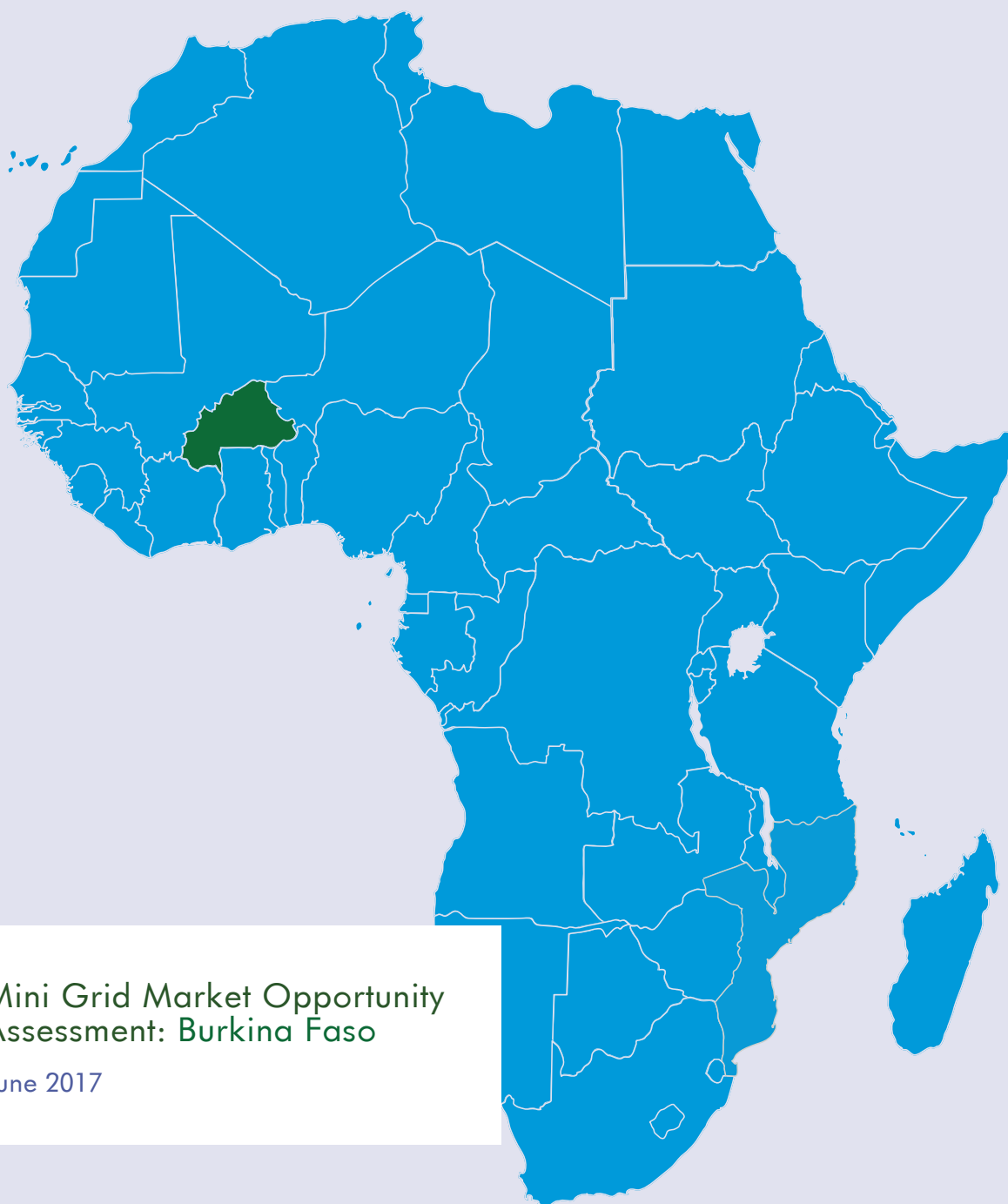


Green Mini Grid Market Development Programme

SEforALL Africa Hub
African Development Bank



Mini Grid Market Opportunity
Assessment: Burkina Faso

June 2017



Prepared by



PREFACE

This paper, part of the Green Mini-Grid Market Development Programme (GMG MDP) document series, assesses the green mini-grid market in Burkina Faso. Green-mini grids include mini-grids powered by renewable energy resources – solar radiation, wind, hydropower or biomass – either exclusively, or in combination with diesel generation.

Mini-grids are not a new phenomenon in Africa. Almost all national utilities own and operate diesel-powered generating facilities not connected to the main grid, which supply electricity to secondary towns and larger villages. This solution to rural electrification often results in significant financial losses for the utility, required to sell power at prices significantly below the cost of production and delivery. Moreover, it leaves the most remote towns and villages unelectrified. The latest Sustainable Energy for All (SEforALL) Global Tracking Framework estimates that the urban-to-rural divide in access to electricity in Africa is as high as 450 percent, with 69 percent of the population in urban areas electrified compared to only 15 percent in rural areas.

There are three principal options for providing new connections to currently unserved populations in Africa, namely: extension of the national grid; installation of separate “mini” grids to operate independently from the main grid; and stand-alone generating systems that supply individual consumers. The most cost-effective approach for powering mini-grids is to use renewable energy sources, which are widely available across Africa.

The development of GMGs is not without its challenges however. In addition to unfriendly policy and regulatory frameworks, barriers to growth of the private mini-grids sector in Africa include the lack of proven business models, market data and linkages, key stakeholder capacity, and access to finance.

In response to these challenges, the SEforALL Africa Hub at the African Development Bank designed and launched Phase 1 of the GMG MDP in 2015, with grant funding from the AfDB's Sustainable Energy Fund for Africa (SEFA).¹ The GMG MDP is a pan-African platform that addresses the technical, policy, financial and market barriers confronting the emerging GMG sector. It is part of a larger DFID-funded GMG Africa Programme, which also includes GMG initiatives in Kenya and Tanzania; country-specific GMG policy development through SEFA; and an action learning and exchange component implemented by the World Bank's Energy Sector Management Assistance Program (ESMAP).

In its Africa Energy Outlook 2014, the International Energy Agency predicted that by 2040, 70 percent of new rural electricity supply in Africa will most affordably come from stand-alone systems and mini-grids. The GMG MDP, SEforALL, SEFA, ESMAP and similar programmes, which are contributing to falling costs, technological advancements and more efficiencies in GMG development, will help ensure that up to two thirds of this supply is powered by renewables.

The goals of the green mini-grid programme are central to AfDB's mission of spurring sustainable economic development, social progress and poverty reduction in its regional member countries. Off-grid and mini-grid solutions are a key component of the AfDB's New Deal on Energy for Africa, launched by the Bank's president in January 2016. The New Deal, a transformative, partnership-driven effort, aspires to achieve universal access to energy in Africa by 2025.

This report was prepared by the Carbon Trust, United Nations Environment Programme (UNEP) and ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) at the request of the AfDB. It was written by Marco Sampablo and Luke Walley of Carbon Trust, Yuri Lima Handem from ECREEE and Eugene Ochieng of UNEP. Carbon Trust is a mission-driven organization helping businesses, governments and the public sector accelerate the move to a low carbon economy. ECREEE is a specialized agency of the Economic Community for West African States. UNEP is a leading global environmental authority.

The content of this report was reviewed by Jeff Felten of the AfDB's GMG team and cleared by Dr. Daniel-Alexander Schroth, SEforALL Africa Hub Coordinator at the AfDB. It was edited by Kimberlee Brown.

1 The SEforALL Africa Hub partnership includes the African Union Commission, the New Partnership for Africa's Development (NEPAD), the United Nations Development Programme (UNDP), and the Regional Economic Communities (RECs), which are represented on a rotating basis. <http://www.se4all-africa.org>

Contents

PREFACE

CONTENTS

LIST OF ACRONYMS

EXECUTIVE SUMMARY	7
1. INTRODUCTION TO THE GREEN MINI GRID MARKET DEVELOPMENT PROGRAMME	10
2. COUNTRY OVERVIEW	12
3. GREEN MINI-GRID POTENTIAL	13
3.1. Introduction	13
3.2. Assessment background	13
3.3. Mini-grid potential assessment	15
3.4. Renewable energy potential for mini grids	19
4. OVERVIEW OF THE ENERGY SECTOR	25
4.1. Current context and overview of responsibilities	25
4.2. Power network and infrastructure	26
4.3. Support for renewable energy	27
4.4. Off-grid developments and support for energy access	28
4.5. Challenges to increase the uptake of green mini-grids	29
5. REGULATORY FRAMEWORK FOR MINI-GRIDS	31
5.1. Regulatory and policy environment: Main takeaways	31
5.2. The mini-grid policy and regulatory environment	32
5.3. Energy sector policy and regulatory framework	36
5.4. Investment incentive policies	38
5.5. Recommendations	40
6. MAIN STAKEHOLDERS	42
6.1. Government and agencies	42
6.2. Mini-grid practitioners and product developers	44
6.3. Bilateral and multilateral donor organisations	47
6.4. Other relevant organisations and initiatives	59
7. ANNEX. OBJECTIVES, SCOPE AND METHODOLOGY OF THE MARKET ASSESSMENT	51
7.1. Objectives of the market assessment	51
7.2. Scope of the market assessment	51
7.3. Methodology	51

List of Acronyms

ANEREEE	Renewable Energy and Energy Efficiency Agency/ Agence nationale des énergies renouvelables et de l'efficacité énergétique
ARSE	National electricity regulator/ Autorité de Régulation du Sous-secteur de l'Electricité du Burkina Faso
CIESPA	Inter-ministerial committee responsible for SEforALL action plan/Comité interministériel chargé de l'élaboration et du suivi du programme d'action SEforALL
COOPELs	Electricity cooperatives/ Coopératives d'électricité
DGCOOP	Ministry of Economy, Finances and Development/ Direction Générale de la Coopération
ECOWREX	ECOWAS observatory for Renewable Energy and Energy Efficiency
ECREE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EIA	Environmental impact assessment
FDE	Electrification Development Fund/ Fonds de Développement de l'Electrification
FIP	Forest Investment Program
FONDEM	La Fondation Énergies pour le Monde
FNUGGF	National Federation of Forest Management Unions/Fédération Nationale des Unions de Gestions des Groupements Forestières du Faso
GGF	Multiple Forest Management Groups
GIS	Geographic information system
MEEVCC	Ministry of Environment, Green Economy and Climate Change/ Ministère de l'Environnement, de l'Economie verte et du Changement climatique
MEF	Ministry of Economy and Finance/Ministère de l'Economie et des Finances
NAMA	Nationally Appropriate Mitigation Action
PANEE	Energy Efficiency Action Plan/ Plan d'Action National d'Efficacité Energétique
PANER	Renewable Energy Action Plan/ Plan d'Action National des Energies Renouvelables
PASE	Energy Sector Budget Support Programme/ Programme d'appui budgétaire au secteur de l'énergie
PASEL	Project for Access to Energy Services/ Projet d'Appui au Sous Secteur de l'Electricité
PERC	ECOWAS Renewable Energy Policy
PNB-BF	National Bio Digester Program/ Programme National De Biodigesteurs
PNDES	National Economic and Social Development Plan/ Plan national du développement économique et social
PPA	Power Purchase Agreement
PPP	Private Public Partnership
PRODERE	WAEMU Regional Program for the Development of Renewable Energies
PV	Photovoltaic

REDD	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
SCADD	Accelerated Growth and Sustainable Development Strategy/ Stratégie de croissance accélérée et de développement durable
SINCO	Cooperative Collective Infrastructure Corporation/ Societe Industrielle de Construction
SONABEL	National utility/ Société nationale d'électricité du Burkina Faso
UNCOOPEL	National Union of Electricity Co-operatives in Burkina Faso/ Union nationale des coopératives d'électricité du Burkina
UNEP	United Nations Environmental Program
UNDP	United Nations Development Program
INSD	National Institute of Statistics and Demographics/ Institut national de la statistique et de la Démographie

EXECUTIVE SUMMARY

This country report is one of five pilot country reports in the first phase of the Market Intelligence business line of the African Development Bank's Green Mini-Grid Market Development (MDP) Programme. The MDP programme has the ultimate objective of fostering access to electricity across Africa by promoting the development of green mini-grids where they are technically and economically a better option than the extension of the main grid. The Market Intelligence business line targets the provision of comparable, actionable data on the potential for GMGs across countries in Sub-Saharan Africa. This report provides an analysis for Burkina Faso.

This report's methodology combines a high-level opportunity assessment with practical knowledge and information targeted at mini-grid practitioners. Information provided covers key stakeholders, raw data on physical and non-physical factors and a policy and regulatory analysis. Assessing the potential for mini-grids is challenging as such analysis requires plenty of data and assumptions. A thorough assessment must include a number of criteria that are driven by the particular business model and approach of the implementing agency for each case. This report therefore aims to capture available data and highlight general assessments that would be relevant to most mini-grid stakeholders. Raw data is provided with this report so stakeholders may further conduct their own specific analysis.

Burkina Faso remains one of the poorest countries in Africa, with a GDP per capita of US\$ 716. Approximately 40% of the population was living below the basic needs poverty line in 2014. The energy access rate stands at 18% nationally and at 3% in rural areas while the settlement electricity coverage rate stands at 33%.² The 2015 National Action Plan under the Sustainable Energy for All (SEforALL) initiative sets renewable energy and energy access targets. The 2030 target national rate for electricity access is 65% and 50% for rural areas. The renewable target is for a 50% renewable energy mix by 2030.

The energy sector is characterised by a low rate of energy access, a high dependence on thermal generation, high power production costs and a loss making power utility. While population and energy demand are growing fast, the national electrification rate of 18% remains low by regional standards. Installed capacity totals 325MW, including 292MW of thermal capacity and 32MW of hydropower capacity. Most of the installed capacity is aging and characterised by low availability rates. SONABEL, the national utility, has been incurring losses for several years. In 2015, its cost of electricity service was around CFA 142 per kWh (approximately US\$ 24 per kWh at the time of writing). Tariffs are non-cost reflective, averaging CFA 90.5 per kWh (approximately US\$ 15 per kWh). SONABEL therefore depends on continuous government subsidies to sustain its operations.

The country has a relatively extended transmission and distribution network. About 63% of the population lives within 15km of the power network, which includes 4,243km of high voltage lines and 8,626km of low voltage lines. The grid extends most into the Central, Southern and Western regions. Transmission and distribution losses amount to 17%, which position SONABEL as one of the best performing utilities in Sub-Saharan Africa in this area. Nevertheless, underinvestment in the network threatens to increase distribution losses.

The key energy sector institutions are the Ministry of Energy, ARSE (national regulator), the Electrification Development Fund and SONABEL (national utility). The country is divided into two distribution segments, with distinct regulations and actors. The first segment includes the area served by SONABEL, the national utility, and covers the main population centres. SONABEL has a monopoly over transmission and distribution, but generation is open to other parties and independent power producers. The second segment includes rural areas, which are the responsibility of the Electrification Development Fund (FDE). FDE coordinates electrification programmes and provides funding to rural electrification promoters in the form of grants and loans. Currently, there are more than 90 local cooperatives with an authorisation or concession to manage a local distribution network in the second segment. Most of them are connected to the grid and purchase power in bulk from SONABEL, but several have generation capacity. One third are estimated to include photovoltaic (PV) systems. A regulatory agency, ARSE, was created in 2007. Operating under the authority of the

2 Defined as the percentage of human settlements that are reached by the main power network or local mini-grids.

prime minister, it has the mandate to regulate operators, arbitrate disputes and protect consumer rights. The government is currently looking to strengthen ARSE's powers under a new energy law, including increasing its power over issuance of sector acts, pricing, control and arbitration.

Several factors are favourable to investments by modern decentralized energy companies. The country has a low rate of electrification. It favours small distribution networks through long term concessions and has significant renewable energy potential, notably in the form of solar irradiation and biomass. The country has a solar irradiation of 5.5 kWh/m²/day for 3,000 to 3,500 hours per year. Significant biomass resources are available in several regions, notably in the East and South-West regions. In addition, Burkina Faso has a stable currency—the CFA franc—pegged to the Euro, which is the common currency of the West African Economic and Monetary Union (UEMOA), of which Burkina Faso is a founding member.

Based on current grid coverage, this analysis estimates that 37% of the population (6.6 million people) would be best served by off-grid solutions. This figure provides an upper limit for the market size for mini-grids as some of these off-grid households are likely to be best served by standalone systems. In terms of people, the largest markets best served by off-grid solutions are found in the Centre-Nord, Boucle du Mouhoun, Sahel and East administrative regions, home to 1.02 million, 1.01 million, 837,000 and 810,000 people, respectively.

This analysis estimates a current market size of US\$ 117.1 million based on regional annual per capita expenditures on energy services. The largest regional market is in Centre-Nord, with an estimated current annual expenditure on energy of over US\$ 20.5 million. Boucle du Mouhoun, Haut-Bassins and Sahel regions also show potential, having estimated market sizes of over US\$ 15 million. The actual market size is likely larger than this however, as decentralized solutions in Burkina Faso are also feasible in areas in proximity of the grid.

