. Monthly Household income per month was calculated by multiplying per capita income per month by the avg. # of persons/household. Per capita income per month for each quintile is calculated by dividing the Share of the country GDP for each quintile by the population of each quintile, which is one-fifth of the country population. The share of the country GDP for each quintile is based on World Bank, World Development Indicators demographic data.

1.3.4 A simple model was used to evaluate the market using the World Bank income quintile data and average energy expenditures as input data.

1.3.5 In determining the monthly energy expenditure related to each tier, the following assumptions were made with guidance from the FGDs output:

<sup>276</sup> Lai, K., Munro, P., Kebbay, M., and Thoronko, A., “Promoting Renewable Energy Services for Social Development in Sierra Leone: Baseline Data and Energy Sector Research, Final Report,” European Union, (July 2015).

<sup>277</sup> 10% is an acceptable figure for lighting and cell phone charging costs for low income groups. See:

<https://www.brookings.edu/blog/africa-in-focus/2017/03/17/figures-of-the-week-benefits-of-off-grid-electricity-solutions/>

- **Tier 0:** Assumed to be an absolute energy poor household, relying solely on kerosene and charcoal both for cooking and lighting.
  - **Tier 1:** The household was assumed to have access to 1 torch light/lantern powered by dry cells, charging services for a phone charged on average 8 times a month.
  - **Tier 1.5:** The household was assumed to have access to 1 torch light and 1 lantern each powered by dry cells, one regular cell phone charged on average 8 times a month, and a radio powered by dry cells (assume access to 2 low quality cells) replaced 4 times a month.
  - **Tier 2:** The household was assumed to have access to 1 torch light and 2 lanterns each powered by dry cells, one regular cell phone charged on average 8 times a month, and one smart phone charged on average 16 times a month, a radio/music player powered by dry cells (assume access to 4 low quality cells), replaced 4 times a month.
  - **Tier 3:** The household was assumed to have access to a generator powering a number of appliances but available only for 2-3 hours a day.
  - **Annualized energy costs** for each of the systems =  $([\text{Capital system cost}/\text{average system life in years}] + [\text{Monthly operating cost} * 12])$
- 1.3.6 The potential market size for each solar tier was then calculated by multiplying the number of off-grid households per quintile that will be willing to pay for each solar tier by the cost of each system (system cost is based on representative data from Burkina Faso, as shown in 2.2.5).
- 1.3.7 In determining the number of off-grid households per quintile that will be willing to pay for each solar tier, the key assumption of the model is that each off-grid household purchases one system and that they will opt for the highest solar system tier they can afford.
- For cash purchases, the assumption was that they will be willing to save up to three months of their monthly energy budget to purchase the system.
  - For PAYG/financed, the assumption was that they will be willing if their monthly energy budget is less than or equal to the monthly PAYG payment AND if the PAYG up-front payment is less than or equal to 3 months of their monthly energy budget.
- 1.3.8 The interest rate for consumer finance was conservatively estimated to be 24% p.a., based on the interest rate cap for Microfinance Institutions in WAEMU countries.<sup>278</sup>

### **2023 and 2030 Household Demand Scenario: Assumptions**

1. The GIS analysis<sup>279</sup> estimated that by 2023, 43.8% of the population will be connected to the national grid, 23.1% will be connected by mini-grids while 33.1% of the population will be connected by off-grid stand-alone solutions. By 2030, the GIS analysis estimated that 79.7% of the population will be connected to the national grid, 7.3% will be connected by mini-grids while 13.0% of the population will be connected by off-grid stand-alone solutions. Based on these dynamics in the demographic patterns, coupled with the existing government plans, the following assumptions regarding the off-grid population based on the quintiles were made:
  - In the 2023 scenario, it was assumed that as the grid gets extended and mini-grids are deployed (based on GIS data), the households in the quintiles with the highest income will be given priority due to their relatively higher power demand and ability to pay for power consumption.

<sup>278</sup> Ferrari, A., Masetti, O., Ren, J., "Interest Rate Caps: The Theory and the Practice," World Bank Policy Research Working Paper, (April 2018): <http://documents.worldbank.org/curated/en/244551522770775674/pdf/WPS8398.pdf>

<sup>279</sup> See **Annex 1** for GIS methodology.

Hence, the highest four quintiles were assumed to have only 1%, 2%, 3%, and 59% off-grid households respectively, while the lowest quintile was assumed to have 100% off-grid households. These assumptions have been made such that the total number of off-grid households assumed is equal to the GIS data 2023 estimate.

- Similarly, in the 2030 scenario, it was assumed that the higher income quintiles will be prioritized for electrification, based on economic considerations, above the lower quintiles. Hence, the highest four quintiles were assumed to have only 1%, 2%, 3%, and 4% off-grid households respectively, while the lowest quintile was assumed to have 55% off-grid households. These assumptions have been made such that the total number of off-grid households assumed is equal to the GIS data 2030 estimate.

Quintile	% Off-Grid (2023)	% Off-Grid (2030)
Highest 20%	1%	1%
Fourth 20%	2%	2%
Third 20%	3%	3%
Second 20%	59%	4%
Lowest 20%	100%	55%

2. Inflation rates for Burkina Faso: According to the IMF World Economic Outlook data, inflation in Burkina Faso is estimated to be at 2% in 2023. It was assumed that the rate will remain the same through 2030. Based on this assumption, the expected prices of the current household energy technologies and the solar alternatives were estimated using an annual price escalation factor of 1.02.
3. Based on a 2.9% population growth rate from the World Bank<sup>280</sup> and the population density dataset used in the study, the estimated total population will be 22,070,950 in 2023 and 26,960,543 in 2030.
4. The least-cost electrification analysis found that the share of the population with access to electricity via the national grid and mini-grids will be 66.9% in 2023 and 87.0% in 2030.
5. To estimate GDP, it was assumed that the current annual GDP growth rate of 6.7% will be maintained through 2023 and 2030:

Parameter	2023	2030
Population	22,070,950 (GIS estimate)	26,960,543 (GIS estimate)
GDP (constant 2010 USD)	\$19,501,290,229	\$30,705,366,233

6. According to the Lighting Global Off-Grid Solar Market Trends Report 2018,<sup>281</sup> the price of pico solar products is expected to fall to USD 10.60 in 2020 and USD 10.10 in 2022 down from USD 10.90 in 2016. Based on these 2020 and 2022 figures, the average annual decrease in prices from 2020 was estimated at 2.36%. It was assumed that the annual price decrease will be maintained at this rate through 2030 (annual cost reduction factor of 0.98).
7. According to the same report, the price of small SHS components is expected to fall to USD 60.40 in 2020 and USD 47.40 in 2022, down from USD 77.80 in 2016. Based on these 2020 and 2022 figures, the average annual decrease in prices from 2020 was estimated at 10.76%. It was assumed that the annual price decrease will be maintained at this level through 2030 (annual cost reduction factor of 0.89).

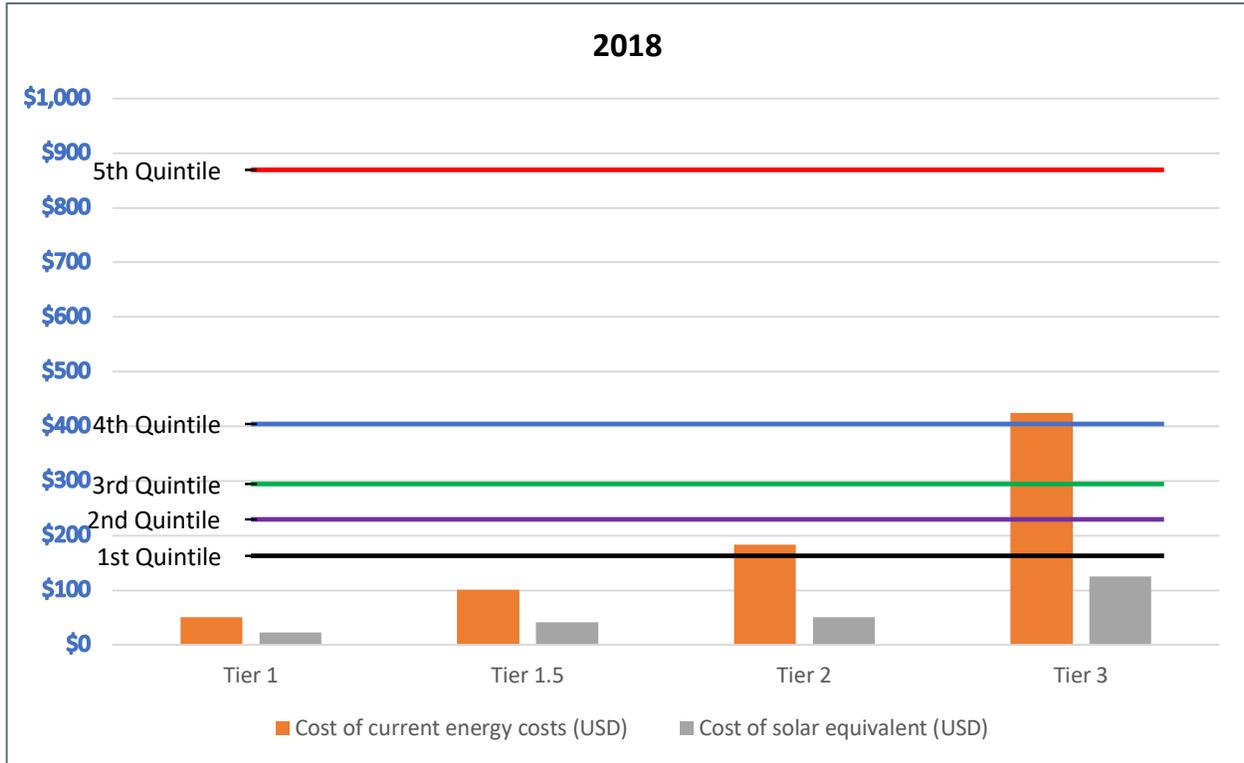
<sup>280</sup> <https://data.worldbank.org/indicator/SP.POP.GROW?locations=BJ>

