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Background Paper for the MRU Region on Renewable Energy

Imprint

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Background Paper for the MRU Region on Renewable Energy

1. HISTORY AND OBJECTIVES OF THE MANO RIVER REGION

The **Mano River Union (MRU),** was created in October 1973 by Liberia and Sierra Leone with the aim of promoting broad integration between the two countries. According to its preamble, it was a question of "promoting greater integration between [the] States in the fields of trade, transport and the development of the Mano River Basin". It takes its name (Mano), the river that originated in northern Liberia (on the slopes of the Nimba Mountains) which serves as the natural border between Liberia and Sierra Leone. The Union was joined by Guinea in 1980 and Côte d'Ivoire in 2008.

When the Union was first established, economic development was at the focus of

discussions. The integration of political and security concerns were introduced to the MRU in the 1990s and 2004 respectively.

The four countries that make up the Union are characterized by common historical, socio-cultural and economic links, as well as similar development challenges. Addressing those challenges requires close collaboration to strengthen links among the countries of the MRU. The accession of Guinea and later of Côte d'Ivoire to the Union were an important step in doing so, as well as the joint resolve to avoid political conflicts, have strengthened the resolve to advance cooperation between the member states.

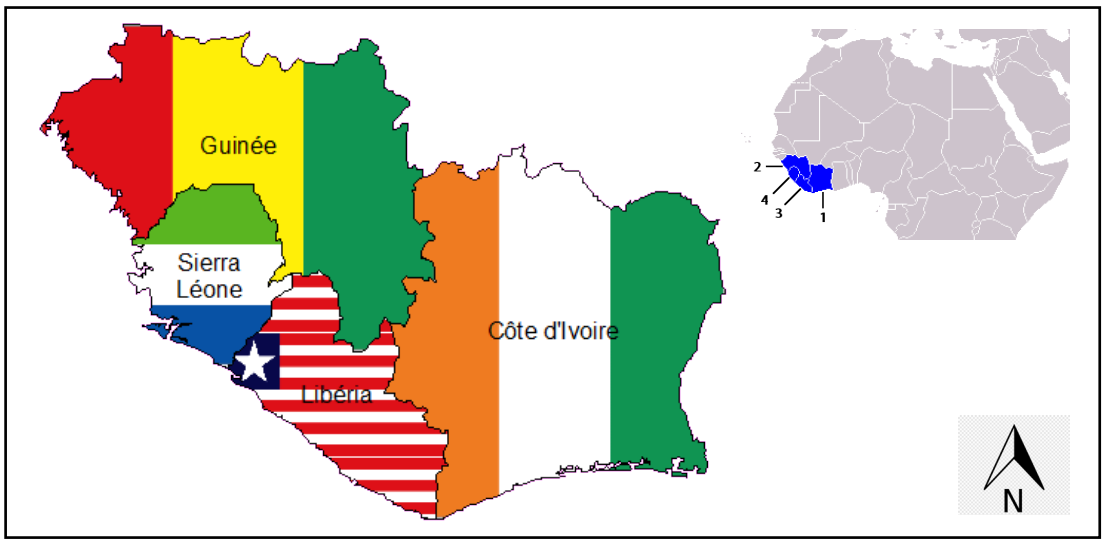
By joining the MRU, the member states aim to:

- ensure the expansion of trade by eliminating all barriers to mutual trade, by cooperating in the expansion of international trade, by creating favorable conditions for an expansion of mutual production capacity, including the gradual development of a policy of protection and cooperation for creating new production capacity; and
- Ensure an equitable distribution of the benefits of economic cooperation

To achieve these objectives, the member states pursue:

- the liberalization of mutual trade in goods of local origin 1. by eliminating tariff and non-tariff barriers to this trade, 2. by harmonizing import custom rates and other tax incentives applicable to goods of local origin; as well as
- adopting support measures by developing cooperation in the field of agricultural and industrial production of goods of local origin.

Figure 1: Map of Mano River Union member countries



2. COUNTRY PROFILES AND POLITICAL SITUATION

2.1. Ivory Coast

2.1.1. Profile

Côte d'Ivoire is the largest economy in the West African Economic and Monetary Union (UEMOA) and continues to experience high economic growth rates after more than a decade of civil conflict and political instability.[1] The country's GDP grew at a rate of 7% in 2017, driven by structural public investment and a robust service sector.[2] Côte d'Ivoire was the second fastest growing country in Saharan Africa in 2017, in part due to favourable agricultural conditions and improved terms of trade. More than half of the country's growing population lives in urban areas. The political capital is Yamoussoukro. The economic capital, Abidjan, concentrates 20% of the population as well as 80% of formal employment and 90% of businesses.[3] In 2017, the Côte d'Ivoire's service sector (energy, communications, transport, financial services and trade) contributed half of the country's GDP, with industry accounting for around 30% of GDP and agriculture making up the balance. However, this dynamic is not reflected in the country's employment structure, since two-thirds of the working population remains in agriculture.

Agricultural processing of cocoa, coffee and palm oil contributes significantly to export earnings, while the cocoa sector accounts for only 10% of GDP and about a third of the country's exports.[4]

[1] "Côte d'Ivoire Country Report," World Bank, (2018), available at https://www.worldbank.org/en/country/cotedivoire/overview
[2] "Côte d'Ivoire Economic Outlook," African Development Bank, (2018), available at https://www.afdb.org/en/countries/west-africa/cote-d%E2%80%99ivoire/cote-divoire-economic-outlook
[3] "Reimagining Ivorian cities," World Bank, (September 2016): http://www.worldbank.org/en/country/Côtedivoire/publication/reimagining-ivoirian-cities
[4] "Côte d'Ivoire Macroeconomic Report," AFD, (2015), available at https://www.afd.fr/en/page-region-pays/cote-divoire

Population	24.3 million
Urban Population	55% of total
GDP	USD 37.43 billion
GDP growth rate	7.6%
GNI per capita*	USD 1,580
Unemployment rate	9.4% (2013 est.)
Poverty rate	46.3% (2015)
Urban	35.9%
Rural	56.8%
Currency	Franc CFA Ouest-Africain (CFA)
Official language	French
Natural resources	Agricultural (Cocoa, Coffee, Sugar, Palm Oil, Cashew Nuts); Ores (Gold, Copper, Manganese, Bauxite)

*World Bank Atlas method (current USD)

NOTE: All figures from 2017 unless otherwise indicated
Source: AfDB and World Bank

Figure 2: Ivory Coast, Macroeconomic and Social Indicators[1]

2.1.2. Political system

Côte d'Ivoire is a unitary presidential, constitutional republic. The president, Alassane Outtara, has been in power since 2010 and has been re-elected in 2010, 2015, and 2020 respectively. The latest election results had been disputed. The election in 2020 was the first to take place under the Ivorian constitution of 2016. The referendum modified several of the president's eligibility criteria: the maximum age limit for a candidate, previously set at 75, was removed, while the minimum age is lowered to 35 (art. 55). Further, only one of the parents of a presidential candidate needs to be of Ivorian nationality by birth, according to the referendum. The candidate himself now may also have had another nationality, but must renounce it before submitting his candidacy.[5] The amended constitution also introduced the function of a vice-president. He succeeds the president in the event of a vacancy in power.

The National Assembly, the legislative arm of the government, is made up of 255 seats filled for five years by one-round majority system, of which 169 are in single-member constituencies and 36 in constituencies with 2 to 6 seats. The last election took place in spring 2021 with almost half the votes being cast for the party "Rassemblement des Houphouëtistes pour la Démocratie et la Paix" (RHDP), the party of president Alassane Outtara.

[5] [5] "Ivory Coast: what will change if the new Constitution is adopted on October 30 - JeuneAfrique.com"[archive], on jeuneafrique.com (accessed November 10, 2019)

2.2. Liberia

2.2.1. Profile

Following the establishment of a democratic government in 2006, the Liberian economy slowly grew. In 2014 to 2015, economic growth stagnated due to low commodity prices and the Ebola outbreak, which caused massive disruptions to the country's development efforts. Driven by exports of its vast mineral resources, growth recovered thereafter and grew at 2.6% in 2017 and is projected to reach 3.9% in 2018 and 5% in 2019.[6] While the extractive industry and services sector account for nearly two-thirds of GDP, 70% of the labour force remains in agriculture. However, he country's macroeconomic gains have not fully translated into livelihood improvements for the whole population. Education and healthcare services remain inadequate, and unemployment and poverty levels remain high, particularly in rural areas. As a result, the country continues depending upon foreign aid.

Population	4.73 million
Urban Population	50% of total
GDP	USD 3.2 billion
GDP growth rate	2.5%
GNI per capita*	USD 620
Unemployment rate	2.39% (2016)
Poverty rate	63.8% (2012)
Urban	55.1%
Rural	67.7%
Currency	Liberian Dollar (LRD)
Official language	English
Natural resources	Agricultural (Cocoa, Palm Oil); Ores (Iron Ore, Gold, Timber, Diamonds, Rubber)

*World Bank Atlas method (current USD)

NOTE: All figures from 2017 unless otherwise indicated
Source: AfDB and World Bank

Figure 3: Liberia, Macroeconomic and Social Indicators[7]

[6] "Liberia Economic Outlook," African Development Bank, (2018):
[7] World Bank method. All figures from 2017 unless otherwise stated. Source: African Development Bank and World Bank

2.2.2. Political situation

Liberia is a unitary presidential, constitutional republic. Following years of political unrest, a democratic elected administration was installed in 2006. The latest presidential election took place in December 2017 at the same time as the legislative elections. No candidate was able to obtain absolute majority in the first round. Following the second round, George Weah (Coalition for Democratic Change) was elected president. The Liberian president is elected at two-round first past the post for a six-year term, renewable once.

