CEREEAC Baseline Report & Needs Assessment

BASELINE REPORT & NEEDS ASSESSMENT – FINAL

with technical and financial assistance of the United Nations Industrial Development Organization (UNIDO) under the umbrella of the Global Network of Regional Sustainable Energy Centres (GN-SEC) Programme

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1. Introduction

The following document presents the full needs assessment and baseline studies for the formation of the CEREEAC. This includes a full description of the ECCAS Energy Context, including the potential for RE and EE as well as discussion of the barriers remaining in place across the region.

This document also details the results of the consultative needs assessment carried out by ITPEnergised and ECREEE with key stakeholders in the region, including representatives from ECCAS member states, as well as other interested parties outside of the region, for example international donors and implementing partners. This needs assessment, carried out through questionnaires and interviews is critical to understanding the demand for and the potential of the CEREEAC.

Finally, the needs assessment focusses on the justification for the centre and the added value it can bring the region as it looks to develop the RE and EE sectors.

2. ECCAS Energy Context

The following chapter gives an overview on the results of the consultative baseline and needs assessment undertaken in each of the eleven ECCAS member states. It identifies current energy challenges and their negative impacts on society, economy and environment. Moreover, it assesses the status and trends of renewable energy[1] and energy efficiency (RE&EE) markets in ECCAS and outlines unexploited potentials and opportunities to accelerate the energy and climate transition. Based on the ongoing national efforts in ECCAS countries, the added value of enforced regional cooperation through a dedicated Centre for Renewable Energy and Energy Efficiency for Central Africa (CEREEAC) is being analysed. This includes a description of thematic areas to which the centre could contribute by addressing existing barrier through regional tools and methodologies.

2.1 ECCAS Development Context

2.1.1 Regional background

The ECCAS is an Economic Community of the African Union for promotion of regional economic co-operation in Central Africa. It *"aims to achieve collective autonomy, raise the standard of living of its populations and maintain economic stability through harmonious cooperation"*. With an area of nearly 6.7 million square kilometres and a population of approximately 190 million, the ECCAS is comprised of 11 member states (MSs): Angola, Burundi, Cameroon, Central African Republic, Chad, the Democratic Republic of Congo, the Republic of Congo, Equatorial Guinea, Gabon, Rwanda and São Tomé and Príncipe.

The following table presents an overview of the ECCAS energy landscape.

Table 1: ECCAS Energy Landscape[2]

Country	Population (million people)	GDP billion/yr (current international $)	GDP per capita (current international $)	Access to electricity (% population)	Electricity consumption (kWh per capita)	Access to clean fuels and technologies for cooking (% population)	HDI (value ; ranking)
Angola	30.81	101.35	3 289.65	43.26	312.23	48.05	HDI: 0.574 Rank: 149
Burundi	11.18	3.04	271.75	11.02	NA	85	HDI: 0.423 Rank: 185
Cameroon	25.22	38.69	1 534.49	62.66	275.20	23.04	HDI: 0.563 Rank: 150
Central African Republic	4.67	2.22	475.95	32.42	NA	0.97	HDI: 0.381 Rank: 188
Chad	15.48	11.24	727.56	11.76	NA	3.13	HDI: 0.401 Rank: 187
Republic of Congo	5.24	11.66	2 223.85	68.52	202.87	24.13	HDI: 0.609 Rank: 138
Democratic Republic of Congo	84.07	46.83	557.06	18.98	108.52	4.02	HDI: 0.459 Rank: 179
Equatorial Guinea	1.31	13.28	10 144.20	67.03	NA	34.39	HDI: 0.588 Rank: 144
Gabon	2.12	16.86	7 956.63	93.04	1167.85	79.12	HDI: 0.702 Rank: 115
Rwanda	12.30	9.63	782.62	34.72	NA	0.57	HDI: 0.536 Rank: 157
Sao Tomé & Principe	0.21	0.42	2 001.14	71.00	NA	16.81	HDI: 0.609 Rank: 137

Note: Statistics for population, GDP, GDP per capita, access to electricity and HDI are from 2018, while the electricity consumption per capita are from 2014 and the access to clean fuels and technologies for cooking is from 2016. NA: Not Available

As it can be seen from Table 1, ECCAS countries vary a lot in terms of population, GDP (current value and GDP per capita), access to electricity, electricity consumption, access to clean fuels and technologies for cooking and Human Development Index.