<sup>281</sup> "Off-Grid Solar Market Trends Report 2018," Dahlberg Advisors, Lighting Global, GOGLA and World Bank ESMAP, (January 2018): [https://www.lightingafrica.org/wp-content/uploads/2018/02/2018\\_Off\\_Grid\\_Solar\\_Market\\_Trends\\_Report\\_Full.pdf](https://www.lightingafrica.org/wp-content/uploads/2018/02/2018_Off_Grid_Solar_Market_Trends_Report_Full.pdf)

8. It was assumed the maximum interest rates in Burkina Faso will stagnate at the current rate of 24% or possibly decline.

Household Cost Savings and Affordability Calculation:

Annual Household Energy Budget by Quintile, Annual Energy Costs and Annual Costs of Solar Equivalents



- This analysis presents annualized costs (not including financing cost) of current energy technologies for each energy tier, compared with the annual cost of an equivalent solar product. The same analysis was also completed for the 2023 and 2030 scenarios.
- Both the annual costs of current energy technologies and equivalent solar solutions considered the capital cost of each unit as well as the operating cost over the average lifetime of a unit.
- These costs were compared with a 10% monthly energy budget for households of different income quintiles. The analysis did not assess affordability for a cash vs. financed purchase over time.

## 2. INSTITUTIONAL DEMAND

### 2.1 Country Categorization

To assess institutional sector demand, the ROGEP countries were grouped into four categories based on income and population density, which are two key factors that influence the number of public service institutions in a given country. The countries were categorized as follows:

Country Categorization by Income and Population Density			
Category 1: Low-income / low population density	Category 2: Low-income / high population density	Category 3: High-income/ low population density	Category 4: High-income / high population density
Niger Burkina Faso Chad Mali Guinea Guinea-Bissau Central African Republic Liberia	Benin Sierra Leone Togo Gambia	Cameroon Côte d'Ivoire Mauritania Senegal	Nigeria Ghana Cabo Verde

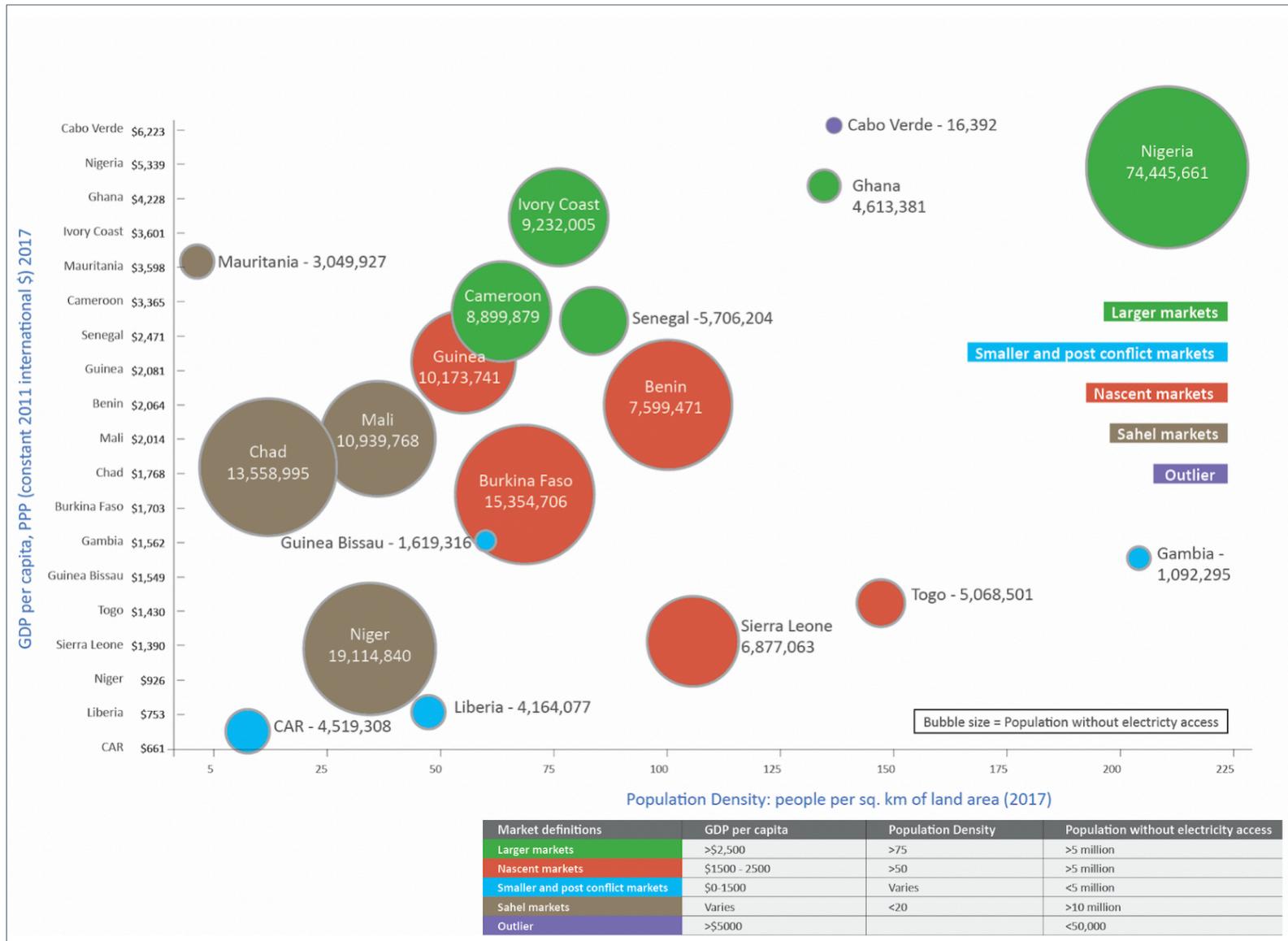
These categories were used to address data gaps, as obtaining accurate and comprehensive data on the number of off-grid public institutions in many of the countries was challenging. Where data was not available, per capita assumptions based on data from similar countries in the same category were used. The following countries were used as reference countries for each category:

Category 1	Guinea, Liberia, Niger
Category 2	Benin, Sierra Leone
Category 3	Côte d'Ivoire
Category 4	Ghana

Categories are defined as follows (and illustrated in the figure below):

- Low population density: <95 people per square km of land area
- High population density: >95 people per square km of land area
- Low income: <\$2,200 GDP per capita
- High income: >\$2,200 GDP per capita

ECREEE: OFF-GRID SOLAR MARKET ASSESSMENT AND PRIVATE SECTOR SUPPORT FACILITY DESIGN



Source: African Solar Designs analysis

## 2.2 Energy Needs by Institutional Market Segment

Institutional Sector	Description	Rating (W)	Time of use (hrs)	Total Wh/day	Total Load	Recommended system (W)
<b>Water Pumping</b>						
	Low power	1,500	6	9,000		1,500
	Medium power	4,000	6	24,000		4,000
	High power	10,000	6	60,000		10,000
<b>Healthcare</b>						
HC1 Health post	Lighting	30	8	240		
	Communication	20	8	160		
	ICT	100	8	800	1,200	250
HC2 Basic healthcare facility	Lighting	200	8	1,600		
	Maternity	200	4	800		
	Vaccine refrigeration	100	8	800		
	Communication	100	4	400		
	Medical exams	200	2	400		
	ICT	200	8	1,600		
	Staff housing	50	8	400	6,000	1,500
HC3 Enhanced healthcare facility	Lighting	400	8	3,200		
	Communication	200	8	1,600		
	Medical exams	600	2	1,200		
	ICT	300	8	2,400		
	Maternity	600	4	2,400		
	Laboratory	1,000	2	2,000		
	Sterilization	1,200	1	1,200		
	Vaccine refrigeration	150	8	1,200		
	Staff housing	200	8	1,600	16,800	4,200
	<b>Education</b>					
Primary school	Communication	20	8	160		
	Lighting	80	8	640		
	ICT	100	8	800		
	Staff house	50	8	400	2,000	500
Secondary school	Communication	20	8	160		
	Lighting	240	8	1,920		
	ICT	400	8	3,200		
	Laboratory use	100	8	800		
	Staff house	200	8	1,600	7,680	1,920
<b>Public Lighting</b>						
Street lighting	Lights	200	8	1,600	1,600	500

Source: The estimates in the table above are based on data obtained from local experts, interviews with solar industry stakeholders and corroborated by secondary desk research.