The Legislature of Liberia consists of an upper house (Senate) and a lower house (House of Representatives), modelled after the United States Congress. The lower house has 73 seats with each of the 15 counties having at least two seats in this House of Representatives. The Senate has 30 members, consisting of two from each county who received the majority of votes.

2.3. Guinea

2.3.1. Profile

The coastal country of Guinea is rich in natural resources which has experienced strong economic growth in recent years. The capital and largest city is Conakry. Larger foreign investments in the country's mineral reserves, led to economic recovery from the impacts of the 2014 Ebola epidemic. Real GDP growth was estimated at 6.4% in 2017 and the years after until the spread of the COVID-19 pandemic. This growth was mainly driven by the mining and energy sectors.[8]

However, this growth has not translated into a significant improvement for the majority of the population, as basic social services remain insufficient, and the country consistently ranks among the poorest in the world. Almost two thirds

[8] "Guinea Economic Outlook," African Development Bank (2018)

of the population live in rural areas and three quarters of the working population depend on the agricultural sector.

Population	12.7 million
Urban Population	38% of total
GDP	USD 10.4 billion
GDP growth rate	6.4%
GNI per capita*	USD 790
Unemployment rate	4.5% (2016)
Poverty rate	55.2% (2012)
Urban	35.4%
Rural	64.7%
Currency	Franc Guinéen (GNF)
Official language	French
Natural resources	Bauxite, Iron Ore, Diamonds, Gold

*World Bank Atlas method (current USD)

NOTE: All figures from 2017 unless otherwise indicated
Source: AfDB and World Bank

Figure 4: Guinea, Macroeconomic and Social Indicators[9]

2.3.2. Political situation

Guinea is a unitary presidential republic with the president being directly elected by the people and being both Head of State and Head of Government. The president is elected for a six-year term, renewable once[10]. In 2020, a constitutional referendum was approved by around 90% of voters. The new constitution would strengthen the presidential regime through prolonging the presidential mandate to six years and opening the option of running for three times in a row.[11]

During the last presidential election in October 2020, the outgoing president Alpha Condé was re-elected in the first round for a third term with just under 60% of the votes cast. His opponent, Cellou Dalein Diallo, received just over 33%.

The National Assembly is the unicameral legislative body of Guinea. It has 114 members, 76 of whom are directly elected by proportional representation and 38 by

[9] World Bank method. All figures from 2017 unless otherwise stated. Source: African Development Bank and World Bank
[10] "New constitution"[archive], at www.presidence.gov.gn (accessed June 11, 2020)
[11] "Guinea referendum backs constitutional changes that may extend president's rule", Reuters (2020), available at https://www.reuters.com/article/us-guinea-election-idUSKBN21E39O

uninominal ballot. The last elections were held in 2020 with Apha Condé's party, the Rally of the Guinean People, winning 79 of the seats.

2.4. Sierra Leone

2.4.1. Profile

The Government of Sierra Leone has made significant progress in consolidating peace and security in the country and in rebuilding the economy following its long civil war. Increased public investment in state-building, infrastructure projects and strengthening of macroeconomic conditions has led to improved economic growth following the 2014 Ebola outbreak, which caused massive disruptions to the country's development efforts. Real Gross Domestic Product growth was estimated at 5.7% in 2017, driven mainly by the mining sector, particularly exports of iron ore.[12] More than half of the population lives in rural areas and two-thirds of the country's labour force engages in subsistence agriculture. However, this growth has not translated into significant improvements for the majority of the population, as basic social services are inadequate, and poverty remains widespread.

Population	7.5 million
Urban Population	40.7% of total
GDP	USD 3.7 billion
GDP growth rate	5.7%
GNI per capita*	USD 510
Unemployment rate	9.1% (2014)
Poverty rate	52.9% (2011)
Urban	31.2%
Rural	66.1%
Currency	Leone (SLL)
Official language	English
Natural resources	Iron Ore, Diamonds, Gold, Bauxite

*World Bank Atlas method (current USD)

NOTE: All figures from 2017 unless otherwise indicated
Source: AfDB and World Bank

Figure 5: Sierra Leone, Macroeconomic and Social Indicators[1]

[12] "Sierra Leone Economic Outlook," African Development Bank, (2018)

2.4.2. Political situation

Sierra Leone is a unitary presidential constitutional republic. The president is elected by direct universal suffrage under a slightly modified two-round majority voting system under which a candidate would need a minimum of 55% of votes in the first round to be elected. Otherwise, the two leading candidates compete in a second round.[13] The last elections were held in March 2018. After two rounds of presidential election, Julius Maada Bio was elected president.[14]

The Parliament of Sierra Leone is a unicameral parliament made up of 146 members. 132 of these are elected directly from across the country's 16 districts. The last election was held in 2018, with the All People's Congress receiving 68 seats, followed by the Sierra Leone People's Party with 49 seats.

[13] "Sierra Leone: The Constitution of Sierra Leone, 1991 (Act No. 6 of 1991)" [archive], at www.wipo.int (accessed March 12, 2018)
[14] "First round of the presidential election in Sierra Leone: a fragile victory for revenge" [archive], available on https://www.lemonde.fr/afrique/article/2018/03/14/premier-tour-de-la-presidentielle-en-sierra-leone-victoire-fragile-des-revanchards_5270916_3212.html, March 14, 2018 (accessed April 4, 2018)

3. THE IMPACT OF COVID-19 ON THE ECOWAS ENERGY SECTOR

The COVID-19 pandemic has disrupted the global system and impacted our way of life like never before. All over the world, airports, borders and businesses were closed down and people were forced to stay at home, as countries took action to contain the pandemic and save lives.

The ECOWAS (Economic Community of West African States) region – of which the MRU is part of - is not an exception. As of July 2021, the region had a total of 172.187 confirmed cases and 2.567 deaths, putting an additional burden on the region's health system. In addition to the impacts on the health of citizens and the healthcare sector, COVID-19 has also exacerbated other development challenges and has slowed down the economy. This led ECOWAS member states to seek long-term solutions that will mitigate the effects of the pandemic on their economies. Burkina Faso for instance, stipulated a comprehensive recovery package, including tax incentives for critical sectors, reduction in electricity bills up to 50% cost reduction for solar kits for vulnerable households.[15]

[15] "Briefing Paper: Renewables in the post-COVID-19 recovery packages of African Countries », Global Renewables Congress (2021), B, available on https://www.renewablescongress.org/wp-content/uploads/GRC-Briefing-Paper_REcovery_African-Countries.pdf

Table 1: Country-specific challenges and planned actions

COUNTRY	CHALLENGES SPECIFIC TO EACH COUNTRY	PLANNED ACTIONS
BENIN	Limited access to energy in rural areas	Develop and implement national plans for decentralized renewable energy infrastructure for clean cooking / bioenergy
CAP VERDE	Disruption of fuel supply and significant drop in demand.	Test the limits of renewable energy penetration and develop pilot storage facilities
GAMBIA	Disruption of fuel supply and significant drop in demand.	Prioritize renewable energies in sector development plans.
GHANA	Slow progress to reach 15% of unserved communities	Revision of the law on renewable energies to make investments in the off-grid sector attractive.
MALI	Delays in the implementation of renewable energy projects and solar energy projects	Revision of the Energy Policy to prioritize renewable energies and energy efficiency for energy security
NIGERIA	Decline in income due to falling oil prices	Development of a program to revive the electricity sector
SIERRA LEONE	Slowdown in investments and expiry of grants due to slowdown in project implementation.	Community engagement and promotion of the rental system for productive use
SENEGAL	Delays in the implementation of renewable energy projects and solar energy projects.	Develop activities to stimulate the bioenergy sub-sector
TOGO	Slowdown in the development of new on-grid and off-grid production capacities.	Speed up the implementation of major renewable energy projects

As ECOWAS countries strives to slow the spread of the virus, member states are also facing the fact that without sufficient energy it is much more difficult to maintain the necessary measures to fight a virus like this. Being confined without electricity, water and fuel for the purposes of cooking and other uses is a reality experienced by millions of people in the region.[16]

4. RENEWABLE ENERGY PROFILES OF MRU MEMBER STATES

In the field of energy, the MRU has created a center for the promotion, operation and the implementation of new and renewable energy sources in the light of existing ECOWAS and Commission économique pour l'Afrique *des Nations unies* (ECA) facilities. In 2000, a first pilot project started, aiming to electrify member countries through an interconnection of the electricity grids of the Côte d'Ivoire, Liberia, Sierra Leone and Guinea. The board of directors of the African Development Bank Group has approved this power grid interconnection program. The AfDB financed total financing needs amounting to 145.000.000 EURO, or about 40% of the total cost of the project. This interconnection was an important step towards energy supply security of the four countries. It also allowed the construction of a high-voltage line (225 kV) of some 1,400 km to connect the networks of the four countries, 11 electrical substations and two regional substations division. This structuring program enabled Liberia, Sierra Leone and Guinea to import electricity from Côte d'Ivoire. [17] According to the board of directors of the African Development Bank Group, this program has improved the rate of access to electricity in the four MRU member countries and even other neighbouring third countries, going from 28% to 33%, connecting 125 villages to electricity along the high-voltage line, 70 schools, 30 health centers and some 1.500 small craft, commercial and industrial enterprises (25% of which are managed by women). In total, nearly 24 million inhabitants have directly benefited from the program with access to reliable energy at a competitive cost. Further, several studies of planning and feasibility of hydropower plants were planned in order to improve energy exchanges.