In terms of population, there are countries that only have 0.21 million people (São Tomé e Príncipe) and others with 84.07 million people (Democratic Republic of Congo).

The GDP across ECCAS also varies greatly. Angola registered the highest GDP of the region (above $100 billion/yr) and São Tomé e Príncipe the lowest (around $0.4 billion/yr). The majority of the ECCAS countries, have a GDP below $15 billion/yr). The same happens in terms of GDP per capita, has there is only two countries with GDP per capita above 5 thousand US$/year, 5 with GDP per capita between 1-5 thousand

[2] Statistics for population, GDP, access to energy and electricity consumption per capita are from the WB (https://data.worldbank.org/) and for HDI from http://hdr.undp.org/en/data

US$/year and 5 countries below 1 thousand US$/year. When compared with the Sub-Saharan Africa (SSA) GDP per capita for that respective year, 7 out of the 11 ECCAS MS have higher GDP per capita of that year[3].

Not even half of the ECCAS population has access to electricity (the average access in the region is around 47%), with countries like Gabon and São Tomé e Principe with electricity access rates above 70% and countries like Burundi, Chad and Democratic Republic of Congo with electricity rates below 30%. The access to clean fuels and technologies for cooking is even lower: only around 29% of the ECCAS population has access to these, with only four countries with access to clean fuels and technologies for cooking rates above 30% (Angola, Burundi, Equatorial Guinea and Gabon) and countries with access rates below 1% (Central Africa Republic and Rwanda).

In terms of Human Development Index (HDI) that varies greatly within the region: the majority of the ECCAS countries position themselves within the medium HDI group (with HDI values between 0.550-0.699), with one country with a high HDI value (Gabon) and with four of them (Burundi, Central African Republic, Chad and Democratic Republic of Congo) within the low HDI group (HDI values below 0.550) and below the average of 0.541 for the SSA countries.

At the industrial level, ECCAS energy use is critical to ensure some key industries including oil and gas and mining remain productive. Clearly, there is also a need for these industries to make changes to move towards a low carbon and net zero future and therefore the integration of RE and EE into these sectors, which drive economic growth in many parts of the region, is essential.

Just as importantly, with so much of the population of the region being involved in subsistence farming and fishing, the need for a secure, reliable and efficient energy sources is critical to be able to help drive people out of poverty and to kick start more high value and productive sectors in manufacturing and service provision.

In relation to this, on 25 July 2016, the United Nations General Assembly adopted a resolution proclaiming 2016-2025 as the Third Industrial Development Decade for Africa (IDDA III)[4]. UNIDO was tasked with leading the implementation of the Decade, in collaboration with a range of partners. The vision for the implementation of IDDA III is to firmly anchor Africa on a path towards inclusive and sustainable industrial development. Without sustainable energy use to support a more diverse, modern and complex economy, achieving the aims of IDDA III will not be possible.

2.1.2 ECCAS Energy Challenges

Notwithstanding that most of its population lacks modern energy services (average electricity access rate of 46.76% and average access to clean cooking fuels of 29.02%)[5], Central Africa has among the most abundant energy resources on the African continent, with 40% of hydroelectrical potential[6] and other primary energy resources that include oil, natural gas, uranium, biomass and geothermal, as well excellent potential for solar and wind energy. Petroleum and traditional biomass products, however, still represent the main sources of energy currently used.

Despite the large potential, Central Africa remains one of the least developed regions on the continent in terms of renewable energy output energy output and in terms of final renewable energy use in the industry sector[7]. This is partly due to relatively low economic output overall and partly a lack of ongoing RE development and a number of barriers to the development of the sector that can be grouped in three main categories: legal and regulatory; financing/investment; and knowledge and information.

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[3] SSA GDP per capita of 2018: 1 589.42 current international $, WB statistics (https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=ZG)

[4] UN Third Industrial Development Decade - https://www.unido.org/who-we-are/idda3-third-industrial-development-decade-africa-2016-2025#:~:text=On%2025%20July%202016%2C%20the,with%20a%20range%20of%20partners.