Nevertheless, a number of policy and institutional barriers hamper the development of green mini-grids. The model of local power cooperatives is quite rigid and relies on continuous funding and subsidies from FDE. Local cooperatives are not financially sustainable, have limited technical capacity and must rely on technical services provided by engineering companies, often funded by FDE. Modern private green mini-grid companies are in a position to help Burkina Faso address these challenges, bridge the current electrification gap, and reduce the financial burden of the power sector on the national budget. Nevertheless, their development and growth require addressing existing regulatory constraints such as the current mandatory nationwide low national tariff, in addition to the requirement that PV power providers with ten or more customers or any project with a generation capacity above 10kW be subject to Ministry of Energy authorization. The government is reportedly developing a new regulatory framework for clean energy mini-grids that, it is hoped, may address some of these issues.



1. INTRODUCTION TO THE GREEN MINI-GRID MARKET DEVELOPMENT PROGRAMME

The African Development Bank's Green Mini-Grid Market Development Programme (MDP) aims to foster access to electricity across Africa. The MDP provides assistance to a range of stakeholders in overcoming the challenges for widespread and sustainable implementation of green mini-grid (GMG) projects by:

- Establishing a comparable, actionable understanding of the GMG market opportunity in SSA;
- Promoting the linkages between communities, public institutions, developers, financiers, and technology providers required for successful mini-grid development;
- Strengthening capacity of developers to develop and operationalise GMG business models;
- Promoting a sound policy and regulatory environment; and
- Engaging project financiers and supporting the development of suitable financial solutions.

This country report is one of five pilot country reports in the first phase of the Market Intelligence business line of the MDP, providing an analysis of the potential for GMGs per country. Successive phases of the MDP will include additional countries to provide comparable, actionable data on the potential for GMGs across countries in Sub-Saharan Africa.

The Market Development Programme is implemented by the Sustainable Energy for All (SEforALL) Africa Hub, through a grant from the Sustainable Energy Fund for Africa (SEFA). The SEforALL Africa Hub, hosted by the African Development Bank, is a partnership of African institutions dedicated to supporting the continent's progress towards the SEforALL initiative's three main objectives on energy access, renewable energy and energy efficiency.

The development of clean energy mini-grids, under the Clean Energy Mini-Grid Partnership is one of the High Impact Opportunities (HIO) under the SEforALL initiative for which the Bank is playing a lead role for Africa. The Partnership will galvanize action on the barriers facing the sector, with the engagement of public, private and civil society expertise and resources. The Clean Mini-Grids HIO, including the co-ordination group, secretariat and wider membership, is the established forum for discussion and coordination of the efforts of development partners to advance the adoption of GMGs. The MDP is designed from the beginning to be integrated and closely coordinated with the activities carried out in the framework of the HIO.



2. COUNTRY OVERVIEW

Burkina Faso, with a population of 18 million people, is a landlocked country in West Africa with a total area of 274,220km.³ The country borders with Mali to the north, Niger to the east and Ivory Coast, Ghana, Benin and Togo to the south. The country is divided into 13 administrative regions including Boucle du Mouhoun, Cascades, Centre, Centre-Est, Centre-Nord, Centre-Ouest, Centre-Sud, East, Haut-Bassins, Nord, Plateau-Central, Sahel et Sud-Ouest. The capital Ouagadougou is located in the centre of the country and has a population of over one million people.

Burkina Faso is characterised by flat undulating landscapes and a dry climate. There are some hills in the western and southeastern parts of the country with the highest point at Tena Kourou reaching 749m. The climate is mostly tropical with warm and dry winters and hot with some rainfall in the summer. Rainfall is often poor averaging between 600 and 900mm but significantly lower in the arid north. Temperatures often exceed 40°C.

The economy is heavily reliant on agriculture and gold production. Close to 80% of the active population is employed in the agricultural sector. Cotton is the country's most important cash crop. Agricultural production is vulnerable to weather conditions and the risk of limited rainfall, as was the case in 2011 when a severe drought resulted in poor harvests and meagre food stocks for villagers and their livestock. In recent years, the country has witnessed significant increased activity in gold exploration and production. Currently, gold accounts for about three-quarters of the country's export revenue, which makes the country highly vulnerable to changes in commodity prices.

The economy has grown at a sustained rate of 5.5% over the last decade, but political and macroeconomic turbulences slowed the growth rate to 4% in 2014 and 2015. Economic growth did not slow down the growth in population, which has been increasing at a sustained rate of 3%. Total population, which was 11.7 million in 2000, reached 18 million in 2016. With a GDP per capita of US\$ 716 Burkina Faso remains one of the poorest countries in Africa. Approximately 40% of the population is living below the basic needs poverty line and 21% undernourished.⁴ In terms of human development, the country ranks 185 out of 187 on the UNDP's Human Development Report 2016. It is not expected to meet most of the Millennium Development Goals (MDGs), particularly in the areas of literacy, health and sanitation.

GDP growth is projected to bounce back to 6% in 2017 and has the potential to remain above 5.5% over the medium term.⁵ The recovery is expected to be led by the services sector, the launch of production of two new gold mines and a rebound in agricultural output made possible by recent abundant rainfall. Increasing mining activity and public investments are expected to lead to growth on imports, only partially offset by the increased value of gold exports.⁶

The government recently published its National Economic and Social Development Plan (PNDES), which foresees a significant increase in investments over the next five years. Driven by the need to promote growth and an increase in living standards, the plan foresees investments of US\$ 26 billion over 2016-20. This figure represents 2.2 times the GDP of 2016. The plan has three focus areas: institutional reform, human capital development and boosting priority sectors. Half of total investments are expected to be in priority infrastructure, including energy (26%), road transport (12%) and water management (12%).

3 UN World Statistics Pocketbook. Ethiopia Country Profile. 2014.

4 IMF

5 IMF

6 IMF

3. GREEN MINI-GRID POTENTIAL

3.1 INTRODUCTION

The power sector in Burkina Faso is characterised by a low electrification rate and a heavy reliance on expensive thermal generation, which creates an opportunity for green mini-grid technologies. The electrification rate stands at 18% nationally and at 3% in rural areas, while the settlement electricity coverage stands at 33%.⁷ Thermal power stations account for 90% of total power generation capacity. The diesel on which they run must be imported and transported, resulting in high generation costs. This context creates opportunities for the development of electrification solutions based on green decentralised energy systems.

Burkina Faso has significant renewable energy potential notably in the form of solar irradiation and biomass. The country has developed 32MW of hydropower potential, but opportunities for further development are limited. According to the UNEP Riso Centre, the economically feasible hydro potential is 215GWh/year. The four hydropower sites that have been exploited to date account already for half of this amount, with an annual production of about 100 GWh. Solar and biomass have therefore the highest potential. The country has a solar irradiation of 5.5 kWh/m²/day for 3,000 to 3,500 hours per year.⁸ Biomass is the most commonly used source of energy, with about 90% of households using wood as the main source of energy. Significant biomass resources are available in several regions, notably in the East and South-West regions. The majority of studies have not identified significant wind potential, with wind speeds generally reaching 4 to 6 m/s, with a maximum of 6 to 7 m/s in the north of the country. A recent mesoscale wind resource analysis estimated potential of 312MW from wind farms and 4,411MW from small 50kW wind turbines.⁹

Mini-grids have been promoted since 2005 when the Electricity Development Fund (FDE) was established. Beyond the concession area of the national utility SONABEL, in segment 2 areas there are currently 93 local cooperatives managing mini-grids. Most of them are connected to the grid and purchase power in bulk from SONABEL, but several have generation capacity. Around one third include PV systems. FDE has supported electrification of over 200 settlements and increased the number of connections in segment 2 areas from 5,000 in 2009 to 25,000 today.

Clean energy mini-grid solutions can accelerate electrification and universal energy access. The Energy Sector Policy of 2014-2025 aims to significantly expand electrification and encourage the utilisation of domestic resources. The 2015 national action plan to drive implementation of the Sustainable Energy for All initiative (SEforALL) and promote renewable energies include targets in terms of energy access and renewable energies.¹⁰ The 2030 target national rate for electricity access is 65%, and 50% for rural areas. The renewable target is for a 50% renewable energy mix by 2030. An off-grid development strategy ("plan Directeur" in French) over the next five years is being developed by FDE, although it has been halted recently to accommodate the changes anticipated under the new energy law in development (Section 5). ANEREEE, a renewable energy and energy efficiency agency, is being established to support implementation of the policy and promote the use of clean energy sources in the country. The policy and regulatory framework is being developed to define responsibilities and to potentially promote private sector participation in the mini-grid sector.

3.2 ASSESSMENT BACKGROUND

Estimating the potential for mini-grids is a challenging task that requires substantial data and assumptions. Some physical factors, such as resource availability and geographic features, can be collected remotely through satellite data, but other factors require the availability of local datasets and surveys. Certain non-physical factors, such as demand and consumption patterns, require precise settlement-level data to be collected. This data is often unavailable, out of date, or

7 Percentage of villages connected to the main power grid or to a local mini-grid. ECREEE Baseline report for Burkina Faso, 2014.

8 IRSAT and DMN

9 <http://dx.doi.org/10.1080/15435075.2016.1253571>

10 Not yet ratified

is highly resource intensive to obtain. An opportunity assessment relies upon a number of assumptions and criteria that are driven by the particular business model and approach of the implementing agency for each case. For example, a private developer may consider purely financial metrics, whereas a community scheme could focus more on the level of service provided. A detailed assessment in this report will not address the needs of all stakeholders for which it is intended. Therefore, this report aims to capture available data and highlights general assessments that would be relevant to most mini-grid stakeholders. Raw data is provided with this report to allow stakeholders to conduct their own further analyses as required.

Data has been compiled from a number of sources for this analysis, including the ECOWAS observatory for Renewable Energy and Energy Efficiency (ECOWREX), the National Institute of Statistics and Demographics, FDE and SONABEL. Data on renewable energy sources is in general limited. No national renewable energy atlas has been completed in Burkina Faso, but some studies have been conducted on hydro, solar and wind potential. In general, there is the need to make Geographic Information System (GIS) data and other information held by public institutions more broadly available to stakeholders and the public at large. The government's new rural electrification plan and regulatory framework for clean energy mini-grids, reportedly under development, may help address this issue.

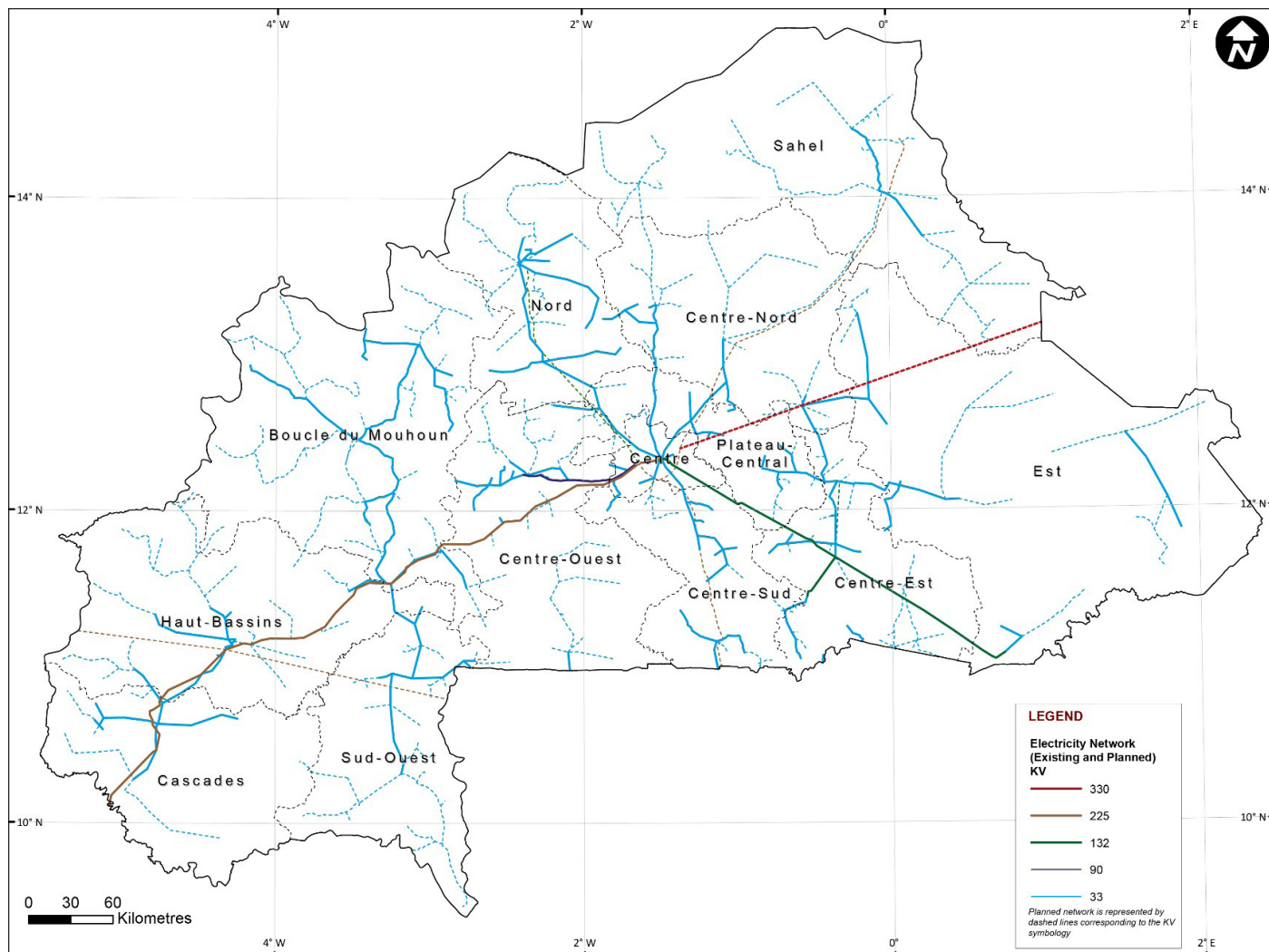
This high-level analysis defines grid and off-grid areas based on their distance from the power network. Grid regions are defined as those areas within 15km of the grid. Off-grid population centres are then mapped, enabling an analysis of the potential for mini-grid projects. Analysis has been conducted using both the current power network and planned power network up to 2025.



3.3 MINI-GRID POTENTIAL ASSESSMENT

Grid coverage is relatively broad, with about 63% of the population living within 15km of the power network. The grid extends most into the Central, Southern and Western regions. Figure 1 shows the current national grid with the planned network extensions up to 2025. The grid extends radially from the central capital of Ouagadougou. Centre is the administrative region with the highest coverage, with all its population centres within 15km from the existing grid. The largest gaps in regional coverage are found in the Sahel and East regions, although a number of grid extensions are planned in these regions. There are sections of the grid that have been built, but not connected to the main grid, for example in the East region. This infrastructure could be either connected to the main grid or integrated into mini-grid projects.

Figure 1. Existing electricity grid with planned network up to 2025.



Source: Sonabel, 2014

Based on current grid coverage, this analysis estimates that 37% of the population (6.6 million people) would be best served by off-grid solutions. This figure provides an upper limit for the market size for mini-grids as some of these off-grid households are likely best served by standalone systems. Figure 2 shows the distribution of population centres located further than 15km from the existing power grid. These population centres are grouped by population size, using the thresholds of 1,000 and 5,000 people. In terms of people, the largest market potential for mini-grids is found in the

Centre-Nord, Boucle du Mouhoun, Sahel and East administrative regions, home to 1.02 million, 1.01 million, 837,000 and 810,000 people, respectively. These results are overall consistent with the results of a study completed by the EU Joint Research Centre in 2016.¹¹

Based on planned network coverage, this analysis estimates that 1.2 million people would be best served by independent mini-grid solutions. In this case, the largest potential for off-grid solutions are in the East, Sahel and Boucle du Mouhoun regions, with 276,000, 215,000 and 187,000 people, respectively. It should be noted however that the current rural electrification model favours network-connected mini-grids, where local distribution companies purchase power from SONABEL, and are then in charge of distribution and bill collection. As a result, grid extension will not necessarily reduce the market potential for mini-grids. Given the persistent limited generation in Burkina Faso and reliance on fossil fuels, further extension of the main grid may also present an opportunity for green mini-grid developers to invest in generation capacity and sell excess power to the grid.¹²

The national average annual per capita expenditure on energy is approximately US\$ 19. This is calculated using 2009 data on regional annual expenditure from National Institute of Statistics and Demographics (INSD),¹³ extrapolated to 2015 (Table 1). The per capita expenditure ranges from US\$ 14 in the East and North regions to US\$ 27 in the Central region.

Table 1. Estimated regional annual per capita expenditure on energy for 2015.

	2009					2015
	Total exp. (billion CFA)	No. of people	No. of households	Yearly HH exp. (CFA)	Yearly per capita exp. (CFA)	Extrapolated annual per capita exp. on energy (US\$)
B. du Mouhoun	257	1,542,923	200,228	1,283,536	166,567	16
Cascades	126	591,794	87,956	1,432,538	212,912	21
Centre	547	1,952,846	386,063	1,416,867	280,104	27
Centre East	191	1,224,131	169,136	1,129,271	156,029	15
Centre Nord	266	1,295,583	164,212	1,619,853	205,313	20
Centre Ouest	215	1,271,257	193,830	1,109,218	169,124	17
Centre Sud	118	683,511	110,681	1,066,129	172,638	17
East	189	1,326,753	193,249	978,013	142,453	14
Hauts Bassins	350	1,606,529	238,287	1,468,817	217,861	21
Nord	180	1,267,204	142,702	1,261,372	142,045	14
Plateau Central	116	745,640	104,611	1,108,867	155,571	15
Sahel	226	1,051,877	171,015	1,321,522	214,854	21
Sud Ouest	103	666,399	99,446	1,035,740	154,562	15
BURKINA FASO	2,884	15,226,448	2,261,416	1,275,307	189,407	19

Source: INSD *Annuaire statistique 2015*

Note: GDP growth is used to extrapolate total expenditure from 2009 to 2015, giving a scaling factor of 140% (World Bank). A currency conversion of 0.0016 US\$/CFA is used. 4.38% percent of the annual expenditure is assumed to be on energy (World Bank Database: Household final consumption expenditure, 2015).