CALCULATIONS: Rating of systems is based on data for sizes of the appliances from a 2016 GIZ solar PV catalogue.<sup>282</sup> The solar PV sizing factor is based on the peak sun hours available across most of Africa.

<sup>282</sup> "Photovoltaics for Productive Use Applications: A Catalogue of DC-Appliances," GIZ, (2016): [https://www.sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/GIZ\\_2016\\_Catalogue\\_PV\\_Appliances\\_for\\_Micro\\_Enterprises\\_low.pdf](https://www.sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/GIZ_2016_Catalogue_PV_Appliances_for_Micro_Enterprises_low.pdf)

Energy Needs Assumptions:

**Water Supply:** Power requirements (low, medium, high) are based on the type of water point:

- Borehole: 40% low power pumps; 40% medium power; 20% high power
- Protected dug well: 80% no pump; 10% low power pumps; 10% medium power; no high-power
- Unprotected dug well: No pump
- Protected spring: No pump
- Unprotected spring: No pump
- Public tap/standpipe (stand-alone or water kiosk): No pump
- Sand/Sub-surface dam (with well or standpipe): No pump
- Piped water into dwelling/plot/yard: No pump
- Rainwater harvesting: No pump

**Healthcare:** The size of the healthcare facility (HC1, HC2, HC3) determines the amount of energy each facility requires.

**Education:** The size of the school and number of students determines the amount of energy each school requires.

**Public lighting:** The electricity needs of a given town/market center (assuming two [2] public lighting points per market center)

**2.3 Institutional Market Sizing Calculations**

Household systems, cost and price per watt:

System Type	Tier Rating	USD/Watt <sup>283</sup>	Average Size (Watts)	Total Cost (USD)
Pico solar system	Tier 1	\$15.00	3	\$45.00
Basic Plug and Play system	Tier 1.5	\$12.50	10	\$125.00
Small HH solar system	Tier 2	\$5.00	50	\$250.00
Medium HH solar system	Tier 3	\$2.50	250	\$625.00

Size of systems used in institutional sector market sizing calculation:

Sector	Description	Size (corrected for time of use)	HH systems
Water Supply	Low Power	1,500	N/A
	Medium Power	4,000	N/A
	High power	10,000	N/A
Healthcare	HC1	250	Tier 3
	HC2	1,500	N/A
	HC3	4,200	N/A
Education	Primary	500	N/A
	Secondary	1,920	N/A
Public lighting		500	N/A

<sup>283</sup> Cost per watt derived from African Solar Designs analysis and from IRENA:  
<https://www.irena.org/publications/2016/Sep/Solar-PV-in-Africa-Costs-and-Markets>

Institutional Sector Market Sizing Calculations:

NOTE: Prices cover only solar components (except for the HC1 tier 3 system, which comes with lighting)

Water Supply						
# of water pumps	X	Size of solar system (watts) (low, medium, high power)	X	Cost per watt for pumping (\$2.50) divided by system lifetime of 20 years	=	Estimated Annualized Off-Grid Solar Market Potential for Water Supply Sector

Healthcare						
# of healthcare facilities	X		X		=	Estimated Annualized Off-Grid Solar Market Potential for Healthcare Sector
HC 1		Cost per tier 3 system (\$625)		Divided by system lifetime of 5 years		
HC 2		Size of solar system in Watts (1500W)		Cost per watt (\$2.50) divided by system lifetime of 20 years		
HC 3		Size of solar system in Watts (4200W)		Cost per watt (\$2.50) divided by system lifetime of 20 years		

Education						
# of schools	X		X		=	Estimated Annualized Off-Grid Solar Market Potential for Education Sector
Primary		Size of solar system in Watts (500W)		Cost per watt (\$3) divided by system lifetime of 20 years		
Secondary		Size of solar system in Watts (1920W)		Cost per watt (\$2.50) divided by system lifetime of 20 years		

Public Lighting						
# of off-grid market centers	X	Size of solar system in Watts (500W)	X	Cost per watt (\$3) divided by system lifetime of 20 years	=	Estimated Annualized Off-Grid Solar Market Potential for Public Lighting Sector

**2.4 Data Collection Approach by Institutional Market Segment**

Burkina Faso			
Water Supply	Healthcare	Education	Public Lighting
GIS data	GIS data + per capita assumption	GIS data + per capita assumption	Per capita assumption

Data was collected on the total number of off-grid institutions by institutional market segment for Burkina Faso from a combination of available GIS data, input from local experts, stakeholder interviews and desk research. Where there were gaps in available data, per capita assumptions were made, as explained in **Section 2.2**.

Assumptions:

**Water Supply:** Of the identified potable water points, it was assumed that 50% will be equipped with a solar-powered water pump. Of the equipped water sources, the division of pumps between low, medium and high-powered pumps was: 50%, 35% and 15%, respectively. The lower cost of the low power pumps

is the driving factor for this assumption. Where this information was not available, a per capita comparison was made with a country in the same category.

**Healthcare:** Wherever possible, specific data on the number of off-grid healthcare facilities by size was used (i.e. HC1, HC2, HC3). Where this information was not available, a per capita comparison was made with a country in the same category.

**Education:** Wherever possible, specific data on the number of off-grid primary and secondary schools was used. Primary schools encompass both primary and nursery schools. Vocational schools and universities were not considered because they tend to be in cities, which are often grid-electrified. Where this information was not available, a per capita comparison was made with a country in the same category. The following per-capita assumptions were made:<sup>284</sup>

- **Primary school:** Per capita calculation using the off-grid population that is 0-14 years
- **Secondary school:** Per capita calculation using the off-grid population that is 15-19 years

**Public lighting:** Using population figures by region, and assuming that the population per market center was 5,000 people, the number of market centers was calculated. An assumption of two [2] public lighting points per market center was used in the calculation. No data on street lighting was included, as it was assumed that street lighting projects are linked to road infrastructure rather than institutions.

## 2.5 Ability to Pay Analysis (Strongest Potential Market Segment)

Data was not available to estimate the monthly energy expenditures of institutional users. Secondary data was available through government and donor program annual budgets for public services but was not comprehensive. A rudimentary analysis was undertaken based on these funding sources and compared to the total solar product market estimate for each institutional market segment in order to discuss the realistic potential market outlook based on the ability to pay. Due to a lack of data, the analysis was not able to take into account other potential sources of funding, such as funds pooled at the national or local level, fees for services etc.

<sup>284</sup> Population without access to electricity:  
[https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport\\_EnergyAccessOutlook.pdf](https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport_EnergyAccessOutlook.pdf)  
 Population ages 0-14: <https://data.worldbank.org/indicator/SP.POP.0014.TO>  
 Population ages 15-19: <https://data.worldbank.org/indicator/SP.POP.1519.MA.5Y>;  
<https://data.worldbank.org/indicator/SP.POP.1519.FE.5Y>

### 3. PRODUCTIVE USE DEMAND

#### 3.1 PUE Applications for Off-Grid Microenterprises (barbers and tailors)

The market sizing calculation for the barbers and tailors sector assumed that hair cutting and sewing appliances will be retrofitted to be powered by a Tier 3 DC solar system (5-year system life). By using a single price for all of the ROGEP countries, this methodology does not take into account country-specific cost and supply chain constraints.

Microenterprises					
# of financially constrained SMEs <sup>285</sup>	X	Cost per tier 3 system (\$625)	Divided by system lifetime of 5 years	=	Estimated Annualized Off-Grid Solar Market Potential for SMEs

#### 3.2 Value-Added PUE Applications

Available data from various sources such as the World Bank, the UN’s Food and Agriculture Organization and GSMA was used to estimate the potential OGS market for productive use applications in each of the analyzed market segments – solar pumping for agricultural **irrigation**, solar powered **milling** and solar powered **refrigeration**.

##### 3.2.1 Irrigation

The market sizing calculation for solar-powered irrigation was based on smallholder irrigation potential (i.e. the amount of irrigable land suitable for smallholder farmers) that could benefit from a solar pumping system (\$650, 6-year system life, 120 W system). This methodology does not take into account affordability (ability to pay) nor does it account for country-specific cost and supply chain constraints.

Value-Added PUE Applications – Solar Irrigation											
Irrigation Potential (hectare) <sup>286</sup>	X	=	Smallholder Irrigation Potential (hectare) <sup>287</sup>	Divided by 0.3 <sup>288</sup>	=	Estimated No. of Smallholder Farms Suitable for Solar Irrigation	X	\$650 (cost of solar pumping kit) <sup>289</sup>	Divided by 6 year (life of system)	=	Estimated Annualized Off-Grid Solar Market Potential for irrigation

#### Methodology for identifying areas suitable for irrigation activities on farms:

The areas for potential irrigation activities were calculated using the visible cropland<sup>290</sup> adjacent to permanent surface water sources. As identified by experts in a study in Zambia<sup>291</sup> and based on other expert consultations, beyond a 5 km distance from surface water, the returns are not economically feasible. **Figure 35** is a map of the cropland within a 5 km distance from permanent surface water.