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[16] "The impact of COVID-19 on the ECOWAS energy sector", ECREE (2020), available at http://www.ecreee.org/sites/default/files/documents/countries/ecowas_energy_sector_ecreee_brief_2020.pdf

[17] CSAO News, «Union du Fleuve Mano, une nouvelle plate-forme pour connecter les pays», revue de presse hebdomadaire du SCSAO, n°116, 2013, pp : 3-5

4.1. Ivory Coast

4.1.1. Energy sector overview

The energy sector in Côte d'Ivoire has been managed by Ivoirienne d'Électricité (CIE) since the early 1990s. In 2013-2014, the government undertook a series of reforms to liberalize the electricity market. CI-ENERGIES (Société des Énergies de Côte d'Ivoire), a public company, which provides electricity as a vertically integrated monopoly and concludes power purchase agreements (PPA) with independent producers of electricity (IPP). electricity (Independent Power Producer, IPP) as the sole transmission and distribution operator.

With an installed production capacity of 2,199 MW, Côte d'Ivoire is the third largest electricity producer in West Africa behind Ghana and Nigeria. The country's electricity supply is dominated by gas-fired generation and large hydropower plants which represent approximately 60% and 40% of installed capacity, respectively.

Rural electrification is the joint responsibility of CIE and the public company CI-ENERGIES. Liberalization of the distribution and retail sectors is planned for 2020 after the expiration of the expiration of the existing concession agreement between.[18]

Table 2: Electricity sector indicators Ivory Coast, 2017

Installed capacity	**2,199 MW**
Thermal	1,320 MW
Hydro	879 MW
Renewables (non-hydro)	-
National access to electrification (2016) Urban electrification Rural electrification	64% 88% 31%
Populatin without acecss to electricity	9.2 million
Households without access to electricity	1.7 million

[18]"Côte d'Ivoire Country Profile," ClimateScope 2020-2021, available on https://global-climatescope.org/results/CI#power-market

Access to electricity and the off-grid market

In 2016, around 9 million people, had no access to electricity. This equals around one-third of the total population. There is a significant disparity in access rates between urban areas (88%) and rural (31%).[19] Off-grid electrification has therefore been a policy priority, with the government seeking to achieve universal access by 2025.

In 2012, with the support of ECOWAS, the government developed and adopted the National Investment Program for Access to Energy Services in Côte d'Ivoire (PNIASE-CI). The program focused on identifying and measuring the level of energy access in the country by examining the proportion of electrified localities and households with access to electricity.[20] The Government subsequently launched the National Rural Electrification Program (PRONER) in 2014 to align public and private resources and to coordinate the development efforts needed to extend electricity coverage to all localities and double the number of domestic connections.

The analysis identified 6,159 localities (316,016 households), representing 6.2% of the population in 2023, as suitable for autonomous, off-grid systems. The research further concluded that this number may rise to 3,122 localities (170,879 households and about 2.8% of the future population) in 2030. Although the total size of the market solar home systems (SHS) for households will decrease over time, their importance will increase in the isolated western regions of the country. According to the analyses, the majority of off-grid households are located in the Woroba regions, Zanzan and Bas-Sassandra by 2030. This would have implications for long-term economic models of the market for solar products, which will need to take into account larger distribution areas as the total number of households without access to electricity will decrease.[21]

One of the key elements of the government's electrification strategy is the Electricity For All Program (PEPT). The PEPT aims to provide access to electricity to approximately one million low-income households over the next five years through a combination of rehabilitation and extension of the transport network as well as a subsidy mechanism that eliminates the high cost of connection to the distribution network for rural households. The PEPT has already established 300.000 network connections. From 2011 to 2016, the number of electrified localities increased by 59% and the national coverage rate by 20% (ratio of electrified settlements

[19] "Energy Access Outlook, 2017: From Poverty to Prosperity," IEA, (2017), available on https://www.iea.org/reports/energy-access-outlook-2017
[20] "SE-for-All Action Agenda: Côte d'Ivoire," SEforALL (2016), available on https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_AAs/CO%CC%82TE_D%E2%80%99IVOIRE_Agenda_d%E2%80%99Action_de_L%E2%80%99initiative_Energie_Durable_Pour_Tous.pdf
[21] " Évaluation du marché de l'énergie solaire hors réseau et conception de dispositifs de soutien au secteur privé", ECREE (2019), available at http://www.ecreee.org/sites/default/files/ecreee_rogep_cote_divoire_final_report_french.pdf

compared to the total number of settlements in the country).[22]

Further, following a new policy in 2014, state-owned CI-ENERGIES began to develop a Rural Electrification Master Plan (PDER) aiming to electrify all rural areas of the country. The plan called for the electrification of all settlements with at least 500 households in 2018 and the achievement of universal access by 2025, through a combination of grid extensions and distributed solar technologies. Under the PDER, CI-ENERGIES estimates that a total of 96 localities are eligible for off-grid electrification by mini-grids. A program is already in place to provide solar-diesel hybrid solutions in 49 of these areas with funding from UEMOA and the ENERGOS-2 program of the European Union (EU).[23]

In addition to public sector initiatives, several private solar companies are also tapping into the country's off-grid market, but participation is still limited. In 2017, The National Regulatory Authority of the Electricity Sector of Côte (ANARE-CI) identified 48 isolated power plants with a total capacity of about 5 MW that operate in rural areas.[24]

These are mainly small thermal power plants, with the exception of seven solar-diesel hybrid mini-grids operating in the northeastern Zanzan region, which were part of a pilot project funded by the EU and the United Nations Industrial Development Organization (UNIDO) to generate solar electricity in targeted communities for productive use.[25]

4.1.2. Development initiatives

4.1.2.1. National Government initiatives

The government, through the Ministry of Petroleum, Energy and Renewable Energy Development (MPEDER), has put in place several strategic plans and key roadmaps for rural electrification and the development of the off-grid sector (Table 1). These key development plans are supported mainly by the World Bank, African Development Bank (AfDB), European Union (EU), West African Development Bank (BOAD) and Exim Bank of China.

[22] "Rural Electrification of Côte d'Ivoire," CIE-ENERGIES (2017), available at https://www.cinergies.ci/
[23] "1st National Workshop: Promoting Private Investments in Autonomous Solar Systems in West Africa and the Sahel,", ECREEE (May 2018), available at http://www.ecreee.org/sites/default/files/atelier-_rogep_guinea_conakry_final.pdf
[24] "Côte d'Ivoire: Energy Sector," Africa-EU Renewable Energy Cooperation Program (RECP) (2017), available at https://www.get-invest.eu/market-information/cote-divoire/
[25] "Promoting renewable energy-based grids in rural communities for productive uses in Côte d'Ivoire," UNIDO (2016), available at https://open.unido.org/projects/CI/projects/100186

Table 3: National Government Off-Grid Development Programs Ivory Coast

Project / Program	Calendar	Market segment (s)	Description
National Rural Electrification Program, PRONER Rural Electrification Master Plan (PDER)	2015-2025	Network extension, mini-grid, picosolar, SHS	• The National Rural Electrification Program (PRONER) and the corresponding Rural Electrification Master Plan (PDER) aim to increase electricity penetration and coverage rates by electrifying 100% of localities with more than 500 inhabitants in 2020 and to achieve access universal by 2025. • Electrification will be achieved by combining grid extension and distributed solar / solar-diesel hybrid technologies. • The scope of this policy covers all the 8.523 localities of the country - the majority of them will be electrified by extension of the grid, with a total of 96 zones identified as being eligible for hybrid solar-diesel solutions. • For small towns, an off-grid strategy using micro-grids and solar kits is being developed for over 3,000 remaining villages and settlements. •It is estimated that PRONER will need USD 675 million over a five-year period to achieve its objectives. • In the absence of a framework governing the off-grid sector, electrification of off-grid areas depends primarily on public or donor funding.
Electricity For All Program, PEPT	2014-2020	Network of distribution (tuning subsidy)	• Add 200,000 new connections each year and 1million by 2020 through a revolving fund to eliminate high grid connection fees for households (from $ 250 to $ 2); • By 2030, CI-ENERGIES estimates that the PEPT program will have connected 70% of the country's households to the electricity grid. • Interim PEPT says the program has been

			successful, making 300,000 connections since 2015.
National Renewable Energies Action Plan, PANER	2011-2020	Renewable energy capacity	• Action plan to inform the national renewable energy strategy with a view to increasing the share of renewable energies in the electricity mix. • As part of the national contribution to the UNFCCC, the GoCI has committed to dedicate 42% of the global share of renewable energies in the energy mix by 2030. • The current electricity pricing environment (low-cost natural gas) will require significant political and regulatory support to achieve the set targets.
Transport and distribution master plans	2016-2020	Transport and distribution network; rural electrification	• Master plans prepared by the CIE for the transmission and distribution of electricity (including assessment of urbanization, rural electrification and atomization of the system). • Each master plan defines investment selection criteria to meet domestic and regional demand (WAPP) and secure supply. • Investments estimated at around USD 2 billion are needed to improve electricity transmission infrastructure, USD 680 million to improve urban distribution (including a new distribution center in Yamoussoukro) and USD 675 million for rural electrification. • The main sources of funding for these initiatives are the World Bank, ADB, BOAD, EU and China.