11 Joint Research Centre, Universal access to electricity in Burkina Faso: scaling-up renewable energy technologies, 2016, Environ. Res. Lett. 11 (2016) 084010. Note: The output of this analysis is a distribution, by population, of 53% grid extension, 46% solar PV mini-grid and 1% PV standalone systems.

12 This model is being explored elsewhere in SSA, particularly in middle-income countries such as South Africa. Here mini-grids can generate revenue while also reducing the demand on an overloaded grid. The grid connection can also be used to reduce the level of generation and storage equipment required.

13 INSD Annual Statistics 2015, December 2016.

This analysis estimates a market size of US\$ 117.1 million, based on the regional annual per capita expenditures on energy calculated in table 1.¹⁴ This is shown in table 2. The largest regional market is in Centre-Nord, with an estimated current annual expenditure on energy of over US\$ 20.5 million. Boucle du Mouhoun, Haut-Bassins and Sahel regions also show good potential, having estimated market sizes of over US\$ 15 million.

This analysis estimates a market size of US\$ 20.9 million when including the planned network extensions up to 2025. The largest markets in this case are the Sahel, East and Boucle du Mouhoun regions. These regions have an approximate annual energy spend of US\$ 4.5 million, 3.9 million and 3.0 million, respectively. The actual market size may be greater than this considering decentralized solutions could also be feasible in areas in grid proximity. As already highlighted, local distribution companies maintain their licence when they are connected to the grid. Thus, the connection to the grid, rather than reducing the market, may actually increase it, creating the potential to sell excess power to SONABEL should appropriate regulations be developed.



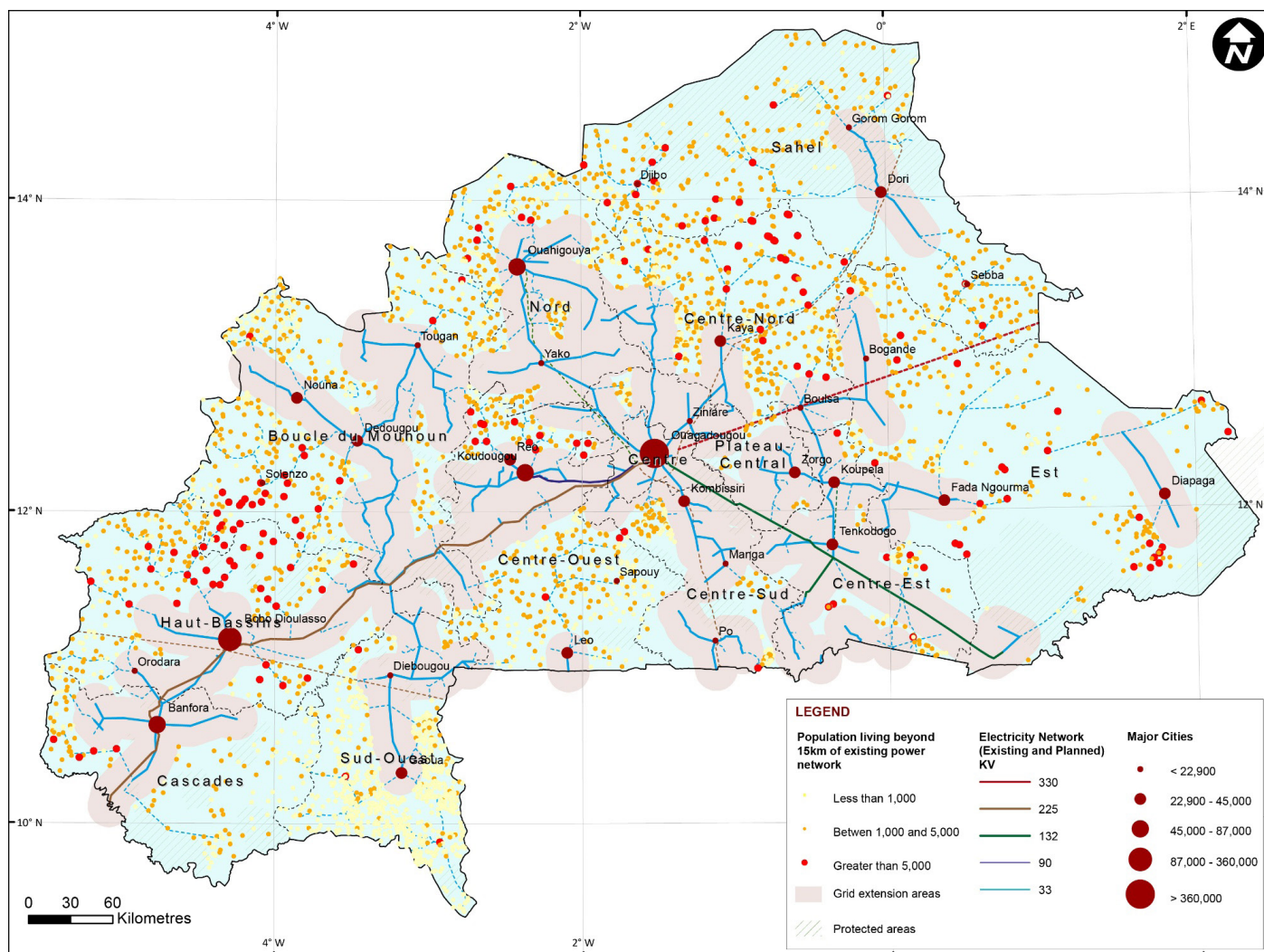
14 The total market size is estimated from the household energy market size. This assumes that 60% of household energy spend is on electricity, and that household spend makes up 60% of the total revenue of a mini-grid (when including revenue from businesses, public sector buildings and industrial users).

Table 2. Estimated household market size for off-grid solutions. Analysis using the existing and planned network up to 2025, and a population split between grid extension and off-grid regions.

Region	Grid Extension	Mini-Grid			
	Population	Population less than 1,000 people	Population greater than or equal to 1,000 and less than 5,000	Population greater than 5,000	Off-grid market size estimate (\$m)
Existing grid					
B. du Mouhoun	1,023,847	124,609	665,224	222,919	16.6
Cascades	342,973	37,814	186,859	38,387	5.5
Centre	1,552,757	-	-	-	-
Centre-Est	1,355,288	18,875	109,436	49,822	2.7
Centre-Nord	729,516	83,778	670,838	264,170	20.5
Centre-Ouest	1,072,037	83,982	408,298	104,206	9.9
Centre-Sud	726,501	26,497	131,638	12,618	2.9
East	682,155	71,605	566,980	171,417	11.3
Haut-Bassins	1,026,138	49,093	416,166	254,943	15.4
Nord	1,253,441	67,231	336,713	43,153	6.2
Plateau-Central	922,908	7,241	92,670	14,339	1.7
Sahel	118,498	59,830	632,258	144,737	17.6
Sud-Ouest	500,253	301,319	123,524	15,499	6.7
TOTAL	11,306,311	931,875	4,340,605	1,336,209	117.1
Existing grid and planned extensions up to 2025					
B. du Mouhoun	1,850,058	19,778	105,190	61,573	3.0
Cascades	511,467	17,808	76,757	-	2.0
Centre	1,552,757	-	-	-	-
Centre-Est	1,495,827	2,533	14,005	21,056	0.6
Centre-Nord	1,634,950	9,196	67,791	36,365	2.3
Centre-Ouest	1,607,628	21,155	39,740	-	1.0
Centre-Sud	880,888	3,998	6,231	6,137	0.3
East	1,215,901	24,795	181,175	70,286	3.9
Haut-Bassins	1,656,485	7,519	38,879	43,457	1.9
Nord	1,677,924	5,423	17,190	-	0.3
Plateau-Central	1,022,894	1,074	13,190	-	0.2
Sahel	739,907	14,930	180,512	19,974	4.5
Sud-Ouest	880,719	39,914	19,963	-	0.9
TOTAL	16,727,406	168,122	760,623	258,849	20.9

Source: Carbon Trust analysis

Figure 2. Distribution and population of settlements further than 15km from the grid.



Source: FDE

3.4 RENEWABLE ENERGY POTENTIAL FOR MINI-GRIDS

HYDRO

Burkina Faso has limited hydropower potential. According to the UNEP Riso Centre, economically feasible hydro potential totals 215GWh/year. To date, four sites have been developed including Bagre (16MW), Kompienga (14MW), Niofila (1.5MW) and Tourni (0.5MW). Together, their annual production capacity is about 100 GWh¹⁵. A preliminary study conducted by SONABEL and EDF in 1999 estimated small-hydro potential at 130MW and identified up to seventy candidate sites.^{16 17} The study estimated costs of energy ranging from CFA 100 to CFA 175 per kWh (US\$ 0.16 to US\$ 0.28 per kWh).¹⁸ A new study conducted in 2008 by DECON determined that 13 were technically and economically feasible. These are listed in Table 3. Of these, the site of Samendeni is being developed, with the construction of a 2.4MW power station ongoing. The sites of Bagré Aval (14MW), Folonzo (10.8MW), Gongourou (5MW) and Bontoli (5.1MW) are undergoing additional

15 SONABEL

16 Inventory of Burkina Faso Hydroelectric Sites, EDF- SONABEL-CNEH, 1999.

17 International Center on Small Hydro Power, 2011.

18 ECREEE, Regional Reports on Renewable Energies, 2009.

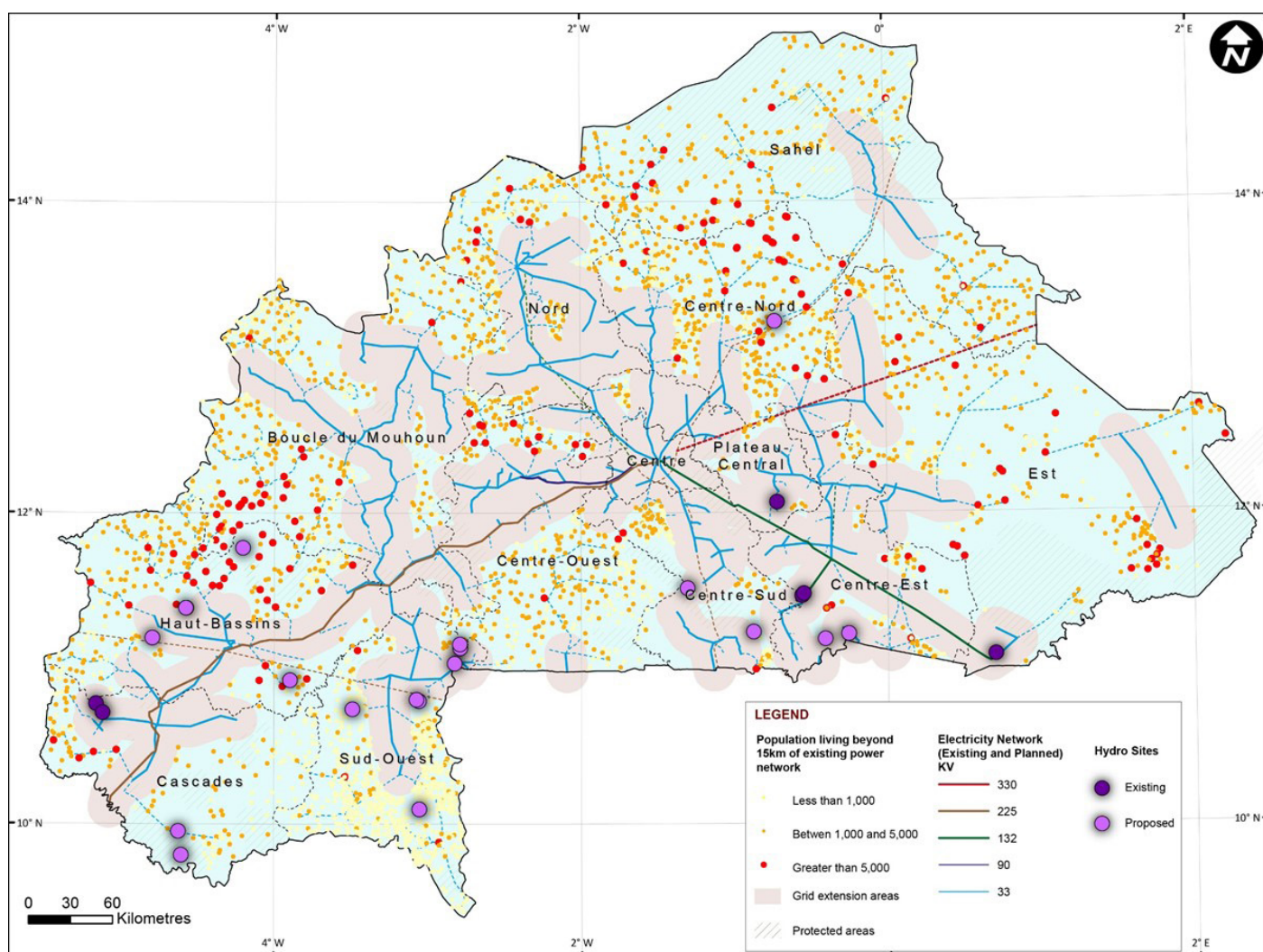
feasibility studies. Figure 3 shows existing and planned hydro sites overlapped with the analysis on grid extension and off-grid areas. The hydro sites are located predominantly in the southern and southwestern parts of the country. Most are found within 15km of the power network and some could be used to power independent rural mini-grids.

Table 3. Identified hydropower sites

Site	Estimated power (MW)	Estimated production (GWh/year)	River
Hydro			
Bagre-aval	14	37.3	Nakambe
Bon	7.8	29.1	Mouhon
Folongo	10.8	27.3	Comoe
Gougourou	5.0	17.7	Poni
Mini-hydro			
Badango	3.0	10.2	Nazinon
Bittou	1.6	6.2	Nouhao
Bontoli	5.1	11.7	Bougouriba
Kirgou	2.1	9.9	Fagoa
Samendeni	2.4	11.2	Mouhoun
Micro-hydro			
Arli	0.9	2.7	Doudobo
Baoue	0.3	0.9	Baoue
Bonvale	0.3	0.5	Siou
Koutseni	0.5	2.2	Dienkoa

Source: DECON, 2008

Figure 3. Existing and proposed hydro sites, included with population centres further than 15km from the grid. Carbon Trust analysis.



Source: ECOWREX

BIOMASS

Biomass is the main source of energy in Burkina Faso for about 90% of households. Biomass, both in the form of firewood and charcoal, is produced through the exploitation of the country's forests and is mostly used as cooking fuel. The exploitation of wood is regulated by the Ministry of Environment, Green Economy and Climate Change (MEEVCC) and its decentralized forest services. Multiple Forest Management Groups (GGF) are coordinated by the National Federation of Forest Management Unions (FNUGGF). Biomass is not currently used to power electricity mini-grids, but two agricultural companies have developed power-generation projects that exploit the by-products of their activities. These are SN Sosuco, a sugar producer, and SN Citec, an oil producer.

Existing biomass potential is associated with agricultural activities, although no thorough assessments of the potential for energy generation exist. Agriculture accounts for about 40% of GDP and employs about 80% of the labour force. While about 11.9 million ha (44% of the country surface) are estimated to have agricultural potential, only 5.7 million ha are actually cultivated. The agricultural production of different crops is given in Table 4. Cereals, including millet, sorghum, corn and rice are the principal agricultural products and produced a total of 4.2 million tons in 2015. Their cultivation involved about 3.6 million ha of land. The main cash crop is cotton, cultivated over 6.6 million ha. Other cash crops include peanuts and sesame, whose cultivation extends over 8.3 million ha. Such crops could form the feedstock for bioenergy

plants, and the government has also explored the substitution of diesel with the oil from the *Jatropha* plant. However, agriculture is still dominated by subsistence production and characterised by low crop productivity, low diversification, and limited participation of formal private businesses.

Table 4. Agricultural production in Burkina Faso.

	2013	2014	2015	2013	2014	2015
Food crops	(in tons)			(in hectares)		
Cereals	4,869,722	4,469,300	4,189,664	4,210,656	3,646,006	3,584,230
Millet	1,078,570	972,539	946,184	1,327,078	1,192,006	1,160,718
Sorghum	1,880,465	1,707,613	1,435,640	1,806,529	1,548,404	1,444,937
Corn	1,585,418	1,433,085	1,469,611	913,630	749,935	820,117
Rice	305,382	347,501	325,138	138,852	144,261	142,715
Others	19,887	8,562	13,091	24,567	11,400	15,743
Cash crops						
Cotton	766,221	894,982	768,930	629,460	651,294	657,840
Peanuts	349,688	335,223	365,887	448,767	375,040	432,665
Sesame	137,347	321,837	235,079	203,449	506,095	400,255

Source: INSD, *Annuaire statistique 2015*

Forests and wooded savannah cover 12 million ha, or 47% of the country's surface. About 12.9 million ha can be classified as forested. Two thirds consist of shrubby and wooded savannah, while 4 million ha are designated as “classified” forests under government management. Over the last 20 years, the country has been suffering a slow, but continuous loss of forest cover, with an average deforestation rate estimated at 0.83%. Most of the land cover change occurred in areas characterised as shrubby savannah as a result of agricultural activities and the production of wood and charcoal as energy vectors.