<sup>285</sup> “MSME Finance Gap,” SME Finance Forum: <https://www.smefinanceforum.org/data-sites/msme-finance-gap>

<sup>286</sup> AQUASTAT – Food and Agriculture Organization: <http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en>

<sup>287</sup> Assumption that 25% of irrigable land irrigated by smallholder farmers;

See: “Lessons Learned in the Development of Smallholder Private Irrigation for High Value Crops in West Africa,” World Bank, (2011): [http://siteresources.worldbank.org/INTARD/Resources/West\\_Africa\\_web\\_fc.pdf](http://siteresources.worldbank.org/INTARD/Resources/West_Africa_web_fc.pdf)

<sup>288</sup> Assumption that smallholder private irrigation consists of small farms (0.3 hectare);

See: “Off-grid Solar Market Assessment in Niger and Design of Market-based Solutions,” World Bank, (December 2017): <https://www.lightingafrica.org/publication/off-grid-solar-market-assessment-niger-design-market-based-solutions/>

<sup>289</sup> 120W solar pumping kit: <https://futurepump.com/futures-bright-farmers-kenya/>

<sup>290</sup> “Prototype Land Cover Map over Africa at 20m Released,” Esa, (February 2018): <https://www.esa-landcover-cci.org/?q=node/187>

<sup>291</sup> “Zambia Electrification Geospatial Model,” USAID and Power Africa, (April 2018): [https://pdf.usaid.gov/pdf\\_docs/PA00T2JC.pdf](https://pdf.usaid.gov/pdf_docs/PA00T2JC.pdf)

### 3.2.2 Milling

The market sizing calculation for solar-powered milling utilized a series of inputs from the UN Food and Agriculture Organization to estimate the smallholder milling potential that could benefit from a 6.5 kW solar powered milling system (20-year system life). Cereals (e.g. rice, maize, millet and sorghum) as well as roots and tuber crops (e.g. cassava, yams and potatoes) were analyzed, as they provide an opportunity for value addition through hulling or milling.

Value-Added PUE Applications – Solar Milling													
Cereals, roots tuber crops (tons) <sup>292</sup>	X	70% <sup>293</sup>	X	50% <sup>294</sup>	=	Smallholder Milling Potential (tons)	Divided by 2 tons per day X 70% capacity factor <sup>295</sup>	=	Estimated No. of Solar Mills	X	6,500 W x \$2.50 per watt Divided by system lifetime of 20 years	=	Estimated Annualized Off-Grid Solar Market Potential for Milling

Ultimately, the ability for an agricultural community to benefit from productive use applications has as much to do with access to markets and improved crop inputs, as it has to do with the pricing and availability of financing to purchase the equipment. Hence, the macroeconomic approach used to carry out this market sizing does not account for country-specific cost and supply chain constraints.

### 3.2.3 Refrigeration

The market sizing calculation for solar-powered refrigeration utilized the estimated number of off-grid market centers in each country to estimate the number that could benefit from a 5.5 kW solar refrigeration system (20-year system life).

Value-Added PUE Applications – Solar Refrigeration							
# Off-Grid Market Centers by country <sup>296</sup>	X	5,500 W <sup>297</sup>	X	\$2.50 per watt	Divided by system lifetime of 20 years	=	Estimated Annualized Off-Grid Solar Market Potential for Refrigeration

### 3.3 PUE Applications for Connectivity/Mobile Phone Charging Enterprises

The market sizing calculation for solar-powered phone charging enterprises was based on each country’s mobile phone penetration rate (number of unique subscribers), rural population rate, and the average costs of OGS phone charging appliances (\$862, 5-year system life, 400 W system).

Mobile Phone Charging Enterprises							
# of Mobile Phone Subscribers in 2017 <sup>298</sup>	X	% rural population	Cost of solar phone charging appliances* divided by lifetime of 5 years	X	0.01 (assuming 1 phone charger per 100 mobile phone users)	=	Estimated Annualized Off-Grid Solar Market Potential for Phone Charging Enterprises

<sup>292</sup> Food and Agriculture Organization: <http://www.fao.org/faostat/en/#data/RF>

<sup>293</sup> Assumption that 70% of crops are milled

<sup>294</sup> Assumption that 50% of milled crops are processed at smallholder farmer level

<sup>295</sup> Solar mill (6.5 kW system) can mill 2 tons of produce per day; assume capacity factor of 70% (for maintenance/seasonality)

See: “Off-grid Solar Market Assessment in Niger and Design of Market-based Solutions,” World Bank, (December 2017):

<https://www.lightingafrica.org/publication/off-grid-solar-market-assessment-niger-design-market-based-solutions/>

<sup>296</sup> <https://www.citypopulation.de>

<sup>297</sup> 5.5kW solar powered refrigeration system – See: <https://www.deutschland.de/en/solar-powered-coldhubs-nigeria>

<sup>298</sup> “The Mobile Economy, Sub-Saharan Africa,” GSMA Intelligence, (2017):

<https://www.gsmaintelligence.com/research/?file=7bf3592e6d750144e58d9dcfac6adfab&download>

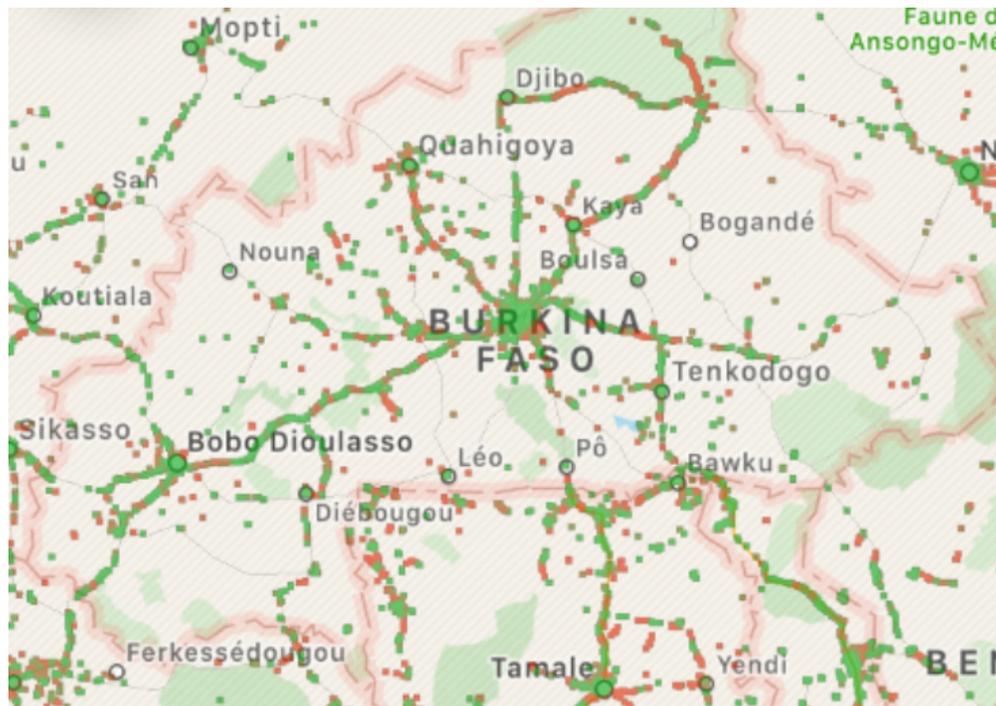
\* Indicative Costs for Phone Charging Appliances<sup>299</sup>

Charging Stations	Cost (USD)	Manufacturer
Charging ECOBOXX Qube (sizes - 50) 5Wp panel	\$83	EcoBoxx/ Sungrid Group (PTY) LTD South Africa
Charging ECOBOXX Qube (sizes - 90) 10Wp panel	\$205	EcoBoxx/ Sungrid Group (PTY) LTD South Africa
Charging ECOBOXX Qube (sizes - 160) 2*10Wp panel	\$209	EcoBoxx/ Sungrid Group (PTY) LTD South Africa
Portable charging station ECOBOXX 300	\$681	EcoBoxx/ Sungrid Group (PTY) LTD South Africa
Portable charging station ECOBOXX 600	\$965	EcoBoxx/ Sungrid Group (PTY) LTD South Africa
Portable Charging Station ECOBOXX 1500	\$1,532	EcoBoxx/ Sungrid Group (PTY) LTD South Africa
Portable charging station BOSS Kit Portable	\$3,025	Phaesun GmbH
Charging Sundaya Charging Station	\$193	Sundaya
<b>Average Cost</b>	<b>\$862</b>	

Source: GIZ and African Solar Designs analysis

Identifying areas of phone network coverage

The mobile phone network geographic coverage was mapped across each country (**Figure 37**). The source for this data is GSMA, which gives a radius ranging between 2-30 km. The radius is affected by a number of variables including tower height, power output, frequencies in use, and antenna type. Since this does not indicate the quality of network, the data was compared with data from OpenSignal, which tracks the signal from users registered on the platform.