[5] Own estimate based on the information depicted in Table 1.

[6] Africa 2030: Roadmap for a Renewable Energy Future, IRENA (2015) https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA_Africa_2030_REmap_2015_low-res.pdf

[7] Africa 2030: Roadmap for a Renewable Energy Future, IRENA (2015) https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA_Africa_2030_REmap_2015_low-res.pdf

Central Africa's energy sector must address the interrelated challenges of energy access, energy security and climate change mitigation and adaptation, which are intertwined with the region's economic and social challenges. This trio of challenges complicates the execution of strategies aimed at fostering socio-economic development, attracting foreign investment, and providing basic social services. This is a circular dilemma whereby the lack of access to modern, affordable and reliable energy services leads to a lack of investment in new industries and business, in turn leading to a lack of jobs and economic prosperity resulting in poor conditions for further investment in infrastructure to improve access and reliability. It also leads to a loss of productivity and competitiveness of urban and rural key industries.

Although investment is higher and access rates are increasing in some parts of the region, for example in more oil-rich economies such as Gabon, the sustainability of this growth (where based on fossil fuels) and the potential for short and medium-term prosperity to be valued over long term sustainable growth should be considered.

Access to reliable and affordable modern energy remains a central challenge to the socio-economic development efforts in the ECCAS region as a whole. In a "business as usual" scenario – without considerable additional investments – energy poverty and its consequences will continue to be a predominant challenge in the region in 2030.

2.1.3 Energy access, affordability and reliability

Access to reliable, cost-effective and environmentally sustainable energy through RE technologies can have a multiplier effect on the development and provision of health benefits, improved livelihoods, poverty alleviation, job creation, gender equality and enhanced access to water and food. These crosscutting impacts of RE are at the heart of efforts to achieve the United Nations Sustainable Development Goals (SDGs).

As it can be seen in Figure 1 and Table 2, the ECCAS region is highly reliable on hydropower (64.75% of the total installed capacity) and thermal generation for electricity (34.83% of the total installed capacity). Other renewable sources (such as solar, wind, solid biofuels and biogas), represent a very small share of the total installed capacity (1.41%). There are countries highly dependent on one type of resource for electricity generation in the country. This is the case of the Democratic Republic of Congo that is highly dependent on hydropower, and Chad and São Tomé & Príncipe that are highly dependent on fossil fuels. Such a situation presents high risks for these countries, as a reduction on the availability of the main resource used for electricity generation could have a big impact on the generated electricity and on what would remain available for the population of these countries.