Several initiatives are being promoted to combat deforestation and harness the power of biomass to improve rural livelihoods. A National REDD strategy has been developed with the goal of improving “the efficiency and sustainability of wood energy value chains and support to alternative carbon emission reducing livelihoods.” Programmes such as the Forest Investment Program (FIP) and a Biomass Energy Nationally Appropriate Mitigation Action (NAMA) are being implemented to operationalise the referred strategy. These programmes build onto the National Program of Burkina Faso (PNB-BF), during the first phase of which 4,013 bio digesters were built, predominantly used for cooking. A second phase is being implemented with 18,200 bio-digesters to be constructed between 2014 and 2017. The Burkina Faso Biomass Energy NAMA, which started in 2015 and is currently seeking financing, aims to reduce emissions associated with biomass use and respective deforestation by distributing energy efficient cook stoves for traditional beer brewing and the production of shea butter and sumbala.¹⁹

SOLAR

Solar irradiation is the most available energy source in Burkina Faso, and in several applications may be cost-competitive with the best alternative option. Burkina Faso enjoys an average daily solar irradiation of 5.5 kWh/m² during 3,000 to 3,500 hours per year.²⁰ The highest potential is in the northern parts of the country, exceeding a daily solar irradiation of 5.75 kWh/m². Given that 90% of electricity is produced through thermal stations running on expensive imported fuels, solar is becoming an increasingly economically feasible alternative. Solar annual average global horizontal irradiation is shown in Figure 4.

¹⁹ Burkina Faso Biomass Energy NAMA, Case Study – International Partnership on Mitigation and MRV, 2015.

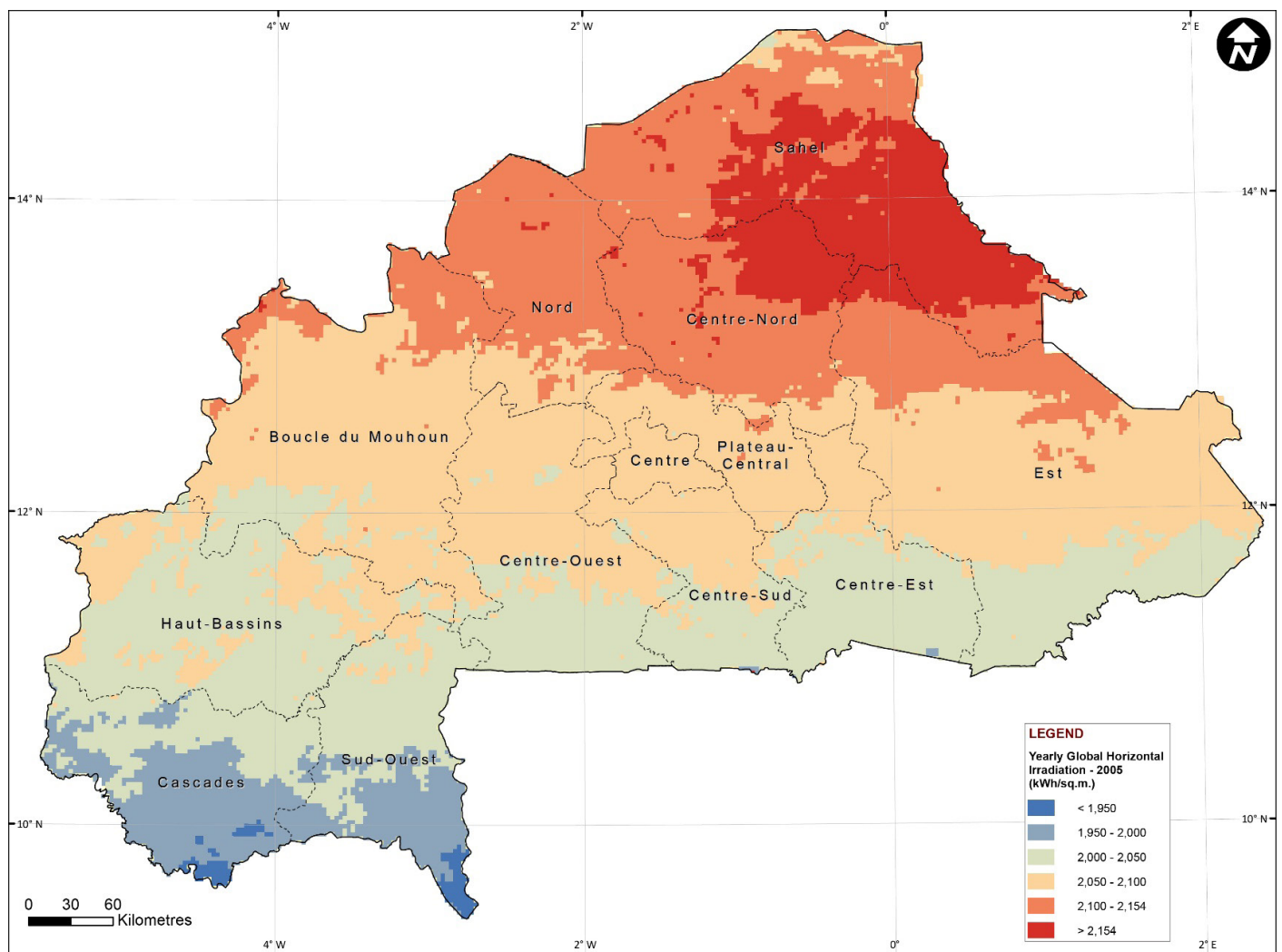
²⁰ Ministry of Energy

Small solar PV installations have seen a significant growth over the last years. ARSE estimated a total installed PV capacity of 2.8MW in 2014, of which 1.2MW corresponded to telecommunication towers and the rest to a number of small systems installed in public and private buildings.²¹ About 80kW correspond to hybrid systems promoted by FDE in rural areas.

To reduce dependency on expensive fossil fuels, the government aims to increase the share of renewable energies, particularly solar PV, in the generation mix. In an effort to reduce generation costs, the government is targeting a significant increase in solar PV generation by 2030. Most of it consists of utility-scale PV power plants. These would require investments in the national grid to enable it to absorb solar power and increase storage or baseload capacity (e.g. thermal power and interconnection) to compensate for the intermittency of solar power.

Several utility scale solar PV projects have been identified and proposed. Although the government aimed at commissioning 120MW of solar PV by 2018, only two projects are at an advanced stage of development. Construction of a 33MW plant started in Zagtoui, in the proximity of Ouagadougou, in the second half of 2016 and is expected to be completed in 2017.²² A 20MW solar plant power purchase agreement (PPA) was also signed with Canadian Windiga Energy, with support from the AfDB (Section 5.2). This EUR 47.5 million project has been mostly funded by donors, including the French Development Agency (AFD) and a EUR 25 million grant from the European Union. Two competitive bids were open in 2013 and 2016 for the development of two other PV plants, with capacities of 70MW and 80MW. Five companies have been shortlisted but none of the proposed projects has reached financial close.

Figure 4. Solar annual average global horizontal irradiation (kWh/m²/year).



Source: DTU/IRENA.

21 ARSE Activities Report, 2014.

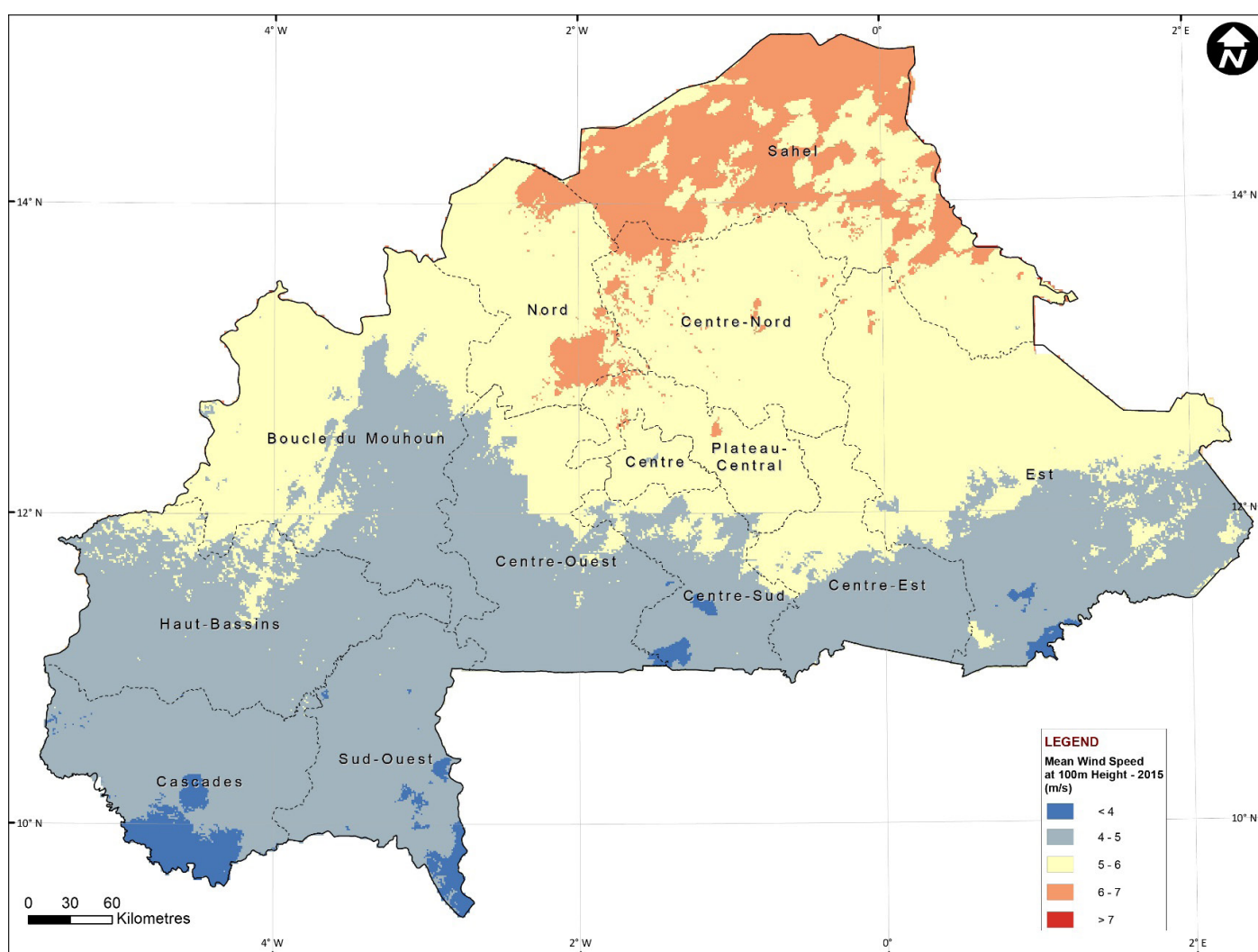
22 ARSE Activities Report, 2014.

Several programmes aim to harvest small-scale solar energy. Under the Energy Facility program, the EU is supporting projects such as the “Eco-Electrification dans le Nord et le Centre-Nord du Burkina Faso” project. Initiated in 2014 and implemented by the Cooperative Collective Infrastructure Corporation (SINCO), the project aims to install a total of 2MW of PV capacity through eight small mini-grids.²³ Solar home systems are also being promoted through several electrification programs such as Miresol, implemented by FONDEM. Some organizations are also testing small-scale thermal power systems of around 10kW.

WIND

Wind speeds generally average between 4 and 6 m/s, reaching 6 to 7 m/s in the Sahel region in the north of the country. The map of mean wind speed at 100m is represented in Figure 5. The majority of studies have not identified significant potential for wind power generation, as 6.5 m/s is generally considered the minimum speed required for wind power projects. A recent mesoscale wind resource analysis confirms that the wind regime is generally low, but shows that the northeastern region of Burkina Faso has a good wind regime at 80 m above ground level. This study estimates potential of 312MW for wind farms and of 4,411MW for small-scale 50kW wind turbines.²⁴

Figure 5. Mean wind speed at 100m.



Source: DTU/IRENA.

23 The status of this project as well as whether these mini-grids will be isolated or grid-connected, is unclear.

24 Yves Gagnon et al. On the wind resource mapping of Burkina Faso. 2016. Int. Journal of Green Energy.

4. OVERVIEW OF THE ENERGY SECTOR

4.1 CURRENT CONTEXT AND OVERVIEW OF RESPONSIBILITIES

The energy sector is characterised by a low rate of energy access, a high dependence on thermal generation, high power production costs and a loss making power utility. While population and energy demand are growing fast, the national electrification rate of 18% remains low, even by regional standards. Installed capacity totals 325MW, including 292MW of thermal capacity and 32MW of hydropower capacity. Most of the installed capacity is aging and characterised by low availability rates. SONABEL, the national utility, has been incurring losses for several years. In 2015, its cost of electricity service was around CFA 142 per kWh. Tariffs, at an average of CFA 90.5 per kWh are non-cost reflective. As a result, SONABEL depends on continuous government subsidies to sustain its operations.

Burkina Faso's energy policy is articulated in the Energy Sector Policy (POSEN) for 2014-2025. To address the multiple challenges faced by the energy sector, POSEN outlines the vision for “a Burkina Faso energy sector that depends on endogenous resources and regional cooperation, ensures universal access to modern energy services and affirms its driving role in sustainable development.” The policy identifies a number of sector reforms to increase energy access, increase energy production and the share of renewable energies, and improve energy efficiency.

The main authority in the energy sector is the Ministry of Energy. The Ministry has the overall responsibility for the energy sector through the energy directorate, which consists of three technical directorates: the Directorate for Renewable Energy, the Directorate for the Promotion of Energy Efficiency and the Directorate of Conventional Energy.

The country has been divided in two distribution segments, with distinct regulations and actors. The first segment includes the area served by SONABEL, the national utility, which covers the main population centres. SONABEL has a monopoly over transmission and distribution, but generation is open to other parties and independent power producers. The second segment includes rural areas, which fall under the realm of responsibility of the Electrification Development Fund (FDE) and local authorities. FDE coordinates electrification programmes and provides funding to rural electrification promoters in the form of grants and loans. A regulatory agency (ARSE) was created in 2007. Operating under the authority of the prime minister, it has the mandate to regulate operators, arbitrate disputes and protect consumer rights. The government is currently aiming to strengthen ARSE's powers under a new energy law, which includes increasing its power over issuance of sector acts, pricing, control and arbitration.

Power distribution is the responsibility of local cooperatives (COOPELs) in the country's second distribution segment. The local cooperative model was identified as a mechanism to promote electrification in rural areas where SONABEL, due to technical and financial constraints, was not able to serve. Currently, there are more than 90 local cooperatives with an authorisation or concession to manage a local distribution network. Most of them are connected to the grid and purchase power in bulk from SONABEL, but several have generation capacity. One third are estimated to include PV systems. These mini-grids average 300 customers, but may supply anywhere from 50 to a few thousand customers. COOPELs are generally managed by a small team of people, often volunteers, which execute simpler tasks such as administration, invoicing and bill collection. There is a national coordinator, the National Union of Electricity Co-operatives in Burkina Faso (UNCOOPEL), which lobbies for financing of the COOPELs and conducts trainings and support visits.

The COOPEL model faces several challenges. Local cooperatives are volunteer-based and most have limited technical capabilities so must rely on external technical providers (so called *fermiers* in French) to manage the distribution network. The role of the tasks assumed by the *fermiers* varies from one COOPEL to another, but may include extending the network, connecting customers, billing, collection, etc. The relationship between *fermiers* and COOPELs varies drastically from one case to another and may be regulated by contract or not. Most local cooperatives are not financially sustainable and suffer losses. This is despite financial support provided by FDE in the form of investment subsidies, subsidies to purchase gasoil and subsidies to cover the costs of technical support services provided by *fermiers*. The financial constraints faced by COOPELs further impact their capacity to pay *fermiers* and reimburse the concessional loans provided by FDE.

Promoting electrification through green mini-grids is a priority in the government agenda. In 2015, national action plans were drafted to support renewable energies (PANER) and drive implementation of the Sustainable Energy for All initiative (SEforALL). These action plans define targets in terms of energy access and renewable energies. The target is for the national electrification rate to reach 36% in 2020 and 65% in 2030 (Table 5). A new agency (ANEREEE) is being created to promote renewable energies and energy efficiency.

Table 5. SEforALL National Action Plan targets for electricity access.

	2010	2015-E	2020-F	2030-F
Urban	46.15%	60%	75%	95%
Rural	1.21%	3%	19%	50%
National	13.56	18%	36%	65%

Source: SEforALL National Action Plan

4.2 POWER NETWORK AND INFRASTRUCTURE

The current electrification rate of 18% and installed power capacity at 325MW have grown slowly over the last five years.²⁵ While the electrification rate in urban areas reached 59%, it is only 3% in rural areas, which is low by regional standards. Installed capacity totals 325MW, which includes 293MW of thermal capacity and 32MW of hydropower capacity. Most of the installed capacity is aging and characterised by low availability rates. The network is connected through a 225kV transmission line to Ivory Coast and Ghana that supplies one third of the country's electricity.