Green: Strong Signal (>-85dBm)  
 Red: Weak Signal (<-99dBm)  
 Source: Open Data Signal

<sup>299</sup> "Photovoltaics for Productive Use Applications: A Catalogue of DC-Appliances," GIZ, (2016): [https://www.sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/GIZ\\_2016\\_Catalogue\\_PV\\_Appliances\\_for\\_Micro\\_Enterprises\\_low.pdf](https://www.sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/GIZ_2016_Catalogue_PV_Appliances_for_Micro_Enterprises_low.pdf)

#### 4. SUPPLY CHAIN ANALYSIS

The Task 2 supply chain analysis was based on the following key sources of data:

- Supplier focus group discussions held in Ouagadougou and Bobo-Dioulasso in June 2018
- Survey of six locally-based solar companies/suppliers in the country
- Survey of 10 larger international solar product suppliers
- ECREEE supplier database
- GOGLA semi-annual sales reports<sup>300</sup>
- Additional supplemental desk research and solar industry stakeholder interviews

These findings were subsequently corroborated by attendees of national validation workshops held in each country at the conclusion of the market assessment.

A list of identified solar companies that are active in Burkina Faso is included below:

1	Africa Énergie Solaire AES
2	Accès Services Energetiques (ASE)
3	Actualité Energie
4	BBOX
5	Benoo
6	Bureau d'Ingénierie et des Géoservices (B.I.G)
7	Burkina Trading International
8	CB Énergie/Lagazel
9	Cabinet Energy Consulting
10	CEAS-Burkina
11	ENEREC Sarl
12	ENERTEL Burkina
13	Energie Renouvelable, Energie et Technologie (ERET)
14	Energie Solaire Energie et Technologie (ESEET)
15	FASEB: Facilité d'Accès aux Services
16	GENESA
17	Greenlight Planet
18	MicroSow
19	Mousstakbal Négoce
20	Nord Conseils Ingenieries (NCI)
21	Projet Production Solaire PPS Sarl
22	SATEL
23	Sahelia Solar

<sup>300</sup> "Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data," GOGLA, Lighting Global and World Bank, (January – June 2018): [https://www.gogla.org/sites/default/files/resource\\_docs/global\\_off-grid\\_solar\\_market\\_report\\_h1\\_2018-opt.pdf](https://www.gogla.org/sites/default/files/resource_docs/global_off-grid_solar_market_report_h1_2018-opt.pdf)  
 "Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data," GOGLA, Lighting Global and World Bank, (July – December 2017): [https://www.gogla.org/sites/default/files/resource\\_docs/gogla\\_sales-and-impact-reporth2-2017\\_def20180424\\_web\\_opt.pdf](https://www.gogla.org/sites/default/files/resource_docs/gogla_sales-and-impact-reporth2-2017_def20180424_web_opt.pdf)  
 "Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data," GOGLA, Lighting Global and World Bank, (January – June 2017): [https://www.gogla.org/sites/default/files/resource\\_docs/gogla\\_sales-and-impact-reporth12017\\_def.pdf](https://www.gogla.org/sites/default/files/resource_docs/gogla_sales-and-impact-reporth12017_def.pdf)  
 "Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data," GOGLA, Lighting Global and World Bank, (July – December 2016): [https://www.gogla.org/sites/default/files/recource\\_docs/final\\_sales-and-impact-report\\_h22016\\_full\\_public.pdf](https://www.gogla.org/sites/default/files/recource_docs/final_sales-and-impact-report_h22016_full_public.pdf)  
 "Global Off-Grid Solar Market Report: Semi-Annual Sales and Impact Data," GOGLA, Lighting Global and World Bank, (January – June 2016): [https://www.gogla.org/sites/default/files/recource\\_docs/global\\_off-grid\\_solar\\_market\\_report\\_jan-june\\_2016\\_public.pdf](https://www.gogla.org/sites/default/files/recource_docs/global_off-grid_solar_market_report_jan-june_2016_public.pdf)

24	SEB-SAS
25	SIPE
26	SIREA Afrique
27	Smart Energy Services
28	SOIER
29	Solafreeca
30	Soleil Burkina
32	Solidarité Énergie Commerce
33	Soltech Burkina
34	Semetech
35	Station Energy Burkina
36	SysAid
37	Terra
38	Total
39	Yandalux Burkina Faso
40	Yeelen Ba
41	Zenith Conception/Solar Energy

Source: ECREEE, Focus Group Discussions; Stakeholder interviews

## ANNEX 3: TASK 3 METHODOLOGY

### FINANCIAL INSTITUTION ASSESSMENT – APPROACH / METHODOLOGY

Data collection under Task 3 included a combination of desk research, collaboration with local experts, and extensive stakeholder engagement with key officials and representatives from local and regional commercial banks, microfinance institutions and other development banks and agencies in Burkina Faso. Interviews were also conducted with regional development banks (namely BOAD and EBID) and other financiers active in the African off-grid solar sector, including export credit agencies, trade funders, crowd funders and impact investors.

The stakeholder engagement activity, which included both phone interviews as well as in-person meetings with key representatives from each FI, was undertaken across the 19 countries with extensive support from ECREEE. As a follow up to each interview/meeting, a questionnaire was administered in order to gather critical data on each institution, including *inter alia* their level of experience and capabilities with off-grid sector lending, SME and consumer lending, relationships with local and international partners etc. Feedback from the interviews and questionnaire, as well as quantitative data from each bank’s published annual reports, was compiled and analyzed in order to assess which FIs could be most suitable local partners / implementing agents for the proposed ROGEP facility.<sup>301</sup>

The questionnaire that was administered to FIs in the country and across the ROGEP region is included below.<sup>302</sup> The results of the survey are summarized in **Section 3.4**.

- Has the bank provided any loans to any segment of the off-grid sector? If so, please describe.
- Has the bank received any inquiries from any segment of the off-grid sector? How many inquiries?
- Did the bank engage in serious discussions or dismiss the inquiry(ies) as not within the bank’s area of lending or not interesting as a new business line? If dismissed, please provide the bank’s reasons.
- If the bank engaged in serious review/discussions and rejected the opportunity, please describe the bank’s due diligence approach and reasons for rejection.
- Is the bank interested to pursue lending to any segment of the off-grid sector? Which segment and which of the bank’s departments and existing products apply?
- Describe the bank’s current loan products and lending activity for the SME, Corporate, Consumer and Agri markets. Please provide rough figures on volumes in number of loans and value in each category. For each category please provide average margins, pricing, loan tenors to borrowers, collateral requirements.
- Does the bank have a structured finance department? Has the bank provided financing to any IPPs? If so, please provide details on the transactions (location, technology, size, maturity, portion of bank engagement in the total financing)
- Does the bank have a trade finance department? What are standard terms and conditions? What are the volumes in number of loans and values?
- Does the bank operate nationwide or only in certain regions? Does the bank have a presence in rural areas and is rural consumer and SME and Agri lending a key business focus?
- Does the bank have experience with managing DFI credit lines? In which sectors/departments? Which DFIs? What volumes? Were the lines fully committed and disbursed? What was the bank’s overall experience with these credit lines?
- Has the bank had dealings with the ECOWAS Bank for Investment and Development (EBID)? What type of relationship? Credit lines? Co-lending? Credit enhancement? Have the experiences been positive?
- What is the bank’s view on accepting hard currency credit lines and on-lending in hard currency? Would the bank hedge hard currency credit lines and on-lend in local currency?

<sup>301</sup> The results of this assessment and corresponding recommendations were prepared for ECREEE in a separate, confidential report.

<sup>302</sup> The survey was adapted based on the type of FI that was being interviewed (commercial banks, MFIs, Regional Development Banks)

- Is the bank interested to explore a credit line with ROGEP? What size of credit line would the bank be comfortable launching with initially?
- Does the bank feel that it would need a third-party guarantee in order to reduce risk enough to make loans to off-grid enterprises? If so, would it be enough if a guarantor were to cover 50% of losses on par with the bank? Or will the bank need the guarantor to take the first 10-20% of losses in an off-grid loan portfolio?
- What pricing does the bank consider to be fair and affordable for third party pari-passu guarantees? For first loss coverage?
- Has the bank had experience with any of the following as guarantors on the bank's loans: Africa Guarantee Fund, Africa Trade Insurers, Afrexim Bank, GuarantCo, IFC, USAID DCA? Has their pricing been fair and affordable? Does the bank have any preference in working with one over the others?
- To engage in lending to the off-grid market segments, would Technical Assistance be helpful? What types of TA would be most useful? Outside consultants to help design specific loan products and underwriting guidelines for the off-grid sector? Outside consultants to develop deal flow and conduct due diligence? Training of bank credit department and account representative personnel? Direct funding to the bank to develop marketing and promotional materials and hire staff?
- Does the bank adhere to and is in compliance with all aspects of the Basel II and III accords?
- Does the bank adhere to and have implemented controls for the Equator Principals and the World Bank/IFC Environmental and Social Standards?