4.1.2.2. Programs of Development Financial Institutions, Donors and development partners

In addition to government initiatives, there are a number of Development Finance Institutions (DFI) and donor-funded programs that support the development of the off-grid sector in Côte d'Ivoire (Table 1). The African Development Bank (AfDB), the EU and the World Bank are the three main financial partners involved in the development of the off-grid sector in Côte d'Ivoire. At the bilateral level, the governments and development institutions of France, Germany, the United Kingdom, the United States and China are all participating, to varying degrees, in the rehabilitation of the Ivorian electricity sector and in supporting growth in its off-grid market. China's Exim Bank are also heavily invested in other major energy infrastructure and utility projects.

Table 4: Off-grid development programs financed by DFIs and donors in Ivory Coast

Project / Program	Sponsor	Calendar	Market segment (s)	Description
Multilateral partner initiatives				
AfDB loan to Zola Energy Côte d'Ivoire (ZECI), a joint venture between Off-Grid Electric (OGE) and EDF	AfDB, Société Générale (SocGen), Crédit Agricole Corporate and Crédit Agricole CIB	2018 - present	Domestic solar systems	• In June 2018, ADB ZECI received a local currency loan of 15.75 billion FCFA (approximately 24 million euros) granted by local subsidiaries of Société Générale and Crédit Agricole. • The AfDB will provide a partial credit guarantee covering part of the secured loan facility as a catalyst.

ENERGOS (Phase II)	European Commission, EIB, BOAD	2017-2020	Update and extension of the transport and distribution network	• A loan of 118 million euros to support access to off-grid electricity in 30 remote sites. • The project also aims to modernize the networks in the cities of Bouaké, San Pedro and Abidjan, and to create a new national distribution center in Yamoussoukro.
Mini solar grids for productive use in the Zanzan region	UNIDO and EU	2012-2015	Mini-solar grid / productive use	• Solar-diesel hybrid mini-grids operating in the north-eastern region of Zanzan, pilot project for the production of solar electricity in targeted productive communities of use. • A project evaluation109 in 2016 showed promise for long-term sustainable impact with sufficient government support. • The concept of the project is being extended in the next projects sponsored by GEF, EU and EDG.
Regional program for the development of renewable energies and energy efficiency, PRODERE	UEMOA, BOAD	2014 - present	Solar kits, solar street lights, solar powered water supply systems	• In Côte d'Ivoire, PRODERE ensures the supply, installation and commissioning of autonomous solar power plants, low voltage distribution networks and solar PV street lights in 12 localities.

Electricity transmission and distribution network strengthening project	African Development Bank	Update of the transport and distribution network	• Sovereign loan of EUR 162 million under the "New Deal for Energy in Africa" program to support the modernization of energy transmission and distribution networks in Africa.	
Electricity transport and access project	World Bank	2017-2022	Update of the transport and distribution network and connection subsidy	• IDA loan of USD 325 million to modernize the transmission and distribution network and improve access to electricity in more than 200 rural areas. • Support the "electricity for all" / PEPT network extension program.
Initiatives by bilateral partners				
Sustainable Use of Natural Resources and Energy Finance (SUNREF) initiative	AFD	2017 - present	Financing of non-network projects and technical assistance	• € 30 million program provides concessional financing to encourage FIs to finance clean energy projects. • Includes technical assistance to validate projects and their eligibility for the program, then present them to partner banks for funding. • The facility has been deployed with partner banks in Benin, Côte d'Ivoire and Senegal. • The SUNREF initiative has

				been largely successful in East Africa, where it has focused on the commercial and industrial (C&I) market segment, where systems are larger, and buyers are often companies with sufficiently large balance sheets to borrow. Therefore, this is one of the self-sustaining market segments where there have been lending so far. The program has just been launched in West Africa and could be a potential partner for ROGEP.
Technical assistance and vocational training program	GIZ	2018 - present	Technical assistance and training on solar photovoltaic energy	• This is a three-year initiative which will be launched in 2018 and which provides 5 million euros for professional training and education in renewable energies in the private sector, including solar-photovoltaic energy and the specialized training of electricians to become specialists. renewable energies.
PRONER / PDER Rural Electrification	KfW	2018 - present	Development of off-grid / mini-grid projects	• According to PRONER, 47 of the other eligible off-grid and mini-grid sites that require development have been proposed to KfW.
Power Africa / US-Africa Clean	USAID	2016 - present	Off-grid solar; Update of the	• Power Africa's off-grid interventions focus on: (i)

Energy Finance Initiative (ACEF)			transmission and distribution network and connection subsidy	supporting the Government's Electricity for All Program (PEPT); (ii) provide advisory assistance to off-grid enterprises (particularly PEG Afrique) to develop their commercial activities in the country; (iii) develop a national off-grid policy, (iv) promote the productive use of energy in the agricultural sector and (v) help the regulator conduct the first-ever national willingness-to-pay survey, which will help support national tariff reform.
China	2009-2013	Solar Kits	• Distribution of 173 solar kits in the localities of Péré, Djamdjankro and Lazarekro in Prikro	

4.1.2.3. Other initiatives

Non-governmental organizations (NGOs) in Côte d'Ivoire are not very active in the sector off- grid sector.

PEG Africa, a private off-grid solar company recently entered the country, received a grant from the Scaling Off-Grid Energy campaign – led by US Agency for International Development (USAID), Power Africa and UK DFID (Department for international development), with the support of the Shell Foundation, Microsoft, Acumen and the United Nations Foundation – to develop its activity in Côte d'Ivoire. The joint initiative aims to expand access to energy to 20 million households in Sub-Saharan Africa through off-grid solar home solutions.[26]

[26] "PEG Africa wins Scaling Off-Grid Energy Grand Challenge grant from USAID," PegAfrica (2016), available at https://pegafrica.com

4.2. Liberia

4.2.1. Energy Sector Overview

The Liberia Electricity Corporation (LEC) is the country's public utility that has a monopoly over generation, transmission, and distribution of power. The Ministry of Mines and Energy (MME) is responsible for energy policy formulation and works with the Rural and Renewable Energy Agency (RREA) to improve rural electrification. The Liberia Electricity Regulatory Commission (LERC), through the Energy Regulatory Board (ERB) acts as the energy sector's regulatory authority.

4.2.2. Electricity Access and off-grid market

Energy access in Liberia represents a significant challenge, as the country has one of the lowest electrification rates in the world. In 2016, an estimated 88% of the population – over four million people – did not have access to electricity, with a significant disparity in rates of access between urban (16% access) and rural (3% access) areas.[27] The Government of Liberia (GoL) has set a target of increasing electrification rates to 70% in the capital Monrovia and 35% of rural areas by 2025

[27] "Energy Access Outlook, 2017: From Poverty to Prosperity," International Energy Agency (2017), available at https://www.iea.org/reports/energy-access-outlook-2017

and universal electricity access nationwide by 2030.[28]

The Liberian power sector remains largely underdeveloped, with limited transmission infrastructure outside of Monrovia. The ECOWAS Energy Protocol has established a foundation for Liberia's national energy policy to support development of the off-grid sector. Under this framework, the Government plans to establish an Off-Grid Power and Renewable Energy Unit within the RREA and to utilize the Rural Energy Fund (REFUND) to support off-grid project planning and development. The GoL is in the process of implementing regulatory measures to increase private sector participation in off-grid development, including opening the off-grid sector to private operators to distribute stand-alone solar products and systems. Further, off-grid electrification has been a policy priority, as the GoL is implementing a range of measures through the RREA to extend transmission and distribution lines, develop renewable energy sources and provide a framework for off-grid electrification to meet its long-term development objectives (see table 3). [29]

The main sector policy is the National Energy Policy from 2009. In addition, the Rural Energy Strategy and Master Plan (RESMP) has put in place ambitious electrification targets for 2030, including a "Beyond the Grid" (BTG) program that will utilize a combination of grid extension and off-grid RE technologies to electrify rural areas Beyond the Grid has three main initiatives:

1. Solar Villages and Home Systems: This initiative aims to provide solar energy to small rural communities with low levels of consumption and, due to their significant distance to electricity grids, are not viable for grid connection in the long-term. The RREA estimates that five communities in each county will be connected with these systems, totalling 75 solar systems nationwide through 2030.
2. Solar Community Services: This initiative consists of installing solar systems in non-electrified community/institutional centers (government, healthcare, education, security etc.). The initiative will be implemented over several phases through 2030.
3. Solar Portable Lamps: This initiative will build upon and reinforce the existing Solar Portable Lamp initiative through the creation of Rural Services Units, responsible for managing the import and distribution of solar lamps, while RREA will maintain responsibility for procurement and for the communication/information campaign.[30]

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[28] "Liberia National Renewable Energy Action Plan," SEforALL / ECREEE (2015), available at http://www.se4all.ecreee.org/sites/default/files/national_renewable_energy_action_plans_nreap_-_liberia.pdf

[2929] "Rural Energy Strategy and Master Plan for Liberia, 2030," Rural and Renewable Energy Agency, Developed by Gesto Energy Consulting, (2016)

[30] "Rural Energy Strategy and Master Plan for Liberia, 2030," Rural and Renewable Energy Agency, Developed by Gesto Energy Consulting, (2016) available at https://liberiaruralenergy.gestoenergy.com/sites/default/files/A%20-

In addition to these efforts, the Liberian SEforALL Action Agenda envisions universal access to electricity via a highly decentralized model that could serve 68% of the population with a combination of mini-grids and standalone systems.[31] Plans formulated by RREA, with support from USAID envision a nationwide effort to electrify the country using primarily off-grid renewable resources. To date, the RREA has prioritized development of a range of small hydro, biomass and solar off-grid renewable energy projects throughout the country.[32] There are also a number of donour-funded initiatives in the off-grid solar sector. In 2016, the World Bank provided USD 27 million for the Liberia Renewable Energy Access Project (LIRENAP), which includes provisions for 100.000 people nationwide to gain electricity access through stand-alone solar systems and lanterns.[33] The EU and USAID have funded similar programs promoting off-grid solar development in Lofa county.