The country has a relatively extended transmission and distribution network. About 63% of the population lives within 15km of the power network, which includes 4,243km of high voltage lines and 8,626km of low voltage lines. Transmission and distribution losses amount to 17%, which position SONABEL as one of the best performing utilities in Sub-Saharan Africa in that respect. Nevertheless, underinvestment in the network threatens to increase distribution losses. In terms of grid expansion, the approach has been to first create the backbone and then expand the distribution network. As a result, two formerly separated electricity networks were interconnected in 2009. Between 2011 and 2015 the number of electrified locations increased from 387 to 575, raising the electricity coverage ratio from 27.42% to 33.32%. In 2015, SONABEL reached about 545,000 customers, while rural cooperatives served an additional estimated 25,000 customers.

Supply has not been able to keep pace with the increase in demand. Power demand has increased drastically over the last decade. SONABEL's customer base increased from 223,312 in 2006 to 544,827 in 2015. Power consumption doubled from 550GWh to 1,125GWh over the same period. Nevertheless, generation capacity increased by only 40%, from 253 in 2006 to the current 321MW. As a result, current electricity supply is only enough to serve the non-peak periods and load shedding has increased significantly. Load shedding reached a record average of 340 hours in 2015, compared to 180 hours in 2009.²⁶

Reliance on thermal power and imported fuels result in high generation costs. While hydropower generation remained stable between 2011 and 2015 at around 100GWh, thermal generation almost tripled, increasing from 360GWh in 2011 to 906GWh in 2015. As tariffs have not absorbed the increase in generation cost, SONABEL has consistently incurred losses over the period. Losses amounted to CFA 15.2 billion in 2011 and CFA 17.7 billion in 2015 (approximately US\$ 30 million in 2015).

25 WB

26 WB

4.3 SUPPORT FOR RENEWABLE ENERGY

Renewable energies have potential, but still play a small role in the country. Small-hydro accounts for 32MW (15%) out of 325MW of installed power capacity. Biomass, including wood and charcoal, is the main fuel for cooking for almost 90% of households. Battery lanterns are the preferred source of light for 61% of households, while solar energy is the main source of light for only 5% of households.²⁷

The mid-term objective of the sector is to reduce dependency on imported fossil fuels and increase the share of renewable energy and electricity imports into the generation mix. Achieving this objective requires investing in generation but also in the national grid to enable it to absorb intermittent solar power. The 2015 National Action Plan on renewable energies sets targets for renewable energies. The action plan has been prepared with the supervision of the inter-ministerial committee (CIESPA) charged with the implementation of the SEforALL program. The action plan sets goals on power production and energy access associated with renewable energies and identifies a number of policy initiatives necessary to achieve the defined objectives. The plan foresees that most of the increase in renewable energy capacity will be in the form of solar PV plants, with a goal of 107MW to be added to the grid by 2020. The on-grid renewable energy targets are given in Table 6. There are also several West African regional policies that apply to Burkina Faso, including the ECOWAS Renewable Energy Policy (PERC) and the WAEMU Regional Program for the Development of Renewable Energies (PRODERE).

Table 6. On-grid renewable energy targets.

	2010	2020	2030
Installed capacity			
Total RE installed capacity (MW)	32	150	318
Share of RE on total installed capacity (%)	15	24	36
Power generation			
Total RE-based electricity produced (GWh)	117	306	685
Share of RE on electricity produced, including imports (%)	12	9	9
Share of RE on electricity produced, excluding imports (%)	21	17	27

Source: Paner

Construction of a 33MW PV plant started last year in Zagtoui, in the proximity of Ouagadougou. This SONABEL promoted, EUR 47.5 million project has been funded mostly by donors, including the French Development Agency (AFD), the European Investment Bank and a EUR 25 million grant from the European Union. The installation will be the largest solar power infrastructure in Sub-saharan Africa. Also under construction is a 2.4MW hydropower plant at Samendeni, a project funded with a US\$ 2 million loan from the Abu Dhabi Fund for Development (Section 6.3).

To achieve the target on RE capacity set for 2020 Burkina Faso will need to rely on private investments. To promote private investments, Burkina Faso has been developing the necessary legal framework. The power generation sector has been liberalised and is open to private investments and operators. Public-Private Partnerships (PPP) principles have been defined in Law 020-2013/AN of May 23rd 2013 and a Directorate for the Promotion of PPP under the Ministry of Economy and Finance (MEF) has been established. Within this framework, the government launched competitive bids in 2013 and 2016 for the development of two PV plants with capacities of 70MW and 80MW. Five companies have been shortlisted but no project has reached financial close. SONABEL's negative financial results are also a significant obstacle to investors interested in projects that aim to sell power to the national utility.

Few investment incentive policies targeting specifically renewable energies exist. The Corporate Tax Law of 2010 provides some incentives to energy projects. Steam, heat, and energy generation equipment can be depreciated at an accelerated rate, while imports made by electricity, water and telecommunication companies are exempt from import tax at

27 INSD 2014

source. Solar equipment is also exempt from VAT and custom duties under the Finance Law of 2013. Although not specific to the energy sector, some investments falling within four privileged regimes can benefit from tax, custom duties, VAT, licence fee, and employer's charges exemptions, depending upon investment and job creation levels.

4.4 OFF-GRID DEVELOPMENTS AND SUPPORT FOR ENERGY ACCESS

The rate of rural electrification, at 3%, remains low despite efforts to accelerate energy access. SONABEL is responsible for electrification in urban and peri-urban segment 1 areas. The policy of SONABEL has been to focus first on creating the backbone and expanding later the distribution network. A high proportion of rural communities located relatively close to the existing grid are not attached to it. Around 1,500 population centres with 2.5 million people are within 5 km of distribution lines but remain non-electrified.²⁸ As a result, lanterns and solar lamps are the main source of lighting. According to the National Institute of Statistics (INSD), the use of kerosene as a source of lighting has decreased drastically in recent years. While it was the main source of lighting for 35% of people in 2009, its use was negligible by 2014 (Table 7). In order to promote electrification in rural areas beyond the reach of SONABEL's network (to segment 2) the Electrification Development Fund (FDE) was established in 2005. With support from FDE some 25,000 consumers in rural areas have been connected to local mini grids (Table 8).

Table 7. Distribution of the main source of household lighting in Burkina Faso, 2009 and 2014.

Main source of lighting	2009 (%)	2014 (%)
Power network	14	19.3
Solar energy	0.7	5
Power generator	0.2	0.2
Lamps with chargeable batteries	4.3	12.5
Lantern	44	61
Oil/kerosene	34.7	NA
Others	2.1	2
TOTAL	100	100

Source: INSD, *Annuaire statistique 2015*

Local electricity cooperatives benefit from extended financial support from FDE. The 93 existing mini-grids are promoted by local cooperatives. COOPELs must get a concession from the ministry of energy when their installed capacity is above 25kW and an authorization when their installed capacity is above 10kW. Solar PV systems serving at least 10 clients also require authorization. To finance a grid, cooperatives can benefit from a grant of 60% and a loan of 40% of the investment costs, reimbursable over ten years, with a three-year grace period and preferential interest rates through FDE. In reality however, due to the financial constraints of COOPELs, loans are generally not reimbursed. Although private sector operators in theory could operate mini-grids, they cannot benefit from the described concessional loan. COOPELs receive additional support from FDE in the form of subsidies to purchase fuel and cover some distribution network operating costs. FDE is funded through a special levy of CFA 2 per kWh on SONABEL's electricity sales and from state and donor funding but has limited resources to support existing and new cooperatives.

Renewable energy-mini grids present an opportunity to increase energy access in rural areas. The national Renewable Energy Action Plan (PANER) aims to drastically increase rural electrification, largely through the expansion of renewable energy solutions. Ambitiously, PANER targets a rural electrification rate of 20% by 2020 and 40% by 2030. According to the Action Plan, candidates for mini-grid electrification include population centres with less than 1,500 people, as well as those centres remotely located from the main grid, which may house over 1,500 inhabitants. For reasons previously explained, these mini-grids are mostly expected to comprise solar PV and hybrid systems. Up to two thirds of rural-mini grids are expected to be running on RE technologies by 2020 (Table 9).

28 Moner-Girona et al., 2016

Table 8. Number of electricity connections.

	2009	2010	2011	2012	2013	2014	2015
SONABEL	284,346	362,165	401,476	436,250	472,441	497,541	544,825
FDE	5,494	11,043	13,700	15,890	18,432	21,382	~25,000

Source: SONABEL, FDE

Table 9. PANER targets for rural electrification.

	2010	2012	2015E	2020F
Rural population	3,146,195	3,492,000	3,690,099	4,302,036
Segment 2 connections	11,043	15,890	~25,000	164,823
People covered by electric connections	48,200	96,400	131,768	868,738
Rural energy access rate	1,5%	2,8%	3,6%	20,2%
Share of rural electrification systems running on RE (including hybrid PV systems)	31.5%	31.5%	62.7%	63.5%

Source: Paner

Several multi-lateral donors are supporting off-grid developments in Burkina Faso. The AfDB is currently supporting SONABEL to implement rural electrification projects in Ouagadougou and Baba Dioulasso, focused on capacity strengthening, due to start in September 2017 (project ref. P-BF-FA0-007). The ACP (African, Caribbean and Pacific)-EU Energy Facility (EF) and the Islamic Development Bank are both supporting FDE for the electrification of respectively 75 villages under the ELSA 2011-2013 and ERD ZIGO 2015-2018 projects and 41 localities under the PERD/SPV project. More recently, the Conseil de L'Entente has started to provide financing for the installation of 350 solar kits and public lighting systems in Sampopo. A US\$ 16 million project funded by IRENA is also under development (third round of funding under the IRENA-ADFD Facility, Section 6.3). This project, which has secured funding, will provide electricity to 42 settlements (12,000 households) in Hauts-Bassins and Boucle du Mouhoun through a 3.6MW solar PV mini-grid, as well as grid extension and solar-home system technologies.

In addition, AfDB and World Bank provide support to the government for energy sector development. Under the Energy Sector Budget Support Programme (PASE), AfDB granted US\$ 26 million to the Ministry of Finance for the development of energy sector infrastructure. This focused on the efficiency of electricity sector management under SONABEL, increasing the functional autonomy of its thermal power generation system and improving the performance of fossil fuel transportation infrastructure. The Project for Access to Energy Services (PASEL), funded by the World Bank, includes activities such as strengthening SONABEL's production capacity, investments to extend electric coverage and installing energy saving equipment. The French company Lagazel has opened a solar lantern factory in Dédougou, which aims to produce 1,500 solar lamps per week using local employees, at a cost of between US\$ 20 and US\$ 33 (Section 6.2).

4.5 CHALLENGES TO INCREASE THE UPTAKE OF GREEN MINI-GRIDS

Conditions in Burkina Faso are ripe for investment by modern decentralized energy companies. The country has a low rate of electrification. It favours small distribution networks through long term concessions. And, it has significant renewable energy potential, notably in the form of solar irradiation and biomass. The new government has made renewable energies and access to electricity a priority and is, reportedly, reviewing the rural electrification plan and the regulatory framework for mini-grids.

Nevertheless, the effectiveness of the current mini-grid model, which relies upon local cooperatives, is questionable. The model has failed to mobilize private investment. In addition, private technical expertise and the construction of mini-grids, as previously mentioned, are still funded by the public sector through FDE. Despite this, most, if not all, existing mini-grids are not profitable and rely on continuous subsidies from FDE to purchase fuel or to pay for the maintenance

and operational services provided by *fermiers*.²⁹ FDE's resources are extremely limited and are insufficient on their own to meet the 2030 electrification targets. The strain on public finances is further magnified by the persistent poor performance of SONABEL, which relies also on continuous public subsidies. To address these challenges, the government recently secured support from the World Bank through the First Energy and Fiscal Management Development Policy Financing Program and the AfDB through the Energy Sector Budget Support Programme that should contribute to strengthening the sector financially.

Existing policies hamper green mini-grid development and limit growth of modern decentralized energy systems.

Modern private green mini-grid companies could help Burkina Faso address the challenges described above, contribute to bridge the current electrification gap and reduce the financial burden the power sector places on the national budget. Nevertheless, their development and growth are currently constrained by policies favouring the COOPEL model and limiting the freedom of small energy companies to operate. One constraint is the existence of a standard national tariff that must be applied nationwide. Another is a requirement that PV power providers with ten or more customers, or any project with a generation capacity above 10kW, be subject to an authorisation from the Ministry of Energy to operate.

29 Evaluation report on the transfer of competencies following the training of COOPEL agents on electrical distribution networks, SONABEL (Department of Training and Development), 2014.

5. REGULATORY FRAMEWORK FOR MINI-GRIDS

5.1 REGULATORY AND POLICY ENVIRONMENT: MAIN TAKEAWAYS

Table 10. Summary of the regulatory and policy environment in Burkina Faso.

	Enabling Factors for the development of clean energy mini-grids	Limiting Factors for the development of clean energy mini-grids
Planning and institutional setting	<ul style="list-style-type: none"> Existence of a dedicated rural electrification fund (FDE) and electricity regulator (ARSE) Energy access targets provided in the 2015 SEforALL National Action Plan (a national electrification rate of 65% with coverage rate of 100% by 2030) Private sector may operate generation and off-grid distribution projects National Plan for Economic and Social Development (PNDES) utilises PPPs to leverage infrastructure investment New energy law under development which updates the licencing of clean energy mini-grid projects framework, potentially including provision for FDE subsidies to private mini-grid operators and for exporting excess power, via a PPA, to SONABEL upon arrival of the grid 	<ul style="list-style-type: none"> Complex institutional setting, with many actors involved in planning and delivery, including local authorities, local cooperatives and mini-grid engineering companies; many of which are limited by capacity constraints Majority of mini-grid concessionaires (local cooperatives) operate as not-for-profits and have limited technical capacity 2006 National Electrification Plan (PNE II) ended in 2015 and has not been replaced resulting in a lack of clarity over future grid extension plans and timeframes
Data availability		<ul style="list-style-type: none"> Development of the sector is constrained due to lack of: data availability, such as geospatial data; central coordination and publication of information on renewable and off-grid energy potential; and a renewable energy atlas
Licensing	<ul style="list-style-type: none"> A number of restrictions applied to rural energy systems may be removed under the new energy law 	<ul style="list-style-type: none"> Low thresholds for mini-grid projects to require administrative approval (10kW); projects below 10kW still require a declaration that includes an environmental impact assessment Authorisation from the Ministry of Energy is required for any PV mini-grid servicing more than 10 clients, which is likely to apply to most projects
Tariffs	<ul style="list-style-type: none"> Fixed rate (CFA 75 per kWh) for wholesale of power from SONABEL to grid connected projects under segment 2 used by many mini-grids to distribute and sell power bulk purchased from SONABEL 	<ul style="list-style-type: none"> Mini-grid developers cannot set their own tariff rate Nationally fixed tariff rate applies to mini-grids, and has not been revised since 2009 National tariff is below the level typically required for profitable mini-grids
Subsidies and incentives	<ul style="list-style-type: none"> Mini-grid developers cannot set their own tariff rate Nationally fixed tariff rate applies to mini-grids, and has not been revised since 2009 National tariff is below the level typically required for profitable mini-grids 	<ul style="list-style-type: none"> Resource limitations restrict the level of support FDE is able to provide to clean energy mini-grid projects FDE subsidies are currently not available to private developers (reportedly under review). Nearly all cooperatives are operating at a loss, despite many receiving FDE subsidies (for the purchase of fuel) Fewer investment incentives available compared to other SSA countries e.g. VAT and customs duty exemptions
Power purchase agreements	<ul style="list-style-type: none"> Individual power purchase agreements have been signed for renewable generation projects 	<ul style="list-style-type: none"> Regulatory framework does not include standard PPAs

	Enabling Factors for the development of clean energy mini-grids	Limiting Factors for the development of clean energy mini-grids
Arrival of the grid	<ul style="list-style-type: none"> Mini-grid concessions are clearly delimited and protected by the legal framework, distribution companies maintain their licence upon arrival of the grid, and can purchase bulk power from SONABEL All customers pay the nationally fixed tariff, therefore no risk of the grid undercutting a mini-grid tariff 	<ul style="list-style-type: none"> Although not applicable to most mini-grids, there is no provision for exporting power under a PPA from mini-grids retrospectively connected to the grid Lack of clarity over future grid extension plans and timeframes, as highlighted in <i>Planning and institutional setting</i>
Technical rules	<ul style="list-style-type: none"> Mini-grid projects follow the general rules for electricity projects in the second segment provided in Law No. 053-2012 	
Mobile services	<ul style="list-style-type: none"> Mobile money service available through Airtel 	<ul style="list-style-type: none"> Development hampered by lack of retail distribution networks and a developed customer goods market

5.2 THE MINI-GRID POLICY AND REGULATORY ENVIRONMENT

PLANNING AND INSTITUTIONAL SETTING

The main authority in the energy sector is the Ministry of Energy. The Ministry is responsible for issuing concessions, licences and authorisations for power generation and distribution projects. The Electrification Development Fund (FDE) coordinates rural electrification programmes and may provide funding to rural electrification promoters in the form of grants and loans. A regulatory agency (ARSE) was created in 2007. Operating under the authority of the Ministry, it has the mandate to regulate operators, arbitrate disputes and protect consumer rights. A new agency (ANEREEE) is being created to promote renewable energies and energy efficiency. Central to the strategic planning for electrification is the National Electrification Plan (PNE). The first PNE was released in 1998, and the second in 2006.³⁰ Although PNE II ended in 2015, there has been no third national electrification plan. This has been reportedly stalled over uncertainty in the impact of various potential regulatory changes being explored under the new government.