## ANNEX 4: GENDER ASSESSMENT

### 1. Context and Purpose of the Gender Analysis

Within the context of this assignment, a gender-focused analysis was undertaken to assess the level of participation of women in each country's off-grid energy sector. This analysis is critical to the overall market assessment given the clear linkages between energy and gender, namely different rates of access and use as well as the impacts of energy sources and appliances in the home, community and wider society. Energy sector studies often fail to obtain gender-disaggregated data, which is necessary to inform policymakers and better understand the needs and priorities of women in the context of sustainable development.

Women in energy-poor households are at substantially higher risk of illness attributable to indoor air pollution and solid fuel (biomass) use.<sup>303</sup> Moreover, the significant time burdens that women and girls face in collecting fuel and water, cooking and processing food often keep girls from attending school; there is evidence that electrified milling equipment and water pumps can significantly reduce this burden. Lack of access to electricity also means that women do not have access to information and communication technologies that could improve their lives.<sup>304</sup>

As a region, West Africa and the Sahel has remained traditionally gender-stratified whereby males on average have greater access to resources, are more empowered by society and have more opportunities than women.<sup>305</sup> To address these challenges, governments across the region have adopted a range of policies to improve gender equality and promote gender mainstreaming. Member states of ECOWAS have adopted a Policy for Gender Mainstreaming in Energy Access, an initiative committed to promoting favorable policies and frameworks and mobilizing resources to more fully engage women in all areas of energy access, including as energy suppliers, planners, financiers, educators and customers.<sup>306</sup> ECREEE, the agency that is administering this policy throughout the region, is supporting implementation of regulatory and institutional measures that aim to improve inclusive energy access in each country by 2030. ECREEE has also partnered with AfDB to launch a separate regional initiative to advance the participation of women entrepreneurs in the renewable energy sector.<sup>307</sup>

Outside of ECOWAS, Cameroon, Chad and Central African Republic are pursuing gender mainstreaming at a regional level through the Economic Community of Central African States (ECCAS) Regional Policy for universal access to modern energy services and economic and social development (2014-2030).<sup>308</sup> Mauritania is also implementing a national policy to address this issue – the National Strategy of Institutionalization of Gender (la Stratégie Nationale d'institutionnalisation du genre).

<sup>303</sup> "The Energy Access Situation in Developing Countries: A Review Focusing on the Least Developed Countries and Sub-Saharan Africa," UNDP and World Health Organization, (2009):

<http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/Sustainable%20Energy/energy-access-situation-in-developing-countries.pdf>

<sup>304</sup> Rewald, R., "Energy and Women and Girls: Analyzing the needs, uses, and impacts of energy on women and girls in the developing world," Oxfam, (2017): <https://www.oxfamamerica.org/static/media/files/energy-women-girls.pdf>

<sup>305</sup> "Situation Analysis of Energy and Gender Issues in ECOWAS Member States," ECREEE, National Energy Laboratory, (2015): <https://www.seforall.org/sites/default/files/Situation-Analysis-of-Energy-and-Gender-Issues.pdf>

<sup>306</sup> Ibid.

<sup>307</sup> "Feasibility study promotes women's participation in energy transition," ESI Africa, (May 7, 2018): <https://www.esi-africa.com/feasibility-study-promotes-womens-participation-in-energy-transition/>

<sup>308</sup> "Central Africa Regional Integration Strategy Paper," African Development Bank, (2011-2015): <https://www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/RISP%20CENTRAL%20AFRICA-ECCAS%20English%20FINAL.pdf>

➤ **Description of Approach / Methodology**

While the data collection for this assignment was not sex dis-aggregated (which was beyond the scope of work), a gender-focused perspective was applied to the overall analysis. The methodology adopted to carry out this exercise included a combination of desk research, literature review, focus group discussions (FGDs) and face-to-face interviews with key gender “focal points” identified by ECREEE in each country. Representatives from women’s groups, female-led businesses and energy sector organizations attended the focus group meetings that were held in Ouagadougou and Bobo-Dioulasso in June 2018 to share their insights and inform the overall market study. A gender questionnaire was also distributed to key stakeholders in Burkina Faso to assess the main barriers/constraints for inclusive participation in the country. The survey examined a number of key gender issues, including *inter alia* access to credit, access to education and information, entrepreneurial and income-generating activities for women (including productive use of energy), representation of women in leadership positions in business and government.

➤ **Gender Questionnaire**

The following questionnaire was administered to key stakeholders in each country. Respondents were asked to reply Yes/No to each question and elaborate as needed.

**HOUSEHOLD**

Are women generally involved in influencing decisions on household energy use/services?

Are off-grid solar solutions (E.g. solar lanterns, solar home systems) largely accessible/made available to the household sector, particularly women-headed households?

Are there any related programs and initiatives (donor, government, private sector, NGO etc.) that are specifically targeting energy related access for women in the household sector?

Are off-grid solar products and services generally affordable for households headed by women? If not, are Microfinance Institutions or other organizations in the country providing credit/financing (grants/loans) to the household sector, particularly women-headed households to increase energy access?

Are women aware of the health impact of unclean energy (e.g. fuel-wood for cookstoves) and the solutions (i.e. solar) to address it?

**COMMUNITY/INSTITUTIONAL**

Are women represented in any high-level energy sector positions? Please provide names/examples, if available, of women in senior management positions in government, committees, boards etc.

Is the mobility and safety of women constrained due to poor energy services (e.g., unavailability of streetlights due to unreliable electricity supply)?

**PRODUCTIVE USE**

What kind of productive use activities do women engage in and what women-led productive use activities can be supported by off-grid solar solutions?

- Agriculture (irrigation, water pumping etc.)
- Shops (retail, artisanal/handicrafts, grocery, salons etc.)
- Restaurants (bar, cafe etc.)
- Kiosks (e.g. mobile money etc.)
- Tourism
- Other

**SUPPLIER**

Please describe the level of engagement that women have in in the off-grid energy services sector. Are women highly employed in this area (e.g. is there data collected on the number of women-owned businesses/SMEs)?

Are there any related programs and initiatives (donor, government, private sector, NGO etc.) that provide training for women to manage or be employed by energy-related enterprises?

**ADDITIONAL:**

What are the main barriers women face to access information?

What are the main barriers/constraints for women entrepreneurs to have access to credit?

Do women have equal access to capacity building and training services (e.g. vocational training/technical education) or do they experience discrimination in access to these services?

What policy, regulatory and institutional framework(s) exist, if any, to address gender mainstreaming<sup>309</sup> (e.g. national gender action plans/related policies etc.)?

Are gender-related issues taken into consideration in energy policy provisions and/or are energy-related issues reflected in gender policies (e.g. existence of ‘gender units’ within public sector agencies and/or ‘gender audits’ in energy sector)?

**2. Gender Profile**

**2.1 The state of gender equality in Burkina Faso**

Structural inequalities and gender discrimination against women and girls persist in Burkina Faso, as inclusive participation remains an ongoing challenge. The gender assessment found that while there have been modest improvements in recent years to certain social indicators such as access to education and healthcare services, gender disparities still exist across the economy, particularly in access to resources, higher education, land ownership, and inheritance systems, political power and decision-making.

**2.2 Gender and poverty**

Poverty remains widespread in Burkina Faso, which remains among of the poorest countries in the world. It is estimated that 44% of the population lives below the poverty line, with the majority of the poor living in rural areas. According to UNDP statistics, 66.8% of the labor force is considered working poor at PPP USD 3.10/day.<sup>310</sup>

**2.3 Gender, Human Capital and Economic Empowerment**

**2.3.1 Education, Skills Development and Training**

Burkina Faso is among the lowest ranked countries in the world according to the UNDP Human Development Index (HDI).<sup>311</sup> While Burkina Faso has achieved gender parity in rates of access to primary education, there is still a considerable gap in higher levels of education; only 6% of adult women in Burkina Faso have attained some level of secondary education compared to 11.7% of men.<sup>312</sup> The gender gap is worse for tertiary education (see **Section 1.2.2.5**). There are also many troubling signs in the country’s primary and secondary education sectors. There are huge disparities in access to education between the country’s poorest and wealthiest quintiles. A shocking 72% of the country’s youth (ages 15-24) have not

<sup>309</sup> **Gender mainstreaming:** The process of ensuring that women and men have equal access to and control over resources, development benefits and decision-making, at all stages of development process, projects, programs or policy.