%20Rural%20Energy%20Strategy%20and%20Master%20Plan/LR.2016.R.002.2%20Rural%20Energy%20Strategy%20and%20Master%20Plan.pdf.

[31] "Liberia National Renewable Energy Action Plan," SEforALL / ECREEE (2015), available at http://www.se4all.ecreee.org/sites/default/files/national_renewable_energy_action_plans_nreap_-_liberia.pdf

[32] "Rural Energy Strategy and Master Plan for Liberia, 2030," Rural and Renewable Energy Agency, Developed by Gesto Energy Consulting, (2016) available at https://liberiaruralenergy.gestoenergy.com/sites/default/files/A%20-%20Rural%20Energy%20Strategy%20and%20Master%20Plan/LR.2016.R.002.2%20Rural%20Energy%20Strategy%20and%20Master%20Plan.pdf.

[33] "Liberia," ClimateScope (2020-2021), available at https://global-climatescope.org/results/LR.

Table 5: Development Finance Institutions (DFIs) and Donor-Funded Off-Grid Development Programs in Liberia

Project/Program	Timeline	Market Segment(s)	Description
World Bank, Liberia Renewable Energy Access Project (LIRENAP)	2016-ongoing	Decentralized energy, solar home systems.	• The project has three components: decentralized electrification in Lofa County to expand access to about 50,000 people; technical assistance to strengthen rural electrification institutions and regulations; and market development of stand-alone solar systems to provide access to over 100,000 people.99 • There are seven sites in Lofa and one site in Grand Bassa. Total support is $27 million USD; World Bank support adds up to $2 million USD.
World Bank, Liberia Accelerated Electricity Expansion Project (LACEEP)	Ongoing	Rural electrification, grid electricity	• Goals of LACEEP are to scale up electrification by connecting domestic, commercial and industrial consumers to the grid; and strengthening the Liberia Electricity Corporation (LEC) to improve its operational and financial performance and long-term sustainability.100 • Total support, all from the world bank, is USD 35 million.
EU National Indicative Program (NIP)101	2014-2020	Energy sector development, including rural electrification	• A total of EUR 100 million has been allocated for projects and programs in Liberia's energy sector, with EUR 45 million dedicated to rural electrification initiatives.

EnDEV, GIZ	2015-ongoing	Pico solar, SHS	• Promotion of pico solar market and supporting solar lamps in the following regions: Nimba, Bong, Lofa, Grand Bassa, Margibi, Gbarpolu • SHS program that gives support/donation to over 250 health, education and social facilities in Liberia. • EnDev also works alongside RREA, REASL, and NGOs to promote small business selling solar products and is involved in outreach, marketing and awareness campaigns. • As of the 2017, the program had successfully installed a total of 3,750 SHS, including 427 SHS in public institutions.
Africa Renewable Energy and Access program (AFREA)	World Bank ESMAP	Renewable Energy	• AFREA has provided support for the development of the Catalyzing New Renewable Energy in Rural Liberia Project, notably by assisting the government of Liberia to establish a rural and renewable energy agency
Power Africa	USAID	Rural electrification	• Power Africa is supporting the development of the nascent off-grid sector. • USAID Liberia has notably conducted three renewable energy pilot projects under community-based ownership models which concluded that solar is the most feasible renewable energy technology to scale up in rural Liberia.

ACP-EU Energy Facility	EU	Rural electrification, solar PV	• The ongoing Light Up Project (2016-2019) supports the development of off-grid solar PV solutions for lighting and cooking, targeting 10,000 villages. As at December 2017, over 2,000 products (solar and cook stove) have been sold through the 10 retailers that have been identified.

In addition to these public initiatives, several private companies are expanding their operations in the country's off-grid space, providing pico solar, solar home systems (SHS) and larger stand-alone solar solutions utilizing Pay-As-You-Go (PAYG) and Rent-To-Own business models.

Table 6: National Government Off-Grid Development Programs in Liberia

Project / Program	Timeline	MarketSegment (s)	Activity
RREA RESMP Beyond theGrid Program (BTG)	Three phases (2015-2020; 2020-2025; and 2025-2030)	Stand-alone solarPV	• Aims to provide 2.2 MW of off-grid electricity accessin areas outside of current grid expansion plans through 2025. • The program plans to use off-grid solar to electrify households and public buildings (schools, health facilities etc.). • Three initiatives: (i) Solar villages and home systems; (ii) solar community services; and (iii) solar portable lamps.
RREA RESMP Decentralized Grid Program (DG)	Three phases (2015-2020; 2020-2025; and 2025-2030)	Solar-diesel "transitional" mini-grids	• Decentralized renewable energy electrification program focusing initially on solar / diesel mini-grid systems. • Estimated USD 292 million in investment and up to 53 MW of production to electrify 96,800 households, 489,000 individuals.
RREA RESMP BuildingCapacity Program	All three phases	Rural electrification training and awareness raising	• Capacity building and awareness raising program of the RESMP to strengthen the applicable public sector programs, project assistance with funding and contract aid, new institutional frameworks, rural energy training centers, the REFUND, and communication assistance. • An estimated budget of USD 52 million is anticipated for the nationwide program.

4.3. Guinea

4.3.1. Energy sector overview

In Guinea, the Ministry of Energy (ME) supervises the energy sector, while the National Directorate of Energy (DNE) is responsible for defining and implementing the country's energy policies, particularly in terms of renewable energies. The public utility, Electricité de Guinée (EDG), manages the national grid and mainly supplies electricity to the capital, Conakry, and other urban areas. EDG is fully state-owned. In 2015, the French private energy company Veolia was tasked with operating and managing EDG under a four-year management services contract funded by the World Bank, in order to improve the operational, commercial and financial performance of the service through a wide range of technical assistance and training of EDG staff.

While the energy sector in Guinea is still dominated by public sector actors, it is currently being liberalized, starting with the production of electricity. A new electricity law adopted in 2017, created the Guinean Agency for Rural Electrification (AGER), replacing the Decentralized Rural Electrification Office (BERD), that oversees the country's electrification programs and initiatives in rural and peri-urban areas, in particular, by using decentralized off-grid solutions. The law, which is currently being revised by the Government of Guinea (GoG),

with the support of the AfDB, also created an independent regulator, the Water and Electricity Sector Regulatory Authority (ARSEE),[34]

4.3.2. Access to electricity and off-grid market

The access to electricity rate in Guinea is among the lowest in Africa, especially in the rural areas of the country. A large part of the Guinean population lives below the poverty line, without access to electricity. In 2016, around 80% of Guinea's total population, around 10 million people, had no access to electricity, with a significant disparity between urban (46%) and rural (1%) areas.[35] The lack of access is at least partly due to systemic problems related to the grid infrastructure and high costs of grid connection. Faced with this situation, the GoG has set itself an ambitious goal: to achieve universal access by 2030.

For Guinea to reach its electrification objectives, about 1.7 million households will have to be connected by 2030. In the long term, the Government estimates that 99% of these households would be served by the network, while only 8.260 households would be served by mini-grids or stand-alone solutions.[36]

In the short term, it may prove difficult to serve a significant portion of the population residing in rural and peri-urban areas through grid extension, due to their relatively low effective energy demand, and the general lack of financial resources for these, as well as the high extension costs. Autonomous solar technologies offer a more cost-effective and efficient solution to meet the real demand for electricity in these regions.

Before the creation of the Guinean rural electrification agency – AGER, the EBRD had launched several pilot small-scale off-grid electrification initiatives. As part of the Decentralized Rural Electrification Project financed by the World Bank (PERD, 2003-2015)[37], the EBRD has been able to carry out decentralized rural electrification projects and has signed 30 concession-type

[34] "Guinea-Mali Interconnection Project: Combined Project Information Documents / Integrated Safeguards Datasheet," World Bank (2018), available at https://ewsdata.rightsindevelopment.org/projects/p166042-guinea-8211-mali-interconnection-project/
[35] "Energy Access Outlook, 2017: From Poverty to Prosperity," International Energy Agency (2017), available at https://www.iea.org/reports/energy-access-outlook-2017
[36] "Guinea Electrification Program: Investment Prospectus," Castalia Strategic Advisor (2017), available at https://castalia-advisors.com/investment-prospectus-for-a-national-electricity-access-scale-up-program/
[37] "Decentralized Rural Electrification Project, Final Assessment Review," World Bank (2015), available at https://documents.worldbank.org/en/publication/documents-reports/documentdetail/191951468274211905/guinea-decentralized-rural-electrification-project

agreements with Guinean private operators. This has led to the development of micro-grids (mainly PV-diesel hybrid solar grids) in rural areas far from the national grid, providing access to electricity to 15.000 households.[38] The agency intends to build on PERD, which includes an innovative model of off-grid rural electrification, through micro-concessions based on Small and Medium Enterprises (SME).[39] A new financing mechanism, the Decentralized Rural Electrification Fund (FERD), was created to address the high upfront costs of rural electrification systems and the lack of available long-term credit. The FERD would:

- (i) fund the operational cost of managing the Decentralized Rural Electrification Office (BERD). The implementing agency, the Decentralized Rural Electrification Office (BERD): to define priority areas; evaluate proposals for Decentralized Rural Electrification (DRE); coordinate, supervise and monitor the implementation of DRE projects; and evaluate, disseminate and replicate activities;
- and (ii) provide loans and grants to promoters of RE projects.