The power sector is divided into two segments with distinct regulations and actors. The first segment includes the area served by Sonabel, the national utility, which covers the main population centres. Sonabel has a monopoly over transmission and distribution but generation is open to third parties. The second segment includes most rural areas, which fall under the realm of responsibility of the Electrification Development Fund (see below) and the local authorities. Decentralisation gives the local authorities the right to manage freely local matters, including working directly with FDE for regional electrification. In segment two areas, power distribution is the responsibility of local cooperatives (COOPELs). Currently there are more than 90 local cooperatives with an authorisation or concession.

The national targets for energy access, renewable energy and energy efficiency are defined in the Sustainable Energy for All National Action Agenda (2015). The country's ambitious energy access target under this plan is to reach a national electrification rate of 65% (95% in urban areas, 50% in rural areas), with coverage rate of 100%. A 50% renewable share of the energy generation mix is also targeted for 2030.

The National Plan for Economic and Social Development (PNDES) promotes public private partnerships (PPPs) to leverage infrastructure investment. An institutional framework for PPPs was established in 2012, which included the creation of the Directorate for the Promotion of the PPP. The legal regime for PPP was established in 2013 under the PPP Law (Section 5.3). This law was legislated in 2014 through decree no. 2014-024. The procedure for PPP project planning

30 Ministère de l'Énergie et des Mines and Coopération du Royaume Danemark DANIDA 1998 Le Plan National d'Électrification PNE, Ministère des Mines des Carrières et de l'Énergie 2006 Le Plan National d'Électrification—Le Deuxième Plan—PNE II.

in Burkina Faso begins with drafting potential PPP projects and programs by the Ministry of Economy, Finances and Development (DGCOOP). The draft list is then submitted for review by the PPP Commission. The Council of Ministers then gives approval to the submitted final list.³¹

A new energy law is being developed which will revise the framework for licencing of clean energy mini-grid projects. A draft energy law is being discussed at the national parliament. The new law is expected to allow private sector production and distribution and will remove the geographical segmentation of the sector currently divided between FDE and SONABEL. Linked to this and the creation of ANEREE, will be the evolving mandate of FDE as a rural electrification agency. The new energy law will also include provisions to support renewable energy at all scales: rural electrification, self-generation and grid-connected generation through fiscal incentives. It will further allow the export of excess power, via a PPA, to SONABEL upon arrival of the grid. However, the level of support FDE will be able to provide to clean energy mini-grid projects under this new framework is likely to be limited given its financial constraints.

DATA AVAILABILITY

The lack of available data constrains development of the energy sector, especially for renewable energy-based and off-grid solutions. The central information source is the National Institute of Statistics and Demographics (INSD). INSD reports annually on social, demographic, economic and environmental metrics such as poverty, energy access, household size, energy infrastructure, land use and forest cover. Relevant energy sector information can be found, such as the location of transmission and distribution grid lines through SONABEL, but is not always easily accessible. There is a lack of thorough resource potential assessments, and there is no centrally maintained source of datasets covering renewable resource availability or off-grid localities. GIS platforms have been developed in the past, such as through the European Union Improve programme, but have limited and outdated information and limited functionality.³² Production of a renewable energy atlas, such as that produced in Mozambique, would be highly beneficial to prospective developers, especially if published on a regularly updated GIS platform. The development of a comprehensive mobile and mobile money services coverage map would also be useful for energy solutions utilising remote payment and monitoring technologies.

LICENCING

Administrative requirements for mini-grids have low thresholds. Mini-grids with a generation capacity above 25kW require a concession; above 10kW require an authorisation; below 10kW they require only a declaration. An authorisation is also required for any PV-based system servicing more than ten clients, which is likely to apply to the majority of projects (Decree No. 2014-636). Licences, concessions and authorisations can be obtained from the Ministry of Energy (MoE), which will also consult with the relevant local authority with respect to those servicing the second segment. Submission requirements for licences, concessions and authorisations include:

- Proof of business registration and land rights;
- Proof of capability, including proof of technical, operational and financial capacity (including three years of financial statements);
- An environmental impact assessment approved by the Ministry of the Environment;
- Business plan and investment program;
- Description of the project, including licence parameters, 1/50000 scale map, specifications for which authorisation and concessions are being applied, project metrics (quality of service, number of people);
- Proof of administration fees payment; and

31 Note on Public Private Partnerships in Burkina Faso, National Plan for Economic and Social Development (PNDES) 2016-2020. <http://www.pndes2020.com/pdf/03-en.pdf>

32 Example - Geographic Information System of Rural Electrification in Burkina Faso, IED, 2006 - http://www.improves-re.com/sig/SIG/th_Reseau/default.asp. Note: last updated in 2012 and of limited practical use for a visitor, given that maps can only be downloaded in pdf format and the data behind the maps cannot be visualized or download by users.

- Other documentation, including attestations to meet financial obligations, service continuity, quality and security, issuance of insurances and civil responsibilities

Authorisations to the Ministry also require agreement from both ARSE and FDE. The application form can be found at the General Directorate of Energy (DGE), and should be submitted to the MoE for the first segment and the relevant local authority for the second segment (who will inform both MoE and ARSE).

Table 11. Licencing requirement thresholds based on generation capacity (x).

	Thresholds - segment 1	Thresholds - segment 2	Duration (years)
License	$x > 500\text{kW}$		Max 25
Concession		$x \geq 25\text{kW}$	Max 15
Authorisation	$250\text{kW} < x \leq 500\text{kW}$	$10\text{kW} < x < 25\text{kW}$	Max 10 (phase 1), Max 05 (phase 2)
Declaration	$x \leq 250\text{kW}$	$x \leq 10\text{kW}$	N/A

All projects must provide an environmental impact assessment (EIA) approved by the Ministry of the Environment, Green Economy and Climate Change. Projects of any size, including those below 10kW, must provide an EIA approved by the Ministry of the Environment, together with the necessary documents to prove they are able to maintain the security of the people and environment. This requirement for all projects to conduct an EIA represents a significant administrative, financial and technical hurdle, especially for small projects.

By comparison, Tanzania does not regulate projects below 100kW and only requires a full licence for projects over 1MW. In Tanzania, there are still a number of stages to the application process, including the requirement for land titles, building permits, business and tax registrations and any resource rights prior to application for a licence. However, only licences for projects over 1MW include additional intensive documentation, such as feasibility studies, environmental impact assessments or proof of managerial competence and a business plan. Additionally, projects under 100kW are not regulated.

Decree 2014-635 outlines additional principles of service for projects under licence, including a responsibility for expansion of service to include low income and vulnerable customers. Decree 2014-635 states the requirement on operators to adapt their service to cater to the needs of low income and vulnerable customers within their concession or operation areas (Article 11). Article 13 specifies that operators must also be willing to extend their investments into rural areas as required to provide services to these low income and vulnerable customers, even where this extension is not profitable. It is not clear if and how this requirement is enforced.

The new energy law being developed will update the framework for licencing of clean energy mini-grid projects, possibly as early as July 2017. No private sector-led off-grid licences have been approved to date. The government is in the process of reviewing its regulation of the off-grid sector reportedly attempting to address legislative changes such as tariffs and the provision of FDE subsidies to private sector off-grid projects.

TARIFFS

The national tariff rate is fixed by the regulator ARSE, and has not been reviewed since 2009. Mini-grid projects cannot set their own tariff. General provisions for regulation of tariffs are covered in the 2013 Energy Law (Section 5.3), Articles 55-58. This includes the guiding principles governing licensees, including fairness, non-discrimination and any public service obligations specified under operating contracts. Tariffs for the first segment are set by the government and regulated by ARSE. FDE can propose changes to the tariff for off-grid projects under the second segment; however, the rates have not changed since 2009. ARSE exercises control over the application of all electricity tariffs, as detailed in Article 58.

The current tariff rate ranges from CFA 75 to 114 per kWh (approx. US\$ 0.12-0.18), tiered by level of consumption and connection type.³³ Decree 09-018 (Section 5.3) details the fixed domestic usage tariff, disaggregated by connection type (single or triple phase) and by connection size. Tariffs are categorised into three consumption bands, with the thresholds

33 Using a currency conversion of 0.0016 US\$/CFA. Correct (rounded) as of February 2017. <http://www.xe.com/>

of 50kWh and 100kWh for a single-phase connection and 100kWh and 200kWh for a triple-phase connection. The lowest rate is CFA 75 per kWh, for a single-phase 3A connection using 50kWh (under development)/year or less. The highest rate is CFA 114 per kWh, for a triple-phase connection with an annual consumption of over 200kWh. Connection fees are fixed at CFA 1,500 CFA and CFA 25,000 in the two referred scenarios (approximately US\$ 2 and US\$ 42, respectively). The low connection fee, likely below the cost of connection, can be a barrier for the financial sustainability of energy projects. Decree 09-019 sets the wholesale price of CFA 75 per kWh for bulk electricity sold by SONABEL to local cooperatives.

SUBSIDIES AND INCENTIVES

FDE subsidies have historically been available to local cooperative off-grid projects. FDE has been providing extensive financing to cooperatives developing off-grid projects, including 100% of system costs; 100% of the costs of the transmission lines; and 60% of the costs of the distribution lines. The remaining 40% of the distribution line costs are provided as a loan. FDE subsidies are also available to cooperatives to bridge the gap between the fixed tariff rate and the cost of energy under a concession, where the tariff can be shown to be unsustainable. To date, this subsidy has been primarily awarded towards the purchase of fuel for diesel-powered mini-grids.

There has been limited capacity building for COOPELs. Local cooperatives are volunteer-based. Most have limited technical capabilities and rely upon external technical providers to manage the distribution network. These relationships are not always regulated by contracts. Meanwhile, the level of engagement varies substantially in different cases. Extensive training and capacity building would be required in order to sufficiently train COOPEL volunteers to reduce dependence on external technical providers. SONABEL and the National Union of Burkina Faso's Electricity Cooperatives (UNCOOPEL) have provided some training historically. UNCOOPEL also provides some support visits and assists with the establishment of new COOPELs, but this is not sufficient.

General investment incentives for electricity companies are available, however fewer are available than in other SSA countries. Available incentives include goods, imports tax exemptions and accelerated depreciation of generation assets, but there are no VAT or customs duty exemptions. A 'privileged regime' is available from the Ministry of Trade, Industry and Handicrafts that can unlock other incentives such as VAT and licence fee exemptions. Section 5.4 provides further details.

POWER PURCHASE AGREEMENTS

The existing regulatory framework does not include standard power purchase agreements (PPAs). Recently a small number of PPAs have been prepared, including the 20MW solar plant PPA signed with Canadian Windiga Energy and drafted with the support of the African Development Bank.³⁴ However, these are individual cases. Tanzania provides a best practice example as it has a streamlined licencing process for small power producers (100kW to 10MW) including standardised power purchase agreements.

ARRIVAL OF THE GRID

The last National Electrification Plan, released in 2006, ended in 2015. There has been no third plan due to uncertainty caused by the change in government in 2015. There is therefore a lack of clarity over future grid extension plans and timeframes (Section 5.2, *Planning and Institutional Setting*).

Local cooperatives are provided a long term distribution concession, which is not impacted by the connection to the main grid. Upon arrival, the mini-grid operator connects the system to the grid, and can fulfil extra demand by buying power from SONABEL at a fixed wholesale price (Section 5.3, *Tariffs*). The majority of the currently operating mini-grids are already grid connected. The model of most of these mini-grids is to distribute and sell power purchased from SONABEL. Currently there is no provision for exporting excess power via PPA to the grid. However, this is reportedly being addressed in the new energy law under development. FDE subsidies provided under the licence remain valid upon arrival of the grid, which has occurred with several operating diesel mini-grids.

34 AfDB Website - <https://www.afdb.org/en/news-and-events/article/sefa-grants-us-950-000-to-support-solar-power-plant-in-burkina-faso-13444/>.

TECHNICAL RULES

Mini-grid projects follow the general rules for electricity projects in the second segment provided in Law No. 053-2012. However, there are no national grid codes or other technical rules to which mini-grid projects must adhere. The projects' technical specifications must be included upon application for a licence.

MOBILE SERVICES

Mobile coverage and ownership is privatised and widespread, with an estimated 85.3% of the population owning a mobile SIM in 2016.³⁵ There are three main mobile operators Airtel, Onatel and Telecel International. 3G services are provided by Onatel's EV-DO fixed-wireless service. The SIM ownership rate is significantly more than the estimated 11.6% of internet users and 0.4% of fixed-line telephone owners.

Airtel, under Airtel Money M-ligdi, provides mobile payment services. This service includes money transfer and payments for mobile credit, water and electricity bills, TV subscriptions, salaries and tuition fees. The spread of mobile payment services across Burkina Faso, as in other West African countries, is hampered by the lack of retail distribution networks (needed to develop agent networks) and a fully developed consumer goods market.³⁶

5.3 ENERGY SECTOR POLICY AND REGULATORY FRAMEWORK

DECREE N° 2000/464 PM of 30 June 2000

<http://www.arsel-cm.org/decret-30-juin-2000-secteur-electricite.pdf>

The decree governing the activities of the electricity sector builds upon the application of certain provisions of law N°98/022 on the electricity sector. It lays out the procedures for granting, renewing, revising, suspending and withdrawing concessions, licenses and authorizations for the production, transmission, distribution and sale of electricity.

ENERGY SECTOR POLICY (2014-2025), 2013

http://www.sips.gov.bf/img_tmp_fichiers/MME-PS-52.pdf

The Energy Sector Policy serves as a reference document for the energy sector in Burkina Faso. This document sets the energy sector's national strategies and targets for 2014-2025 including 50% renewable generation by 2025 and opportunities for solar and biomass technologies.

LAW NO. 053-2012, 2012 (Law No. 053-2012/AN)

http://www.arise.bf/IMG/pdf/loi_no053an_17_decembre2012.pdf

This law outlines the general regulation of the electricity sub-sector in Burkina Faso. It provides details about operation and organisation of the first and second segment of the electricity sector. With respect to the first segment, power generation is open to competition while transmission and distribution remains the monopoly of SONABEL. With respect to the second segment, power generation and distribution are liberalised under the supervision of FDE and ARSEL. This 2012 law does not include any specific regulations or references to renewable energy or clean energy mini-grids. However, the government is currently working on a revision of Burkina Faso's electricity law.

DECREE NO. 2003-089/PRES/PM/MCE

<http://www.ecowrex.org/sites/default/files/2003%20Decret%20Creation%20FDE.pdf>

35 BuddeComm, Burkina Faso - Telecoms, Mobile and Broadband - Statistics and Analyses, <https://www.budde.com.au/Research/Burkina-Faso-Telecoms-Mobile-and-Broadband-Statistics-and-Analyses>

36 AfDB, Financial Inclusion and Integration through Mobile Payments and Transfer, 2012.

This 2003 Decree established the Electrification Development Fund (FDE) with the mission to promote rural electrification in Burkina Faso. FDE is affiliated with the Ministry of Energy, has a legal mandate and full financial and management autonomy.

DECREE NO. 2004-517/PRES/PM/MCE of 19 November 2004

<http://faolex.fao.org/docs/texts/bkf49856.doc>

This 2004 Decree updated the status of SONABEL, the national electricity company of Burkina Faso. Under this decree, SONABEL became responsible for all activities related to power generation, transmission and distribution, as well as power imports and exports in Burkina Faso.

DECREE NO. 2007-868/PRES of 26 December 2007

[https://burkinafaso.eregulations.org/media/loi%20n%C2%B0033-2007%20an%20\(1\).pdf](https://burkinafaso.eregulations.org/media/loi%20n%C2%B0033-2007%20an%20(1).pdf)

Article 29 of this decree established that starting from 1st January 2008, a tax for electrification development would be collected from SONABEL's power sales to fund FDE. The tax rate is set at CFA 2 per kWh (US\$ 0.0032 per kWh).³⁷

DECREE NO. 2008-369/PRES/PM/MCE/MEF/MCPEA of 24 June 2008

http://www.legiburkina.bf/m/Sommaires_JO/D%C3%A9cret_PM_2008_00369.htm

This 2008 Decree established the organisation, operation and duties of the Electricity Regulation Authority (ARSE) responsible for the regulation of the electricity sector. ARSE advises on the granting, renewal and revision of concessions, licences and authorisations. It also suggests tariff modifications, sets the access conditions of third party networks and provides recommendations on contract specifications of the transmission operator.