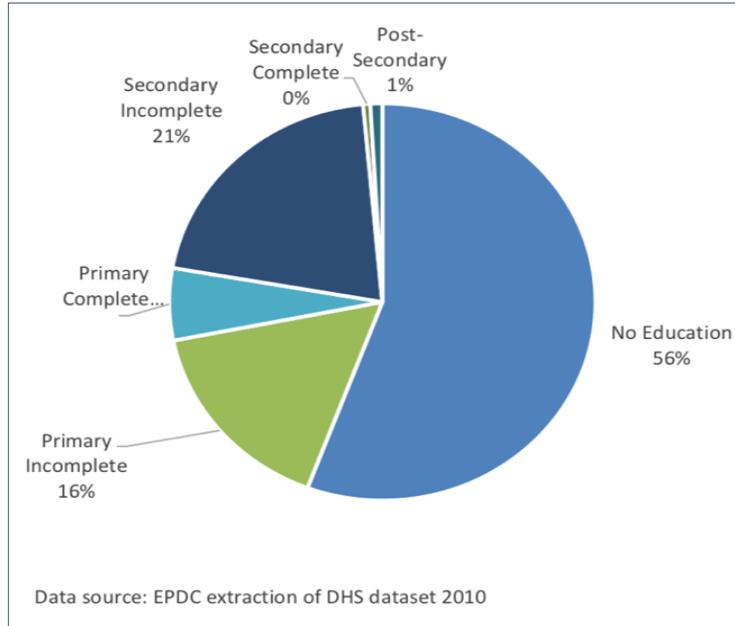
<sup>310</sup> “UN Human Development Indicators: Burkina Faso,” UN Development Programme, (2018): <http://hdr.undp.org/en/countries/profiles/BFA>

<sup>311</sup> “Human Development Indices and Indicators: 2018 Statistical Update,” UN Development Programme, (2018): [http://hdr.undp.org/sites/default/files/2018\\_human\\_development\\_statistical\\_update.pdf](http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf)

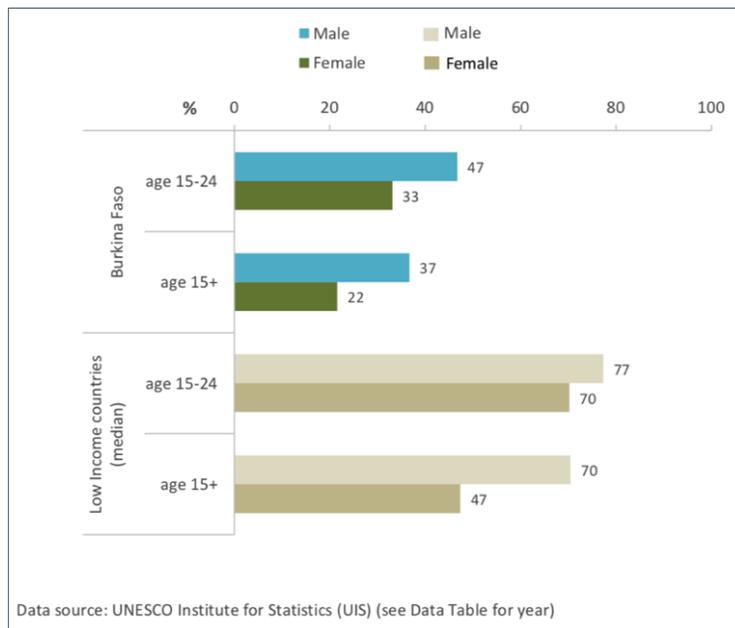
<sup>312</sup> “UN Human Development Indicators: Burkina Faso,” UN Development Programme, (2018): <http://hdr.undp.org/en/countries/profiles/BFA>

completed primary education. An estimated 50% of girls of official primary school age (ages 6-11) and 66% of female youth of secondary school age (ages 12-18) are out of school.<sup>313</sup> This trend remains consistent in literacy rates among Burkina Faso’s youth and adult populations, as just 22% of the country’s female adult population is literate, compared to 37% of the adult male population.<sup>314</sup>

### Education Attainment for Burkina Faso’s Youth (Ages 15-24)



### Literacy Rate Among Youth and Adult Population



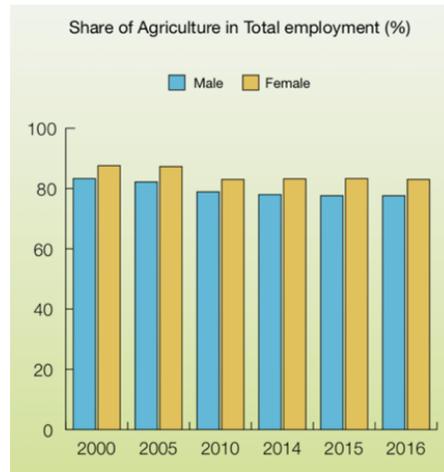
Source: UNESCO Institute for Statistics

<sup>313</sup> “Burkina Faso: National Education Profile, 2014 Update,” Education Policy and Data Center, (2014): [https://www.epdc.org/sites/default/files/documents/EPDC\\_NEP\\_Burkina\\_Faso.pdf](https://www.epdc.org/sites/default/files/documents/EPDC_NEP_Burkina_Faso.pdf)

<sup>314</sup> Ibid.

In terms of vocational training and technical education, the national policy for professions (Politique nationale de l’enseignement et de la formation technique et professionnelle) was adopted in 2008 and positions the promotion of women’s employment as a priority.

According to the UN, as of 2017, only 34.5% of women in Burkina Faso had an account at a financial institution or with a mobile money service provider.<sup>315</sup> This can be attributed to the country’s elevated levels of poverty, low or irregular sources of income, low rates of financial literacy, and a perceived lack of need. This is also a result of the fact that most banks are focused on serving the formal sector, while many women remain engaged in informal economic activities – especially subsistence agriculture, which has employed around 80% of the country’s female labor force since 2000.<sup>316</sup>



Source: African Development Bank

### 2.3.2 Fertility Rates and Reproductive Health

Burkina Faso also faces major challenges in the health sector. As of 2017, the fertility rate in Burkina Faso was at 4.36 children per woman. The country’s maternal mortality rate is relatively high; for every 100,000 live births, 371 women die from pregnancy related causes. As of 2017, 29.1 % of women had an unmet need for family planning.<sup>317</sup>

### 2.3.3 Participation and Decision-Making

Socio-cultural perspectives in Burkina Faso remain male-dominated, as conventional gender roles continue to hold women back. This is reflected in household decision-making, which often plays a role in restricting the rights and empowerment of women. These dynamics are also reflected in the rates of representation of women in the labor market as well as in leadership positions in business and government.

<sup>315</sup> “Human Development Indices and Indicators: 2018 Statistical Update,” UN Development Programme, (2018): [http://hdr.undp.org/sites/default/files/2018\\_human\\_development\\_statistical\\_update.pdf](http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf)

<sup>316</sup> “Indicators on Gender, Poverty the Environment and Progress toward the Sustainable Development Goals in African Countries,” African Development Bank, (2017): [https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/GENDER\\_Poverty\\_and\\_Environmental\\_Indicators\\_on\\_African\\_Countries-2017.pdf](https://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/GENDER_Poverty_and_Environmental_Indicators_on_African_Countries-2017.pdf)

<sup>317</sup> “Human Development Indices and Indicators: 2018 Statistical Update,” UN Development Programme, (2018): [http://hdr.undp.org/sites/default/files/2018\\_human\\_development\\_statistical\\_update.pdf](http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf)

Although women’s level of participation in the economy is growing, they still lag behind men, with an adult labor force participation rate of 58.2% compared to 75.2% for men.<sup>318</sup> As of 2018, women held only 11% of the country’s seats in parliament, despite the fact that a gender quota is in place.<sup>319</sup> There are also very few women in leadership positions in the country’s energy sector.

## 2.4 Gender Policy, Institutional and Legal Framework in Burkina Faso

### 2.4.1 Gender Mainstreaming initiatives by the Government

The GoBF has adopted several policies and action plans to promote gender equality and has signed on to key international and regional framework agreements protecting women’s rights. At the international level, Burkina Faso has ratified the Convention on the Elimination of All Forms of Discrimination Against Women and is also signatory to the Protocol to the African Charter on Human and People’s Rights on the Rights of Women in Africa among others.<sup>320</sup>

The country’s Constitution (1991) guarantees the equality of men and women. The Government has enacted a number of laws to ensure the protection and promotion of the rights of women and children and to create an enabling environment to ensure inclusive participation in the country’s development. These include the 2009 National Gender Policy (Politique Nationale Genre: PNG), which were implemented under the Strategy for Accelerated Growth and Sustainable Development (Stratégie de croissance accélérée et de développement durable: SCADD) for 2011-2015. The Ministry of Women, National Solidarity and Family is another agency mandated to formulate gender-responsive policies and to coordinate and monitor their implementation within different sectors of the society.

To address the country’s massive problems in education and literacy, in 2012, the GoBF implemented the Strategic Development Program for Basic Education (Programme de Développement Stratégique de l’Education de Base: PDSEB) for 2012-2021. In 2018, the GoBF also adopted the “National Strategy of Girls Education” (Stratégie nationale d’accélération de l’éducation des filles: “SNAEF”).

In the energy sector, the Government’s has adopted the ECOWAS Policy for Gender Mainstreaming in Energy Access, an initiative that aims to promote inclusive policies and frameworks to mobilize resources to engage women in all areas of energy access.<sup>321</sup> The GoBF has also taken measures streamline gender into its energy policies by establishing a gender focal point at the Ministry of Energy.