More recently, the Government has developed the National Rural Electrification Program (PNER), with the support of ECOWAS Centre for Renewable Energy and Energy Efficiency (CEREEC).[40] The PNER included capacity building and the development of a plan of 15 years by AGER. In addition to public institutions, several private solar companies also operate in the country's off-grid sector.

4.3.3. Development initiatives

4.3.3.1. National Government initiatives

The GoG, through the Ministry of Energy, has developed a number of strategic plans to address rural electrification and develop the off-grid sector with the support of the World Bank, AfDB, Agence française de développement (AFD), ECOWAS Centre for Renewable Energy and Energy Efficiency) (ECREEE ,the EU and other partners. The

[38] "Preparation of the PNER for the 2030 horizon, of the two PPERs and capacity building in AGER planning: Final Report Volume 2, Volume 1 (provisional version)," ECREEE, I2D (2017), available at http://www.ecreee.org/sites/default/files/procurment/attachments/tors_ager_pner_.pdf
[39] "Decentralized Rural Electrification Project, Final Assessment Review," World Bank (2015), available at https://documents.worldbank.org/en/publication/documents-reports/documentdetail/191951468274211905/guinea-decentralized-rural-electrification-project
[40] "Preparation of the PNER for the 2030 horizon, of the two PPERs and capacity building in AGER planning: Final Report Volume 2, Volume 1 (provisional version)," ECREEE, I2D (2017), available at http://www.ecreee.org/sites/default/files/procurment/attachments/tors_ager_pner_.pdf

current GoG program guiding the development of the sector is the National Expansion of Low-Cost Electricity Access Project – for which the corresponding investment prospectus has been launched as part of technical assistance by SEforALL and the World Bank.

4.3.3.2. Programs of Development Financial Institutions and Donors

Development Finance Institution (DFI) donor programs and initiatives that support the development of the off-grid sector in Guinea are summarized in Table 4.

Table 7: Off-grid development programs funded by DFIs and donors in Guinea

Program	Sponsor	Calendar	Market segment (s)	Description
Conakry electricity grid rehabilitation and extension project	World Bank and French Development Agency	2019 - present	Network extension and rural electrification	• In 2019, the World Bank and AFD loaned $ 106 million to Guinea for the rehabilitation and extension of the Conakry electricity transmission network and for the development of isolated off-grid areas. • The off-grid component of the project aims to finance the rural electrification of 3,000 households.
Project to expand access to electricity in Guinea	World Bank / SEforALL Trust Fund	2017-present	Rural electrification	• Financing of the scaling up of the investment prospectus for access to electricity (USD 2.1 million) in order to: (i) mobilize concessional financing to support the development of a monitoring and evaluation framework to monitor sector performance; (ii) increase the

				capacity of Ministry of the Environment in PPPs and (iii) develop a hydroelectric atlas for the country.
Guinea power sector restructuring project	African Development Bank, French Development Agency and World Bank	2018 - present	Institutional capacity building	• Component 1: Improvement of EDG's performance through a management services contract (USD 14million equivalent). • Component 2: Improvement of the Conakry distribution network and EDG's commercial performance (33.7 million USD). • Component 3: Technical assistance to the Ministry of Energy and AGER, monitoring and evaluation, and support for project implementation ($ 2.3 million).
Electricity transport and distribution master plan	African development bank	2018 - present	Electricity transmission and distribution	• The AfDB is one of the main development partners of the GoG, providing technical assistance for the implementation of the rural electrification project. • The TA aims to help the government to harmonize and coordinate efforts between the PNER and the Electricity and Distribution Plan.

4.3.3.3. Other initiatives

Apart from the Government and DFI donor initiatives mentioned above, there are also several NGO programs and other related initiatives active in the off-grid sector of Guinea.

Fondem (Fondations Énergies pour le Monde) is a French NGO that promotes off-grid solar solutions for the country's rural population, in particular the electrification of 20 villages (3.000 direct beneficiaries and 20.000 indirect beneficiaries) in Kouramangui and Middle Guinea.[41] Further, Solar Synergy – a Micro-Projects Agency[42] Consortium – is frequently offering funding (grant possibility in 2018 of around 2.000 to 15.000 EURO per project) for micro and small renewable energy projects, including off-grid solar projects.

4.4. Sierra Leone

4.4.1. Energy Sector Overview

The Ministry of Energy of Sierra Leone (MoE) is the public authority responsible for the electricity and water sectors. Other institutions involved in the energy sector include the Ministry of Finance, the Ministry of Planning and Economic Development, the Public Private Partnership Unit in the Office of the President, the Ministry of Health and Sanitation, the Ministry of Agriculture and Forestry, the Ministry of Trade and Industry, the Ministry of Local Government and Rural Development and the Ministry of Works and Public Assets. In 2016, the Government instituted reforms to the electricity sector and unbundled the National Power Authority

[41] "Small Hydraulic Project in Guinea", Fondem (2015), available at https://fondem.ong/
[42] "Presentation of funding," Agence Micro-Projets (2018), available at https://www.agencemicroprojets.org/

(NPA) into two utilities – Electricity Generation and Transmission Company (EGTC) and Electricity Distribution and Supply Authority (EDSA). An independent regulatory authority, the Sierra Leone Electricity and Water Regulatory Commission (SLEWRC), was also established.

4.4.2. Electricity Access and off-grid market

Energy access rates in Sierra Leone are among the lowest on the African continent. In 2016, an estimated 91% of the population - about 7 million people - did not have access to electricity, with a significant disparity in rates of access between urban (12%) and rural (6%) areas.[43] The Government intends to achieve universal access by 2025.

In 2017, the Government of Sierra Leone (GoSL) published the Electricity Sector Reform Roadmap (2017-2030), which provides a detailed framework for development of the country's energy sector over three distinct periods through 2030 - recovery, transition and delivery. Each with its own set of reform measures and actions to restructure the power sector and achieve long-term objectives. The roadmap includes a detailed plan to electrify rural areas that are beyond the feasible reach of the grid by utilizing off-grid renewable energy solutions (mini-grids and stand-alone systems). The strategy also calls for key institutional reforms including the formation of a Rural Electrification Agency and an Energy Management Fund.[44]

The Rural Renewable Energy Program (RREP), funded by the UK Department for International Development (DFID) (GBP 33million, about US$ 55 million) and implemented by the UN Office for Project Services (UNOPS), aims to increase access to electricity in rural areas of Sierra Leone. In its first phase, the RREP funded solar PV electrification of 50 community health clinics (6 kW systems) scattered throughout the country, which were subsequently extended to mini-grids with a capacity of 16-36 kW. In its second phase, the project electrified an additional 40 mini-grids (health centers and communities), with sizes varying between 40-200 kW and based on a private sector co-financing arrangement. For the first 50 sites, the project is entirely financed by grant funding with no recovery of the capital through tariff.

[43] "Energy Access Outlook, 2017: From Poverty to Prosperity," International Energy Agency (2017), available at https://www.iea.org/reports/energy-access-outlook-2017
[44] "Electricity Sector Reform Roadmap (2017-2030) Sierra Leone," Millennium Challenge Corporation (2017), available at https://rise.esmap.org/data/files/library/sierra-leone/Energy%20Access/EA%2014.1B.pdf

4.4.3. Development Initiatives

4.4.3.1. National Government Initiatives

The GoSL has led several initiatives to address the country's rural electrification challenges. The Electricity Sector Reform Roadmap includes plans to develop and implement a Rural Electrification Master Plan in 2018 to 2019 along with an Energy Management Fund. The National Renewable Energy Policy stresses the importance in implementing off-grid solar solutions as a key element to meet rural electrification objectives. In addition, the Energy Sector Strategy and Action Plan (2014-2017) included an allocation for the development of off-grid systems in the country. The GoSL has also sponsored the Barefoot Women Solar Engineer Association of Sierra Leone (BWSEASL), which has supported installation of more than 7.000 solar home systems in rural Sierra Leone.[45] Previously, in 2014, the GoSL has also undertaken various public street lighting initiatives, including in Freetown, Makeni, Kambia, Port Loko, Kono, Kenema, Kailahun and Bonthe.

4.4.3.2. DFI and Donor Programs

In addition to Government-led initiatives, there are a number of related Development Finance Institution (DFI) and donor-funded programs also supporting development of the off-grid sector in Sierra Leone, led by the EU and ECREEE among others, while UK DFID and AFD have been engaged on a bilateral basis (Table 5).