DECREES NO. 2009-108 AND NO. 2009-019, 2009 (Decrees No. 09-018/MCE/MCPEA/MEF, No. 09-019/MCE/MCPEA/MEF)

<http://www.fde.bf/wp-content/uploads/Arr+%C2%ACt+%C2%AE-018-prix-de-vente-+%C2%AEnergie.pdf>

<http://www.fde.bf/wp-content/uploads/Arr+%C2%ACt+%C2%AE-019-vente-+%C2%AEnergie-SONABEL-+%C3%A1-ERD.pdf>

The 2009 Energy Tariff Decrees fixed the selling prices of electric power produced, imported, transported and distributed under the second segment of electrification. Decree 09-018 details the set domestic usage tariff, disaggregated by connection type - single or triple phase and by connection size (amps). Decree 09-019 sets the wholesale price for electricity generated, imported, transported or distributed by SONABEL in the second segment. The tariff rates are detailed in Section 5.2.

LAW NO. 020-2013, 2013 (Law No. 020-2013/AN)

http://archives.assembleenationale.bf/20122014/IMG/pdf/loi_no_020_portant_regime_juridique_du_partenariat_public-prive_au_burkina_faso.pdf

Law No. 020-2013 establishes the legal regime for public-private partnerships (PPPs) in Burkina Faso. The department in charge of PPPs sits under the General Directorate for Cooperation in the Ministry of Economy, Finances and Development. More detail is provided in Section 5.2. The law is supported by three decrees that operationalise PPPs:

- Decree No. 2014 – 024 /PRES/PM/MEF, which enforces the modalities of Law N° 020-2013;
- Decree No. 2014-628 /PRES/PM/MEF, which establishes the duties, composition and functioning of the Public Private Partnership Commission; and

³⁷ Using a currency conversion of 0.0016 US\$/CFA. Correct (rounded) as of February 2017. <http://www.xe.com/>

- Order No. 2014-0263/MEF/SG/DGCOOP, which defines the duties, composition and functioning of the Commission concerning the selection of private partners for the realization of projects under public-private partnership.

DECREE NO. 2014-635, 2014 (Decree No. 2014-635/PM/MS/MEF)

http://www.arse.bf/IMG/pdf/decree_n2014_635_mef.pdf

This document details the obligations of electricity service providers to consumers, exemptions and the conditions of the application of public service obligations. This includes the right to access within a concession area, provisions for interruption of service and the obligation of providers to provide basic services to customers and ensure security of supply.

DECREE NO. 2014-636, 2014 (Decree No. 2014-636/PRES/PM/MME/MEF)

http://www.arse.bf/IMG/pdf/decree_n2014-636_mefb.pdf

This 2014 decree establishes the framework to issue concession, licensing, authorization and submission contracts for power installations. This includes defining generation as being open for competition in both the first and second segments. Distribution is open for competition only in the second segment while transmission remains the monopoly of SONABEL in both segments.

DECREE NO. 2015-172, 2015 (Decree No. 2015-172/MME/SG/DGE)

http://arse.bf/IMG/pdf/rapport_dactivites_arse_2014.pdf (pages 34 - 42)

Decree No. 2015-172 builds upon Decree No. 2014-656, adding prescriptions including detailed terms and conditions for the issuing of concession, licensing, authorization and submission contracts for electricity installations. The decree includes which licences are required for different sizes and types of projects, which services are open to competition, the process for applying for and issuing licenses, and the associated conditions and fees. Most importantly, this decree allows the licencing of off-grid projects to private developers (rather than only to cooperatives as was the case previously). This law especially requires amending to better accommodate green mini-grid development.

A catalogue of other policies, including the main administrative and public laws, labour and company laws, can be found at <https://www.lexadin.nl/wlg/legis/nofr/oeur/lxwebfa.htm>.

5.4 INVESTMENT INCENTIVE POLICIES

FDE STATUS DOCUMENT

<http://www.fde.bf/wp-content/uploads/STATUT-FDE.pdf>

This document describes the status and role of the electrification development fund. FDE is responsible for providing technical and financial assistance to electrification projects and for increasing projects' submissions by operators (Chapter 2, Article 6). FDE only provides financial support to projects that have been positively evaluated by its technical bodies. These projects will need to meet appropriate criteria of technical, economical, financial and institutional feasibility. Criteria are fixed by the ministers in charge of energy and finance and under advice of FDE (Chapter 2, Article 8-9).

LAW N°008-2010/AN of 29 January 2010

http://www.gouvernement.gov.bf/IMG/pdf_loi_008_2010_AN-2.pdf

This law creates a corporate tax applicable to companies' profits or revenues. It also includes some incentives for energy equipment and for energy generation companies.

- Accelerated depreciation: Companies taxed under the actual profit regime provided under Article 87 and 88 (Chapter 2, Section 2, Paragraph 1) are allowed to use an accelerated system of depreciation on their fixed assets, including machines that generate steam, heat or energy. This allows companies to depreciate their energy generation assets faster to reduce taxable profit. However, goods that were used at the time of acquisition or with under three years of product lifetime are excluded – see Chapter 1, Section 2, Paragraph 3, B) Deductible charges.
- Tax at source exemption: All company import goods are subject to tax at source. Some companies are exempted including water, electricity and telecommunication companies – see Chapter 2, Section 11, Paragraph 1, Article 105-106.

LAW N°051-2012/AN

http://www.finances.gov.bf/index.php?option=com_edocman&view=document&id=406&catid=107&Itemid=190

This finance law covers the execution of the government's budget for 2013. It includes VAT and custom duties exemptions for solar equipment – Titre 1, Chapter 1, Article 29.

LAW N°2013- 493 /PRES

http://investburkina.com/textes_legaux/Loi-PPP.pdf

This law mentions that partners for Public-Private Partnerships are selected through public bidding processes at national or international level – Chapter 3, Section 2, Article 16.

In addition to the renewable energy sector incentives described above, the government has also established regulations to support all companies that contribute to social and economic development of the country. This includes:

LAW N°007-2010/AN of 29 January 2010

http://www.gouvernement.gov.bf/IMG/pdf_bfcodeinvest2010.pdf

This law modifies Law N° 62/95/ADP of 14 December 1995 on Burkina Faso's Investment Code. The Investment Code's objective is to promote productive investments that will lead to social and economic development. It includes the following updates:

- Privileged regimes: Four regimes (A, B, C, D) categorized by company investment levels and job creation – Titre 1, Article 6.
- Conditions: Companies that wish to benefit from a privileged regime must submit a request to the Ministry of Trade, Industry and Handicrafts along with documents specified by the Decree N°96-235 of 30 July 1996 (<http://lankcharl2008.unblog.fr/2008/06/24/composition-du-dossier-de-demande-dagrement-au-code-des-investissements/>)– Titre 3, Chapter 1, Article 18.
- Incentives: Companies that benefit from one of the privileged regimes will be subject to tax and custom incentives, such as VAT, licence fees, and employer's charges exemptions during the investment and operational phases. Incentives are specified for each privileged regime - Titre 3, Chapter 1, Article 24.

Law N°025-2012/AN 26 of July 2012 and Law N°037-2013/AN grant additional incentives for investment agreements signed between 2012 and 2015 within the framework of the Accelerated Growth and Sustainable Development Strategy (SCADD). The National Economic and Social Development Plan (PNDES) has replaced SCADD. Incentives similar to those under SCADD may be developed under PNDES.

5.5 RECOMMENDATIONS

Burkina Faso has made solid progress towards stimulating the market for mini-grids. Given the low current rate of rural electrification, clean energy mini-grids are seen as an opportunity to increase energy access and alleviate poverty. This opportunity is reflected in the ambitious targets set out in the Renewable Energy Action Plan (PANER), which aims to achieve 20% rural electrification by 2020 and 40% by 2030. The current PANER is also important in recognising the limitations of the previous plan in only utilising public funding and depending exclusively on FDE. The new program is also expected to be more liberalised and open to private investment. The new energy law under development will update the framework for licencing of clean energy mini-grid projects and will confirm the opening of production and distribution to private companies. Additionally, there is a good opportunity for solar providers to replace the existing diesel mini-grids with solar PV hybrid systems.

A number of initiatives may contribute to the development and growth of clean mini-grids, which could be supported by the Green Mini-Grids Market Development Programme and other donors. Accordingly, the following, non-exhaustive, high-level recommendations to promote green mini-grids and private operators are suggested. They are categorised into four areas, including: policy support, national electrification planning, market development, and financing.

In an effort to develop the green mini-grid sector, this analysis recommends the government:

Policy support

- Conduct an in-depth operational and financial review of existing mini-grids and COOPELs. The review will further identify and refine possible measures to make mini-grids sustainable, some of which are described below.
- Reduce the administrative burden on mini-grids, especially for small systems. This could include:
 - increasing the size threshold for different licencing requirements;
 - introducing a minimum threshold for regulation of mini-grid projects; and
 - removing the need for environmental impact assessments for smaller projects.
- Assist the development of supportive legislation for increased coverage and access to mobile payment solutions. This could include legislation for the publication of actual service coverage by service providers

National electrification planning

- Support the development of a transparent national planning process, including a single, coherent national rural electrification plan, to provide clarity over the current and future boundary between grid and off-grid areas.
- Support the development of GIS-based planning capabilities and processes within national and regional planning organisations, with a focus on training and knowledge sharing.

Market development

- Promote capacity development and training for cooperatives and other mini-grid operators. This could potentially include financial management, low-level system maintenance and broader project management skills. It could also include the development of academic courses.
- Address the lack of accessible data on resource availability, potentially through a national renewable energy atlas such as the ones released for DRC and Mozambique, and ensure all data is made openly and freely available, as well as being updated at suitable intervals.
- Update, disseminate and freely publish existing GIS datasets. Support the development of further GIS datasets (i.e. demographic factors: population, income and ability to pay).
- Support the development of comprehensive mobile and mobile money services coverage map for Burkina Faso (mobile money coverage is growing annually, so updates would be necessary for this resource to remain useful).

Financing

- Increase the sustainability of FDE and SONABEL by, amongst others, increasing the national electricity tariff. Currently the sector relies on FDE for many services including electrification and subsidies. FDE however, is reliant on donor funding and the tax levy. Sustainable profitability of FDE and SONABEL is necessary to effectively roll out access to energy programs.
- Work with financial institutions and other stakeholders to reduce investment risk by delivering training on understanding decentralised energy systems, their risks and opportunities.
- Strengthen the national financing strategy for renewable energy and focus the energy sector strategy on solar technologies to best enable effective decarbonisation of the energy mix.
- Support the development of alternative financing solutions, investment funds, microfinance and climate finance mechanisms, including through support to financial institutions in Burkina Faso to help de-risk (real and perceived) renewable energy and mini-grid investment.

6. MAIN STAKEHOLDERS

6.1 GOVERNMENT AND AGENCIES

MINISTRY OF WATER RESOURCES AND ENERGY (MINEE)

Contact: Massoma Bille (DERME Director)
Email: massomabille@yahoo.fr
Website Link : <http://www.mng-cameroon.org/>

The MINEE establishes, executes, and oversees policy in water and energy. In addition, it sets the incentive framework, grants production and distribution concessions and licenses, promotes and establishes strategies for renewable energy. Basile Atangana Kouna, is the current Minister for the MINEE. Following Decree N°2012/501 of the 7th of November 2012, the government created a division within the MINEE responsible for renewables energy (DERME). DERME seeks to develop sector specific policies, undertake applied research and ensure technology transfer in renewable technologies. It further leads on the promotion, development and extension of renewable energies. In addition, the MINEE holds responsibility for the Energy Sector Development Plan (PDSE), runs a data management team, and has recently released a number of annual energy reports on Cameroon.

THE MINISTRY OF ENERGY (MOE)

Contact: H.E. Prof. Alfa Oumar Dissa (Minister)
Email: alfadissa@yahoo.fr
Fix: +226 25 318430
Bruno Korgo (Director of Renewable Energies)
Email: brunokor@yahoo.fr
Link: www.mines.gov.bf

The Ministry of Energy (formerly the Ministry of Mines and Energy, MME) is the designated ministry responsible for the electricity sector in Burkina Faso. It is responsible for the policy of the energy sector, the strategy of electricity planning, regulation and control of the power infrastructures. The ministry is also responsible for issuing concessions, licenses and authorizations for power systems.

Other relevant ministries include:

- Ministry of Economy, Finance and Development: Minister Halizatou Rosine Coulibaly
- Ministry of Territorial Administration and Decentralization: Minister Siméon Sawadogo
- Ministry of Foreign Affairs, Cooperation and Expatriates: Minister Alpha Barry
- Ministry of Agriculture and Hydraulic Installations: Minister Jacob Ouédraogo
- Ministry of Mines and Quarries: Minister Oumarou Idani
- Ministry of Environment, Green Economy and Climate Change: Minister Batio Bassière
- Ministry of Higher Education, Scientific Research and Innovation: Minister Alkassoum Maiga
- Ministry of National Education and Alphabetisation: Minister Jean-Martin Coulibaly
- Ministry of Transport, Urban Mobility and Transport Safety: Minister Souleymane Soulama

- Ministry of Trade, Industry and Handicrafts: Minister Stéphane Sanou
- Ministry of Health: Minister Nicolas Méda

THE ELECTRICITY SUB-SECTOR REGULATION AUTHORITY (ARSE)

Contact: Ahmed OUEDRAOGO
 Email: ahmedyachine@gmail.com
 Tel: +226 70620314
 Link: <http://www.arse.bf>

ARSE is the national regulatory agency for the electricity sector. Its main role is to regulate power generation, operation, transmission, distribution, import, export and commercialisation in Burkina Faso. It is responsible for the approval of concessions, licences and authorisation demands and also establishes electricity tariffs applied by operators.

FDE – ELECTRIFICATION DEVELOPMENT FUND

Contact: Gervais Ouoba (Technical Director)
 Email: gervais.ouoba@gmail.com
 Pipi Kassida Paul KABORE (Head of Section)
 Email: p_kabore@yahoo.fr
 Link: www.fde.bf

FDE is in charge of the second segment of the electricity sub-sector in Burkina Faso. Its mission is to promote access to electricity in rural areas at affordable costs. The FDE has contributed to the elaboration of the national plan for electrification and has assisted in the implementation of rural electrification pilot projects.

SONABEL

Contact: SERME Daniel (Director of Studies, Planning and Equipment)
 Email: daniel.serme@sonabel.bf
 Tel: + 226 25306100
 Link: www.sonabel.bf

SONABEL is the national power utility. Following the electricity sector reform (Law No. 053-2012/AN) which creating two separated segments, SONABEL is responsible for the first segment of the electricity sector, which includes all infrastructure that existed at the moment of the reform. The company still has the monopoly on power transmission in both segments while distribution is open to competition in the second segment.

NATIONAL AGENCY FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY (ANEREEE)

Contact: None to date
 Link: None to date

ANEREEE is an agency created in 2016 to support rural electrification from renewable energy sources and energy efficiency. The establishment of ANEREEE reflects the government's ambition for an energy transition. However, the Agency's role has not yet been fully defined.

NATIONAL INSTITUTE OF STATISTICS AND DEMOGRAPHICS (INSD)

Contact: Secretariat
Email: insdbf@yahoo.fr
Tel: (+226) 50 32 49 76
Link: www.insd.bf

INSD is the central body for official statistical data in Burkina Faso. It is responsible for economic, social, demographic, cultural and environmental data. Data is collected via surveys and censuses and focuses primarily on poverty, birth rates and other justice and social action indicators.

NATIONAL COUNCIL OF STATISTICS (CNS)

Contact: Permanent Secretariat of the National Statistics Council
Email: spcnsmfe@yahoo.fr
Tel: (+226) 50 32 40 56
Link: <http://cns.bf/>

The National Council of Statistics coordinates the activities of the National Statistical System (NSS), and facilitates and ensures consultation between producers and users of statistical information in Burkina Faso. The NSS is the administrative framework for the producers and users of official statistics, which provides coordination between organisations involved in the production of national statistics and national training institutions for statisticians and demographers.

ECONOMIC COMMUNITY OF WEST AFRICAN STATES (ECOWAS)

Contact: Monsieur Oumarou Ganou, Head of the ECOWAS National Office
Email: gannbou@gmail.com
Link: www.ecowas.int

The Economic Community of West African States (ECOWAS) is constituted of fifteen member countries in the western region of Africa. It aims to achieve mutual political, economic and cultural benefit through closer union of its member countries. This includes economic agreements such as tax exemptions and trade liberalisation, as well as multi-national policies on energy and climate change. For example, the ECOWAS Regional Policy on Renewable Energy (EREP) sets out a common policy for the advancement of renewable energy across the region.

Burkina Faso is engaged with a number of ECOWAS programmes, including the ECOWAS Program for Small Hydropower (2013 – 2018). The program contributes to the EREP and looks to increase access to modern energy services by developing the enabling environment for investment in small hydropower systems. In Burkina Faso, the targets of the EREP translate into the installation of 2,425MW of renewable electricity capacity by 2020 and 7,606MW by 2030. Small hydropower is estimated to contribute 787MW (33%) by 2020 and 2,449MW (32%) by 2030 to this additional capacity.