### 2.4.2 Gaps in the Gender Policy/Legal Framework

Despite the Government’s policy initiatives and legislative reforms, gender inequality remains an ongoing challenge across the country’s political, economic and socio-cultural landscape, as women still face many barriers to inclusive participation. Women are often curtailed in their access to information and decision-making. Moreover, Burkina Faso’s legal system consists of statutory, customary, and religious laws, leading to contradictions and inconsistencies among the three. Overall, the country still ranks among the worst globally the UNDP’s Gender Inequality Index (145<sup>th</sup> out of 158 ranked countries).<sup>322</sup> While multiple deprivation characterizes life for a sizable share of African women, rates are significantly higher in West Africa and the Sahel – with Burkina Faso ranking among the seven worst nations in Africa.

<sup>318</sup> Ibid.

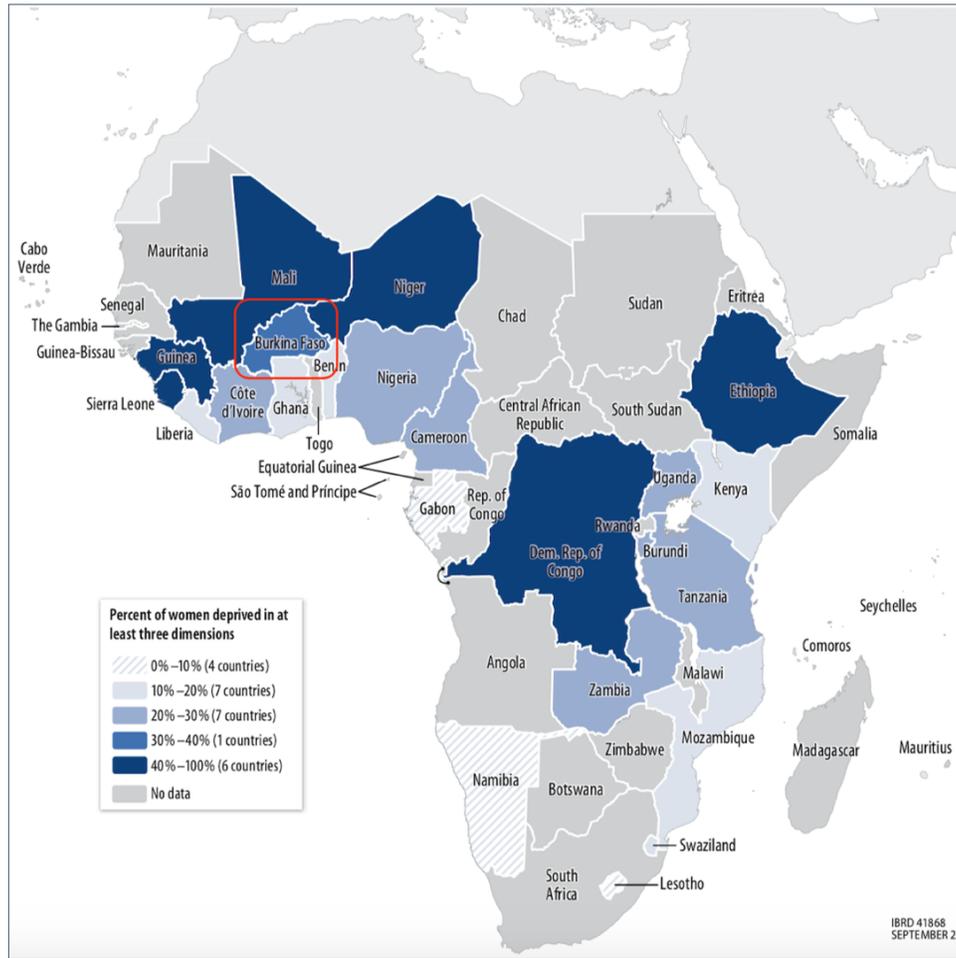
<sup>319</sup> Ibid.

<sup>320</sup> Ratification Table : Protocole to the African Charter on Human and People’s rights on the Rights of Women in Africa: <http://www.achpr.org/instruments/women-protocol/ratification/>

<sup>321</sup> “Situation Analysis of Energy and Gender Issues in ECOWAS Member States,” ECREEE, (2015).

<sup>322</sup> “Gender Inequality Index,” UNDP, (2015): <http://hdr.undp.org/en/composite/GII>

Socioeconomic Deprivation of Women in Africa<sup>323</sup>



Source: World Bank

As described above, significant gender gaps persist in the areas of education, literacy, access to information and decision-making. There is also still a lack of sex-disaggregated data across all sectors of the economy, which is critical to inform policy decision and promote gender mainstreaming on a national scale.

## 2.5 Summary of Recommendations

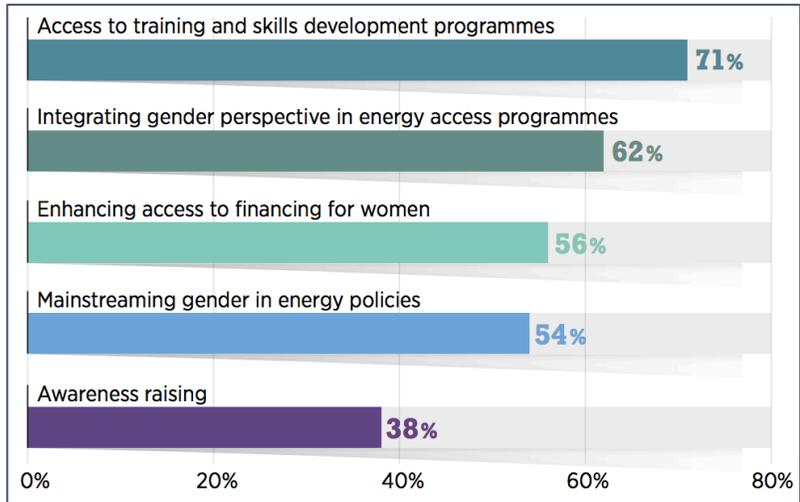
Given the increased attention that gender inclusion has received in development planning, there are a number of tools that are now available to policymakers that can be utilized to support gender mainstreaming and encourage women’s participation in the energy sector. Despite encouraging progress in the discourse on gender and energy access, substantial efforts are still needed, especially in enabling women’s participation in the sector in different roles, including as energy entrepreneurs and in leadership positions.<sup>324</sup>

<sup>323</sup> “Poverty in a Rising Africa: Africa Poverty Report,” The World Bank Group, (2016): <https://www.un.org/africarenewal/sites/www.un.org.africarenewal/files/Poverty%20in%20a%20Rising%20Africa%20Overview.pdf>

<sup>324</sup> “Renewable Energy: A Gender Perspective,” International Renewable Energy Agency, (2019): [https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA\\_Gender\\_perspective\\_2019.pdf](https://irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA_Gender_perspective_2019.pdf)

In seeking solutions to improve women’s engagement in energy access, a 2018 IRENA survey found that access to necessary technical, business or leadership skills development programs was the single most important measure that could be taken. Over half of survey respondents also highlighted the need to integrate gender perspectives in energy access programs as well as enhanced access to finance.<sup>325</sup>

Measures to Improve Women’s Engagement in Energy Access



Source: International Renewable Energy Agency

In addition to the measures highlighted in the figure above, below is a list of additional policy recommendations that could further improve gender equality in Burkina Faso’s energy sector:<sup>326</sup>

- Take measures to close the gender gap in access to education, particularly in higher levels of education
- Implement a quota system to increase the number of women employed in government’s energy ministry and ensure that women are part of decision-making processes in the energy sector
- Implement policy and budgetary measures to support programs that aim to raise awareness and promote opportunities for women as energy customers, suppliers, financiers, and educators
- Commission studies to collect, synthesize and publish gender-specific/sex-disaggregated data on women’s energy access and usage to inform (i) public policy development to improve rates of access for women; and (ii) private sector on potential customer needs (e.g. clean cooking technologies, productive use of energy applications etc.)
- Undertake a “gender audit” of the energy sector and develop a gender action plan to inform long-term policy objectives targeting gaps in the existing framework and promoting inclusive participation (e.g. by adding gender categories to policies and accounting for gender impacts in strategic planning).
- Raise awareness / provide training and technical support to private sector businesses / SMEs on (i) the benefits of gender inclusion and in viewing business decisions through a gender lens; (ii) the value of gender-disaggregated data; and (iii) how to develop and implement gender strategies to encourage inclusive participation.<sup>327</sup>

<sup>325</sup> Ibid.

<sup>326</sup> **NOTE:** This is not an exhaustive list of recommendations as it is only intended to address inclusive participation in the energy sector; there are many gender-related challenges that warrant further study and attention within the context of the country’s complex economic and social structures that are beyond the scope of this analysis

<sup>327</sup> “ECOWAS-CTCN Project on Mainstreaming Gender for a Climate Resilient Energy System in ECOWAS Countries: Final Report,” ECREE and CTCN, (May 2018):

[https://www.ctc-n.org/system/files/dossier/3b/180627\\_final\\_report-uk.pdf](https://www.ctc-n.org/system/files/dossier/3b/180627_final_report-uk.pdf)

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