Table 8: DFI and Donor Funded Off-Grid Development Programs in Sierra Leone

Project / Program	Funding Source (s)	Timeline	Market Segment (s)	Description
Rural Renewable Energy Program (RREP)	DFID	2017 - 2019	Stand-alone systems, minigrids	• The RREP program funded by DFID and implemented by UNOPS aims to increase electricity access in rural Sierra Leone over a 3-year period. • The first phase of the project

[45] "Introduction: Energy Sector in Sierra Leone," Ministry of Energy (MOE), Government of Sierra Leone (2014), available at http://www.energy.gov.sl/EnergyProfile_SL.pdf

				(2017-2018) already supplied solar PV electricity (6 kW systems) to 54 rural community health centers. • The second phase of the project (2018-2019) will also provide 40 micro-grids between 40 and 200 kW to additional health centers and markets. • The first 54 sites which are included as part of the first phase of the project are financed solely by grants.
Promoting Renewable Energy Services for Social Development project (PRESSD)	EU	Ongoing	Stand-alone systems, picosolar	• Provides an innovative, decentralized approach to supporting households and businesses with power in rural Sierra Leone. • Present in six districts of Sierra Leone including Bombali, Kambia and Portloko, in the North, and in Kenema, Kono and Kailahun in the East. • Distributing: - 100 charging stations of approx. 570 W each. - 22 Energy hubs of average 3 kW each (in agricultural business processing centers) - 3 mini-grids (Gbinti - 79 kW; Panguma - 64 kW; Segbwema - 127 kW) - 12 schools (average 4.3kW), 3 hospitals (20.6 kW), 7 large clinics (3.8 kW), 2 small clinics (1.5 kW) - 3 solar PV laboratories (3.6 kW) in technical institutes including Government Technical Institute

				(GTI) Kissy, Government Technical Institute (GTI) Magburaka and Eastern Polytechnic (EP) of Kenema - 10,558 pico-PV products (D-Light home lighting systems) for sale through a retailing network".
Power for All - Energy Access Campaign	DFID, Climate Works, A Environment, others	2015 - Present	Pico solar	• **Seeks to improve market conditions and increase** investment in off-grid solar in Sierra Leone • **Sierra Leone was the first country to participate in the** Energy Africa Campaign, and has since received policy support and technical assistance from the UK government. • **As part of the Energy Africa Campaign compact** between the GoSL and the UK Government, Sierra Leone announced the removal of import taxes on solar equipment.
EU Africa Infrastructure Trust Fund	EU, AfDB, KfW		Grid maintenance	• **Includes a EUR 10 million direct grant for rural electrification** • **The grant will finance activities for development of five off-grid substations in Sierra Leone**

4.4.3.3. Other initiatives

Outside of the Government and donor initiatives mentioned above, there are several non-governmental organization (NGO) programs and other related initiatives active in Sierra Leone's off-grid sector:

- **Acumen Fund**: In early 2018, the nonprofit global venture fund, Acumen, invested in Easy Solar, a South African company based in Sierra Leone, to support the company in its efforts to provide off-grid solar services in the country. This investment was made under Acumen's Pioneer Energy Investment Initiative, an effort to bridge the funding gap in off-grid energy and accelerate access across the developing world.[46]

- **Akon Lighting Africa:** In 2018, Senegalese rapper, Akon, through his organization, Akon Lighting Africa, committed to provide 5.000 streetlamps and 2.500 solar-powered traffic lights for several cities in the country.[47]

- **Cordaid Investments:** The asset management branch of Cordaid Foundation rolled out its Stability Impact Fund Africa (SIFA) activities in Sierra Leone in 2015. It has provided important working capital investments into the solar companies of BBOXX SL and Easy Solarthat are among the largest in Sierra Leone.

- **Barefoot Women**: Barefoot Women Solar Engineer Association of Sierra Leone (BWSEASL) is supported by the Government and trains women in solar technology. This is a branch of the larger Barefoot College Initiative, which is based in India. Hundreds of female technicians have received scholarships for training through this program. The initiative has led to tangible results by installing more than 7.000 solar home systems in rural Sierra Leone.[48]

[46] "Acumen Makes First Investment in Sierra Leone," Acumen (2018), available at https://acumen.org/blog/press-releases/acumen-makes-first-investment-in-sierra-leone/
[47] "Sierra Leone: Senegalese rapper Akon aims to light streets with solar energy," Takouleu, J., Afrik21 (October 7, 2017), available at https://www.afrik21.africa/en/sierra-leone-senegalese-rapper-akon-aims-to-light-streets-with-solar-energy/
[48] "Introduction: Energy Sector in Sierra Leone," Ministry of Energy (MOE), Government of Sierra Leone (2014), available at http://www.energy.gov.sl/EnergyProfile_SL.pdf

5. RENEWABLE ENERGY AND CLIMATE CHANGE CHALLENGES

The electricity sector faces many challenges in the Mano River Union countries: (a) low electrification rate; (b) limited electricity supply; (c) dominance of thermal energy; and (d) weak financial and institutional capacities of national electricity companies.

Low investment in the electricity infrastructure sector has led to very low levels of service. According to the general secretariat of the MRU, "The cost of energy production per kilowatt hour remained very high in these countries which had some of the lowest energy access rates in the world, 2% in Liberia, 2% in Sierra-Leone and 10% in Guinea". The construction of the inter-country line has favoured the development of hydroelectric potential in the region, allowing the exchange of electricity between countries within the large West African market and thus contributing to regional integration and slight improvements of energy services.[49]

[49] "Spécificités et enjeux de l'union du fleuve Mano (UFM) dans les dynamiques d'intégration régionale en Afrique de l'Ouest (1959 à 2014)", Keita, F.B. (December 2018), available at https://www.researchgate.net/publication/332254769_Specificites_et_enjeux_de_l%27Union_du_Fleuve_Mano_UFM_dans_les_dynamiques_d%27integration_regionales_en_Afrique_de_l%27ouest_1959_a_2014

Climate change challenges and adaptation measures

Despite being rich in natural resources, West Africa remains one of the poorest regions in the world and, according to current climate forecasts, will be the most affected by climate change. Over the past forty years, the impacts of climate change have exposed the vulnerability of the region. This has led national and local actors from all sectors to make enormous efforts to adapt to the consequences of climate change and to anticipate its future impacts.

As the recent food crises have demonstrated, climate scenarios for West Africa indicate that the climate variability we are currently witnessing is likely to increase and intensify. Droughts, floods and storms could increase in frequency and intensity. Precipitation levels and patterns could change. In coastal areas, sea levels are rising with increasing temperatures, which could pose a threat to coastal regions and ecosystems.

The potential impacts on society and economies across the region are considerable, negatively affecting all sectors and population groups, changing economic outputs especially from agriculture. Increasingly frequent dry seasons will also have an impact on the regions energy security, as it directly impacts hydropower resources, one of the most important sources of energy for the MRU. This means, that with climate change proceeding, diversification of the energy mix will become increasingly important.

To address these challenges and reduce the social, economic and environmental impacts of future climate change, West African countries have identified medium and long-term adaptation measures in their National Communications to the United Nations Framework Convention on Climate Change (UNFCCC).

These important efforts at national and local levels must be accompanied and complemented by concerted responses at the sub-regional level. It is in this context that the international conference on reducing vulnerability to climate change of natural, economic and social systems in West Africa, held in Ouagadougou in January 2007, recommended the development of a sub-regional action program to reduce the vulnerability of West Africa and Chad to climate change. The design of this program was entrusted to the Economic Community of West African States (ECOWAS) and several other regional organisations. [50]

[50][50] "Strategic Program for Vulnerability Reduction and Adaptation to Climate Change in West Africa", ECOWAS, available at https://www.iucn.org/sites/dev/files/import/downloads/pasr_rv_ao.pdf

Maintenance and extension of the national grid

Côte d'Ivoire as well as Liberia have experienced an economic growth in recent years at a scale which has significantly increased the country's electricity demand. This puts a burden on the electricity supply which might be too much to be handled by current grid maintenance levels and would need further investments to reduce losses and expanding access, in order to achieve long-term electrification targets. Yet, both countries lack the funds to invest sufficiently in maintenance and upgrades and continue to depend on foreign assistance for this purpose.

Electricity tariffs

Electricity tariffs are a significant challenge for all member states of the MRU. Except for Liberia, every country (Sierra Leone, Guinea, Côte d'Ivoire) subsidizes their electricity tariffs for low-income consumers. This enables provision of electricity to the poorest of households below the average cost of supply. This subsidisation scheme is financed by utilities and the respective governments who pass on the costs to residential, commercial and industrial consumers. These consumers pay a much higher price for electricity consumed. In Côte d'Ivoire commercial users pay about 20% higher electricity rates to subsidize parts paid by utilities.[51] As a result the MRU member states pay some of the highest electricity rates in the West African region (e.g. $ 0.28/kWh in Sierra Leone).[52] In the absence of cost-reflecting tariffs, the respective publicly owned utilities are not financially viable and face high levels of technical and commercial losses and chronic under-registration of consumers or users. As

5151 "Comparative analysis of electricity tariffs in ECOWAS member countries", African Development Bank Group, Energy Policy, Regulation and Statistics Division (2019), available at https://africa-energy-portal.org/sites/default/files/2019-12/Electricity%20Tariffs%20Study%202019.pdf

52 "Comparative analysis of electricity tariffs in ECOWAS member countries", African Development Bank Group, Energy Policy, Regulation and Statistics Division (2019), available at https://africa-energy-portal.org/sites/default/files/2019-12/Electricity%20Tariffs%20Study%202019.pdf

a result, the countries remain largely dependent on foreign aid for the extension and maintenance of the grids.

In an attempt to solve this challenge, Côte d'Ivoire sought to restructure tariffs. This has led to protests and the government was forced to retrack a proposed tariff increases in 2016 following public unrest.[53]

In spite of this cross-subsidization scheme, electricity remains unaffordable for large parts of the population of Sierra Leone. Average households in the country spend about 25% of their income on electricity compared to an average of 17% across the ECOWAS region, while electricity expenditures for low-income consumers remain nearly twice the ECOWAS average (3.2% in Sierra Leone compared to an average of 1.74% in the ECOWAS region). These high costs serve as a significant deterrent to private business and investment and hinder economic growth.