6.2 MINI-GRID PRACTITIONERS AND PRODUCT DEVELOPERS

There are currently 93 local electricity cooperatives (COOPEL) managing small grids in rural communities. Local cooperatives are the recipient of the concessions, licences and authorisations granted by FDE. To operate and maintain power systems, most of the time a COOPEL will engage with a private engineering company. The National Union of Burkina Faso's Electricity Cooperatives (UNCOOPEL) leads the coordination of cooperatives. Existing cooperatives' contact details are available upon request to FDE. Below is a sample of local cooperatives:

Name of representative	COOPEL
NORTH	
MAMOUDOU Boureima	ARBINDA
LESSAMBA Saïdou	BOENA
YAMPA Oumarou	DEOU
MAHMADOU Souleymane	MARKOYE
ZOMBRE Dominique	OUARGAYE
TAMBOURA Amadou	SEBBA
SORE Lassané	SEYTENGA
SOUTH	
YE Kani Pascal	BAGASSI
ZONGHO Daouda	BATIE
NANA Koara Malick	SAPOUY
KINDA Boukary	SOLENZO

A non-exhaustive list of engineering companies providing technical and managerial expertise to existing mini grids include:

PROJET PRODUCTION INTERNATIONALE S.A (PPI)

Contact: Keré Ismael (Solar Energy Technician)
 Email: kere_ismael@yahoo.fr
 Tel: + 226 2533 0104
 Link: <http://ppi-industriel.com>

PPI has over 20 years of experience in the following solar energy areas:

- Installation and commercialization of solar energy systems and products
- Solar public lighting
- Production of electricity from solar energy
- Solar pumping systems

ELECTRIFICATION, ONDULATION, DISTRIBUTION ET ASSISTANCE (EODA)

Contact: Bambore Nadege (Financial Director)
 Email: eoda@fasonet.bf
 Tel: +226 25 30 06 84
 Link: <http://eoda-burkina.com/>

EODA specialises in the installation, operation and maintenance of power generators including mini-grid systems. Created in 1985, the company is based in Burkina Faso.

SERVICES INFORMATIQUE TELECOMMUNICATION ENERGIE (SATEL)

Contact: Email: epdsate@fasonet.bf
 Email: contact@satel-burkina.com
 Tel: +226 50 37 37 22
 Mobile: +226 70 21 13 90
 Link: <http://www.satel-burkina.net>

Created in 2001, SATEL provides services in the energy, telecom and electronic security sectors. In the energy sector its activities include installation of power generators and transformation stations, construction of MT and BT lines and implementation of solar projects. The company is based in Burkina Faso and has activities in Mali, Niger, Cote d'Ivoire, and Togo.

PROJET PRODUCTION SOLAIRE SARL (PPS SARL)

Contact: Emmanuel Kabore (General Director)
Email: manuelkabore@yahoo.fr
Tel: + 226 78 81 55 77
Link: <http://www.ppsenergy.net>

A solar technology organisation based in Burkina Faso, PPS produces and installs a number of solar-based solutions including public lighting, solar generation (solar PV and hybrid mini grid systems, standalone systems) and solar pumping systems.

SOCIÉTÉ D'INSTALLATION MAINTENANCE ET D'ÉTUDE D'ÉQUIPEMENT ÉLECTRIQUE (SIMEEEL)

Contact: Zoubga Mathias (General Director)
Email: m.zoubga@simeeel.com
Tel: +226 70 33 91 64
Link: <http://simeeel.com/fr>

Created in 1998, SIMEEEL is specialised in the construction of MT and BT structures including mini-grids and indoor installations. The company is based in Burkina Faso and has activities in Togo, Niger and Chad.

CB ENERGIE

Contact: Arnaud Chabanne (Founder)
Email: cbenergie@yahoo.fr
Tel: +226 20 52 10 02
Link: <http://www.cb-energie.com/nos-solutions/>

CB Energie provides installation, operation and maintenance of solar equipment. Established in 2004, the company is based in Burkina Faso and has offices in France and Mali.

ENERGIE DEVELOPMENT INGENIERIE SERVICES (EDIS)

Contact: Romain FRANDJI (Director)
Email: r.frandji@edis-energie.com
Tel: +226 25 36 37 69
Link: <http://www.edis-energie.com/index.php/about-us/le-groupe-ied.html>

EDIS specialises in the implementation of rural electrification projects including feasibility studies for renewable energy projects, supervision of implementation, technical assistance, etc. EDIS is based in Burkina Faso and is a subsidiary of IED headquartered in France.

YELEN BA (FOUNDATION RURAL ENERGY SERVICES)

Contact: Yameogo Bourahima (General Manager)
Email: cheickfadil@yahoo.fr
Link: <http://www.fres.nl/fres-in-burkina-faso/>

Yeelen Ba is a decentralised services company supplying solar home systems to households and small companies. Yeelen Ba is a company of Foundation Rural Energy Services (FRES), and is active mainly in the province of Kénédougou.

LAGAZEL

Contact: Arnaud Chabanne (Co-Founder and Head, Burkina Faso)
Tel: +226 73 65 00 00
Link: <http://www.lagazel.com/burkina-faso>

Lagazel is a French company manufacturing solar lamps in Africa. Lagazel recently opened a solar lantern factory in Dédougou, which aims to produce 1,500 solar lamps per week using local employees.

6.3 BILATERAL AND MULTILATERAL DONOR ORGANISATIONS

AFRICAN DEVELOPMENT BANK (AFDB)

Contact: Mme Antoinette Batumubwira, Resident Representative
Email: a.batumubwira@afdb.org
Link: <https://www.afdb.org/en/countries/west-africa/burkina-faso/>

AfDB intervention in Burkina Faso is based on two pillars: development of infrastructure that supports economic growth and strengthening governance. AfDB's objective in the energy sector is to reduce and secure costs of energy supply. Two projects are currently being implemented. The Energy Sector Budget Support Programme (PASE) provides EUR 25 million funding to the Ministry of Finance for the development of energy sector infrastructure. The Electrification of Ouagadougou and Bobo Dioulasso Semi-Urban Areas Project (PEPU) includes capacity building support to SONABEL; MT and BT networks extensions; and an addition 17,500 connections that will benefit households.

FRENCH DEVELOPMENT AGENCY (AFD)

Contact: Pascal Collange, National Representative
Email: afdouagadougou@afd.fr
Tel.: (+226) 25 30 60 92
Link: <http://www.afd.fr/home/pays/afrique/geo-afr/burkina-faso>

AFD focuses on three main sectors in Burkina Faso: education and professional training; urban infrastructure; and rural development. AFD's support strategy is provided in its Partnership Framework Document (DCP). The agency has established a strong partnership with SONABEL and has invested EUR 53 million in the energy sector between 2007 and 2011. It financed the Bobo-Dioulasso and Ivory Coast interconnection and is currently financing the Ouagadougou and Ghana interconnection. AFD is also part of the Zagtouli solar power plant, which will be the largest solar power infrastructure in Sub-Saharan Africa.

WORLD BANK

Contact: Lionel F. Yaro, Communications Associate
Email: lyaro@worldbank.org

Link: <http://www.worldbank.org/en/country/burkinafaso/overview#1>

The Country Partnership Strategy (CPS) establishes the strategic relationship between Burkina Faso and the World Bank. The World Bank Group currently has 18 national and 7 regional projects in Burkina Faso, which represent respectively US\$ 1.3 billion and US\$ 163.8 million of commitments. The Project for Access to Energy Services (PASEL) 2013-2019 includes activities such as strengthening SONABEL's production capacities, investments to extend electric coverage and setting up of energy saving equipment. The total budget of the project is estimated at \$52.87 million.

EU DELEGATION

Contact: Laura Vitullo, Program Manager - Energy - Infrastructure Section

Email: Laura.VITULLO1@eeas.europa.eu

Tel.: +226 25 49 29 53 / 25 49 29 00

Link: https://eeas.europa.eu/delegations/burkina-faso_en

EU support to Burkina Faso is defined in the National Indicative Program 2014-2020 and includes an indicative budget of EUR 21 million. Priority sectors include governance, health, food and nutritional security, sustainable agriculture and water. The ACP-EU Energy Facility (EF) financed the ELSA (Electricité pour le Sahel) project between 2011 and 2013, which led to the electrification of 30 villages. Currently, the facility is financing the ERD ZIGO (Electrification Rurale Décentralisée des provinces du Ziro et du Gourma) project that will electrify 45 villages.

INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA) – ABU DHABI FUND FOR DEVELOPMENT (ADFD)

Contact: ADFD Representative

Faisal Al Remeithi, Senior Specialist in Partnership and International Cooperation

Email: adfd@irena.org

Link: <http://adfd.irena.org>

IRENA and ADFD provide funding to developing countries through concessional loans. The objective is to support transformative and replicable transitions in the use of renewable energy. In 2016, Burkina Faso was selected for a US\$ 16 million project (US\$ 10 million ADFD) that will implement a 3.6MW solar PV mini-grid. This project will be implemented in partnership with FDE, and will provide electricity to 42 settlements (12,000 households) in Hauts-Bassins and Boucle du Mouhoun through mini-grid, grid extension and solar-home system technologies.

ISLAMIC DEVELOPMENT BANK (IDB)

Contact: Rabat Regional Office (includes Burkina Faso)

Email: RORM@isdb.org

Link: <http://www.isdb.org>

Burkina Faso is one of IDB's member countries. The IDB is currently financing the PERD/SPV (Projet d'électrification rurale décentralisée par système solaire photovoltaïque) that will electrify 41 localities via grid extension (33kV lines). The project's total budget is around US\$ 10.8 million (90% IDB) and will be implemented by FDE.

LUXEMBOURG DEVELOPMENT COOPERATION (LUXDEV)

Contact: Regional Bureau of Ouagadougou

Email: rof.oua@luxdev.lu

Link: <https://oua.luxdev.lu/fr/home>

LuxDev supports a wide range of sectors in Burkina Faso including vocational training and basic education, natural resources management, health and energy. The most recent programme in the energy sector is the Multifunctional Platform for the Fight Against Poverty that ended in September 2015. This national programme provided support to the Ministry of Finance for the installation of 238 small, decentralised energy infrastructures. The objective was to develop income-generation activities in rural communities. This programme also included trainings to build local operating capacities. Such systems could be transformed retrospectively into green mini-grids if required.

DANISH DEVELOPMENT COOPERATION (DANIDA)

Contact: Albert Bruun Birnbaum, National Representative

Email: albbir@um.dk

Link: <http://burkinafaso.um.dk/da/danida/>

DANIDA's support strategy is in line with Burkina Faso's poverty reduction strategy (SCADD) and includes activities in areas such as water and sanitation, agriculture, human rights and stability, cultural cooperation, business partnership and macroeconomics. Currently, DANIDA does not have any energy sector project in Burkina Faso. However DANIDA, with the World Bank and national funds, financed the initial activities of FDE upon its creation in 2003. Its financing was responsible for the electrification of 46 communities until 2014, through a mixture of grid connection and diesel mini-grids. It has also been involved in other energy projects in the past, such as partially funding the 2005-08 EUEI Partnership/Dialogue Facility Pilot Project: Mainstreaming Energy for Poverty Reduction and Sustainable Development into EU Development Assistance (MEPRED).

6.4 OTHER RELEVANT ORGANISATIONS AND INITIATIVES

AFRICAN ASSOCIATION FOR RURAL ELECTRIFICATION (CLUB-ER)

Contact: Silvia Puddu, Secretariat

Email: secretariat@club-er.org

Link: www.club-er.org

CLUB-ER is a network of over thirty public sector organisations responsible for rural electrification in Africa. This network focuses on capacity building for rural electrification through sharing expertise, including training and disseminating support tools.

ECOWAS CENTRE FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY (ECREEE)

Contact: Nicola Bugatti, Renewable Energy and Energy Efficiency TA

Email: nbugatti@ecreee.org

Link: www.ecreee.org

The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) contributes to the sustainable, economic and social development of ECOWAS member states (Section 6.1) through access to modern energy services. ECREEE has been established to implement ECOWAS's Rural Electrification Program. The centre is also the SEforALL focal point for the ECOWAS region.

EUROPEAN INVESTMENT BANK (EIB)

Contact: Secretariat

Email: eu-africa-itf@eib.org

Link: www.eib.org/projects/loans/regions/acp/mz.htm

In 2014, EIB provided EUR 23 million of financing to SONABEL for the installation of a solar plant in Burkina Faso. It also financed the Belgtanga (Ghana) and Ouagadougou (Burkina) interconnection in 2011 as well as the Bobo Dioulasso and Ouagadougou interconnection in 2004.

NATIONAL CENTER FOR SCIENTIFIC AND TECHNOLOGICAL RESEARCH - INSTITUTE OF APPLIED SCIENCE AND TECHNOLOGY RESEARCH (IRSAT)

Contact: Dr. Hagretou Sawadogo-Lingani, Director of IRSAT

Email: hagretou@yahoo.fr

Tel.: (00 226) 2535 6031

Link: <http://www.cnrst.bf/index.php/irsat/>

IRSAT is a specialised institute of the National Center for Scientific and Technological Research, focused on scientific and research programs in the areas of natural substances, energy, food technology, and mechanisation. In the energy area, studies and researchers are focusing on both renewable and conventional energy.

INTERNATIONAL INSTITUTE FOR WATER AND ENVIRONMENTAL ENGINEERING (2IE)

Contact: Hama Yacouba, Director of the Research Department

Email: hama.yacouba@2ie-edu.org

Link: <http://www.2ie-edu.org/en/>

The International Institute for Water and Environmental Engineering (2IE) is a higher education and research institution. The education element focuses on training innovative and entrepreneurial engineers in the expertise areas of water and sanitation, energy and electricity, environment and sustainable development, civil engineering and mining, and management and entrepreneurship. The research element of the institute focuses on the strategic sectors of water and waste treatment, renewable energies, mining and the production of eco-materials. This includes incubating a number of projects and businesses working within these sectors.

7. ANNEX. OBJECTIVES, SCOPE AND METHODOLOGY OF THE MARKET ASSESSMENT

7.1 OBJECTIVES OF THE MARKET ASSESSMENT

The objective of the Green Mini-Grids Africa Market Development Programme is to support the scale-up of investments in commercially viable GMG projects through a broad range of interventions to improve the enabling environment. The project seeks to remove or reduce market barriers at regional scale and strengthen the ecosystem for the emergence of a thriving GMG sector in Sub-Saharan Africa – contributing significantly to the objectives of the SEforALL. The Market Intelligence business line supports activities that foster the ability of project developers, investors and public entities in identifying market opportunities for GMGs, facilitating a coherent national approach and supporting the linkages between central authorities, local/national businesses, investors and communities with demand for power.

7.2 SCOPE OF THE MARKET ASSESSMENT

This report is one of five country reports that form part of the third deliverable for this project. All published deliverables will be available through the African Development Bank and other dissemination channels. As written in the original terms of reference, the project had three main deliverables:

“D1 - An evaluation of the methodologies and best practices available for assessing GMG potential; D1 will analyse the methodologies currently utilised to assess the GMG potential with top-down approaches. The assessment will include data requirements, software requirement, robustness, handling of data paucity, quality of outputs, facility of use, openness of the system, interoperability with other planning tools, cost and any other specific strength or weakness. The Output of the D1 will be a report accompanied by an executive summary and a presentation or infographics.

D2 - Creation or choice of an opportunity assessment methodology in order to generate comparable data across countries, to the extent that is possible; On the basis of the methodological analysis made in D1, the consultant will present a methodology able to generate comparable data across countries. The methodology shall generate quality outputs, be robust, scalable, preferably based on open source or commonly used software and need only limited training. The output of the D2 will be a methodological paper or report and a presentation. If any new software tool will be developed to implement this methodology, it will have to be disseminated as open source.

D3 - The publication of country-level analysis on mini-grid market opportunities, initially focussing on at least five countries in SSA that are prioritising GMGs, generated with the above methodology. AfDB will provide the country list and will support the consultant to get access to country institutions, notably the SEforALL focal points, and national sources of data to apply the methodology. The D3 Output will be a report with the assessment for the five countries.”

7.3 METHODOLOGY

This methodology was developed during the second phase of this project, the Green Mini-Grids Market Development Program - Market Intelligence business line, which is also available via the African Development Bank.

This analysis, the results of which are provided in Section 2, considers the potential for mini-grids by segmenting the countries into two areas: grid and off-grid areas. This split is based on the distance of 15km from the power network. We have used the planned power network for up to 2025. The GIS sources used in this analysis are detailed below. .

POPULATION CENTRES

Source: FDE

EXISTING AND PLANNED POWER GRID

Source: MME-SONABEL-FDE, 2014

PROTECTED AREAS

Source: The World Database on Protected Areas, 2014

LAKES AND WETLANDS

Source: Global Lakes and Wetlands Database, 2004

IDENTIFIED RENEWABLE SOURCES AND PROJECTS

Source: ECOWAS observatory for Renewable Energy and Energy Efficiency (ECOWREX) database

MEAN AVERAGE WIND SPEED

Source: DTU/IRENA, 2005

ANNUAL GLOBAL HORIZONTAL IRRADIATION

Source: DTU/IRENA, 2015

Green Mini-Grids
Market Development Programme
Document Series
©2017 African Development Bank Group

Contacts:

The SEforALL Africa Hub Secretariat
hosted by the AfDB

African Development Bank
Statutory Headquarters
Immeuble du Centre de Commerce
International d'Abidjan-CCIA
Avenue Jean-Paul II
01BP1387
Abidjan 01, Côte d'Ivoire

SEforALL Africa Hub
Coordinator
Dr. Daniel-Alexander SCHROTH
d.schroth@afdb.org
www.se4all-africa.org
se4all.africa@afdb.org