Liberia is the only member of the MRU not subsidizing electricity consumption. Subsequently, electricity tariffs in Liberia are much higher than other countries in the region and are among the highest in the world, ranging between USD 0.38 / kWh and USD 0.45 / kWh.

Imbalanced energy mix

The four member states of the MRU all rely on an imbalanced energy mix, which always includes heavy reliance on large hydropower projects. These kind of RE sources, apart from their environmental impact, will be increasingly subjected to climate change and won't be able to supply the countries with enough energy during dry seasons.

- Ivory Coast: the country's energy sector is overly dependent on natural gas and hydropower, technologies that are sensitive to price volatility and weather conditions. Private investment continues to support gas projects, while investing very little in non-hydropower renewable energy. The off-grid sector is still only a comparatively minor actor in the country's long-term electrification plans.
- Liberia: The country's power supply mix relies on a combination of large hydropower and liquid fuels (diesel and heavy fuel oil) for thermal power plants. Thermal power subsidizes for missing power supply from hydro during dry seasons. There is comparatively little investment in small-scale and off-grid RE to electrify dispersed settlements beyond Monrovia, which could be more economically served by renewable-powered mini-grids or stand-alone systems rather than by extending the national grid.
- Guinea: The country's energy mix is largely dependent on thermal energy and large

[53] "Côte d'Ivoire: energy sector", Africa-EU Renewable Energy Cooperation Program (RECP) (2017), available at https://www.get-invest.eu/market-information/cote-divoire/

hydropower plants. There is comparatively little investment in non-hydropower renewables.

- Sierra Leone: The country's power supply mix is overly reliant upon liquid fuels (diesel and heavy fuel oil) and large hydropower. There is comparatively little investment in non-hydro renewable energy.

Rural electrification

In spite of significant steps to ensure full energy access for their populations and ambitious long-term plans, many of the MRU member states still face significant challenges. In Sierra Leone, only 6% of the rural population had access to electricity in 2016, and only 3% of the rural population of Guinea in 2015. The latter achieved an average access rate of 32% in 017/2018 after the construction of a dam in Kaléta in 2015. [54]

Some of the MRU member states have prioritized extension of the national grid over development of mini-grids and stand-alone systems, to advance rural electrification. This approach however, needs significant amount of public funding and reduces resources available for other sectors, while simultaneously underutilizing the countries' RE potential. With less than 5% of an estimated cost of $ 796 million for electrification until 2020 spent on renewable energy and off-grid projects, the case of Côte d'Ivoire shows the lack of recognition for renewables to drive electrification.

In addition, the institutional market segment (i.e. schools and health clinics) in Côte d'Ivoire faces budgetary and public finance restrictions that hamper investment in stand-alone solar power for these facilities[55], as well as regulatory uncertainty. However, market liberalization is expected to extend to electricity distribution after the expiration of the CIE concession agreement in 2020, which would allow private operators to enter the market. Until then, uncertain regulatory environment can hamper private investment in the off-grid sector.[56]

[5454] "Guinea at a Glance," SEforALL-Africa (2018), available at https://www.se4all-africa.org/seforall-in-africa/country-data/guinea/

[55] "Country Profile of Côte d'Ivoire", ClimateScope (2020-2021), available at https://global-climatescope.org/results/CI

[56] "Unlocking Private Investment: A Roadmap to Achieve Côte d'Ivoire's 42% Renewable Energy Goal by 2030", International Finance Corporation (2018): https://www.ifc.org/wps/wcm/connect/25885390-8a37-464f-bfc3-9e34aadc01b4/IFC-Côte_dIvoire-report-v11-FINAL.PDF? MOD-AJPERES

Local financial institutions

Local financial institutions (FIs) and microfinance institutions (MFIs) lack sufficient internal capacity and incentives to invest in the renewable energy/off-grid sectors. This is a challenge, because it shapes the institutional perception of risks for RE projects in these emerging markets. This lack of local investments and increased risk perception leads to a lack of knowledge for available technologies, market characteristics and data. Credit performance of financed projects are often limited. There are also likely misperceptions about the potential size of these markets as well as doubts about the profitability of offering financial products in rural off-grid areas, where the creditworthiness of potential clients may be an issue.[57]However, again these doubts are often a result of limited evaluation capacities in FIs.

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

6. RECOMMENDATIONS

Successful development of the renewable energy off-grid sector will require more than just a financial support mechanism - the Government and its supporting agencies will also need to develop expertise and implement a range of measures to expedite growth of the market, including a robust technical assistance (TA). Table 6 presents some indicators facing off-grid market development in countries and proposed mitigation measures and recommendations.

Table 9: Recommendations

National policy frameworks and regulations	Transform fossil fuel subsidies into future oriented RE markets and re-invest savings into grid maintenance and off as well as near-grid technologies.
	Development of clear, least-costly and integrated rural electrification plans (on-grid, near-grid, off-grid) which includes all technology options and is consistent with national energy and development goals and plans.
	Enabling policy framework to encourage private participation and investments in mini-grid and autonomous solar system options. Including guidelines to strengthen collaboration between governments, the private sector, businesses, industry associations and other relevant

	stakeholders to coordinate the development of effective policies that are flexible and responsive to the needs of the market and communities.
	Establish one-stop shops to support with (i) awareness raising, education and training for consumers, including organization of appropriate community management structures; (ii) solar PV system supply chain and operations and maintenance (O&M) services, including training of local technicians to ensure that the cost of maintenance is affordable and sustainable; and (iii) standards for equipment and service providers (ie installers, technicians) to guide customers to companies providing the best value for their money, (iv) sets up and manages an open-source database for RE and off-grid related information, best practices and exchange service information, (v)supports with permits, approval processes and innovative business models, (vi) supports communities with technical regulatory and financial capacities
	Stronger integration of energy planning and development approaches to facilitate pilot projects or programs
Capacity building	
	Establish funds to tap into capacity building to install and maintain off-grid technologies.
	Design training programs for marginalised and rural communities to install and maintain technologies. Supervise the implementation of tax exemptions coordinating with all relevant stakeholders and regulatory bodies.
Renewable energy finance	
	Develop innovative finance mechanisms and incentives to promote off-grid technologies which are able to cover the whole supply chain (including batteries, inverters)
	Establish financial support programs in the form of grants, subsidies or similar measures that are unlocking private finances in a non-bureaucratic, flexible and predictable way, in order to reduce risks associated with high upfront costs of RE
	Create PPP programs to share the high costs of project development and market entry, in particular with developers in remote areas
	Analyze where subsidies and exemptions for non-renewable energy sources give an unfair advantage to fossil fuels and hamper the development of clean energy solutions

	Scale up public finances to co-finance solar system installation in public facilities (schools, health centers etc.)
	Develop a data bank for contract and funding options to help grant geographic concessions to private operators.
	Help governments develop procedures and guidelines to enable a level playing-field for community-based approaches for rural electrification.
Quality standards and safeguards **Awareness raising and inclusion**	
	Establish national and international quality standards for technical equipment for stand-alone and off-grid solar equipment.
	Integrate standards into appropriate oversight bodies to ensure that quality verification procedures are in place and adhered to
	Establish frameworks that offer protections to consumers and suppliers, including regulations, among others, which (i) require a license for sale and installation of solar equipment; (ii) prohibit the sale of poor quality products; (iii) establish warranties and (iv) allow businesses or public authorities to prosecute those caught in distributing counterfeit and products with inferior standards
	Support certification programs as well as technical and vocational training through governments, private sector and / or academia for the installation and maintenance of solar systems
	Encourage civil society and private sector participation in formulating ambitious standards not just for equipment but also social and environmental safeguards
	Assist in the development of strategies that encourage inclusive gender participation in the energy sector
	Develop clear procedures for licensing and permitting
	Assist in the development of strategies that encourage inclusive gender participation in the energy sector
	Support governments, professional associations and civil society organizations to develop and implement awareness-raising, marketing and consumer education on advantages of off-grid solar products and on existence of related national programs
	Support the development and implementation of programs aimed at educating consumers, retailers and distributors to product benefits quality certified sunglasses
Pricing structures	
	Support the capacity building of regulations, governments and non-stakeholders

	governments about the different systems of pricing offered by stand-alone providers of solar systems to improve understanding and avoid unnecessary interventions to regulate.
	Support regulators and off-grid companies to collaborate specifically in the development of pricing for the productive use market segment vs. Support off-grid entrepreneurs and telecommunications in strengthening and promoting links between telecommunications companies/mobile money providers and solar companies out network to help deploy platforms technology and PAYG business models.
RE deployment	
	Map the RE resources in each country and quantify resources available for grid, near grid and off-grid options.
	Biomass: a. Help governments to take stock of sustainable biomass energy potential as well as the consumption of populations, b. Promote the use of improved and electric stoves in countries to protect the environment
	Wind energy: a. Help governments to have information systems on wind data in order to identify areas of possible wind power system installations; b. Promote wind energy
	Solar: The successful development of the solar sector will require more than a simple financial support mechanism. The government and supporting organizations will also need to develop and implement a series of measures to accelerate the growth of the market, including a strong technical support platform. This platform should focus in particular on (i) consumer awareness, education and training, including the organization of appropriate community management structures; (ii) supply chain and operation and maintenance services for solar PV systems, including training of local technicians to ensure that the cost of maintenance is affordable and sustainable; and (iii) standards applicable to suppliers of equipment and services (ie installers and technicians) to direct customers to the most cost-effective companies. These measures should be part of a national strategy for the rural electrification sector aimed at informing the decision-making of the

	main stakeholders regarding the development of the country's autonomous solar PV energy market.

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