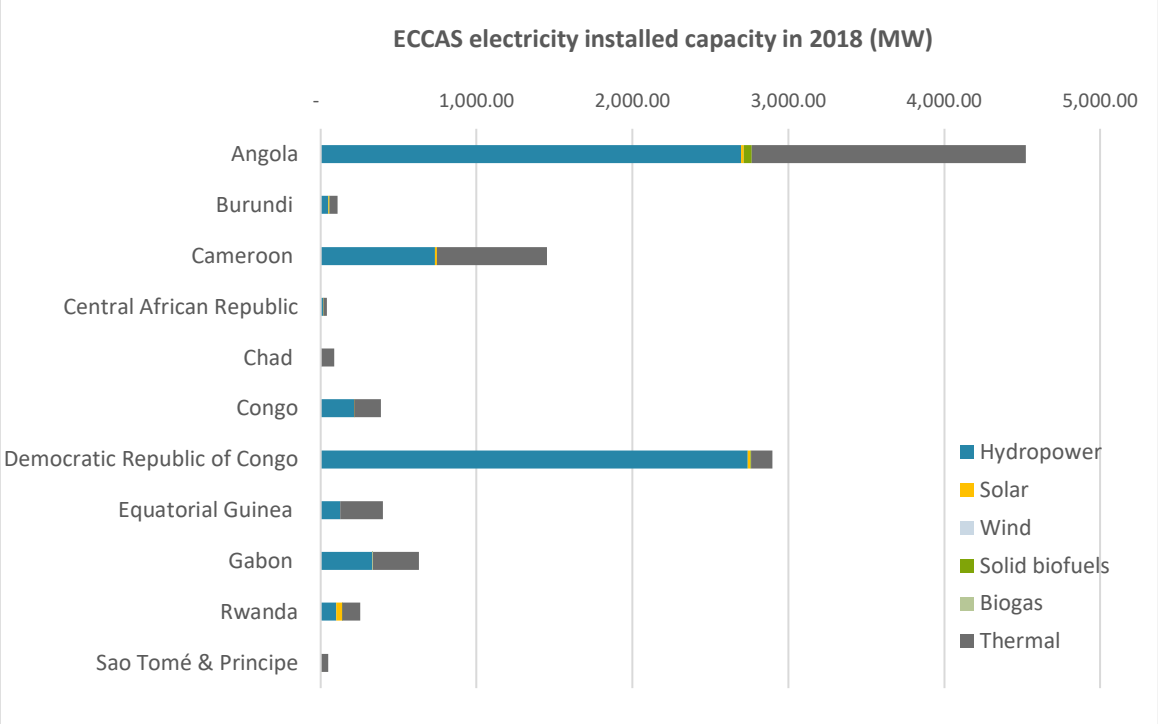


Figure 1: ECCAS electricity installed capacity in 2018[8]

Access rates across the ECCAS are well below what would be required to reach the SDGs, and below the average of Sub-Saharan Africa as a whole. Table 2 provides the status of access to electricity, access to clean cooking fuels and technologies, as well as demand and supply in the ECCAS Region, based on a review of ECCAS countries (full Country Profiles are found in Annex).

Table 2: Electricity Generation and Access Statistics for ECCAS

Country	2018 RE Generation Capacity (MW)[9]	2018 Thermal Generation Capacity (MW)	Access to Electricity (percentage) – 2018			Access to clean fuels and technologies for cooking (% of population) - 2016
			Urban	Rural	Total	
Angola	2 763.24	1 761.00	73.70	NA	43.26	48.05
Burundi	57.38	51.00	61.67	3.44	11.02	85.00
Cameroon	746.49	705.00	93.30	23.00	62.66	23.04
Central African Republic	19.15	22.00	55.25	16.32	32.42	0.97
Chad	1.27	86.00	41.84	2.75	11.76	3.13
Republic of Congo	214.47	170.00	92.41	20.19	68.52	24.13
Democratic Republic of Congo	2 761.66	135.00	50.70	NA	18.98	4.02

[8] IRENA statistics: 2018 IRENA statistics: https://www.irena.org/Statistics/View-Data-by-Topic/Capacity-and-Generation/Technologies
[9] 2018 IRENA statistics: https://www.irena.org/Statistics/View-Data-by-Topic/Capacity-and-Generation/Technologies

Country	2018 RE Generation Capacity (MW)[9]	2018 Thermal Generation Capacity (MW)	Access to Electricity (percentage) – 2018			Access to clean fuels and technologies for cooking (% of population) - 2016
			Urban	Rural	Total	
Equatorial Guinea	127.14	274.00	90.36	6.60	67.03	34.39
Gabon	332.89	296.00	96.67	62.51	93.04	79.12
Rwanda	137.10	118.00	89.06	23.42	34.72	0.57
São Tomé & Principe	2.64	45.00	76.70	55.74	71.00	16.81
Total	***7 163.43***	***3 663.00***	-	-	-	-
Average	-	-	***74.70***	***19.45***	***46.76***	***29.02***

Table 2 indicates that all countries, except Gabon (62.51%) and São Tomé & Principe (55.74%), have less than 50% of electricity access within rural populations. Urban areas are better served but still suffer from rates as low as 41.84% in Chad, rising to up to 96.67% in Gabon. In general, within urban areas, the poorest communities and peri-urban areas are more likely to suffer from poor rates of energy access. Overall access rates are extremely low with access rates under 70% for all countries in the region other than Sao Tome and Principe and Gabon,.. These electrification rates show that the level of energy consumption in the region has a potential to grow significantly in most countries, even without considering the knock-on impact of increased economic growth, as access improves. Looking into the evolution of electricity access rates in the region, as depicted in Figure 2, it can be seen that all ECCAS MSs register a growing trend, especially after 2012, where all of them have different paces. What is also important to note, is that 6 out of the 11 ECCAS MSs in 2018, had electricity access rates below the SSA average access rate (47%).

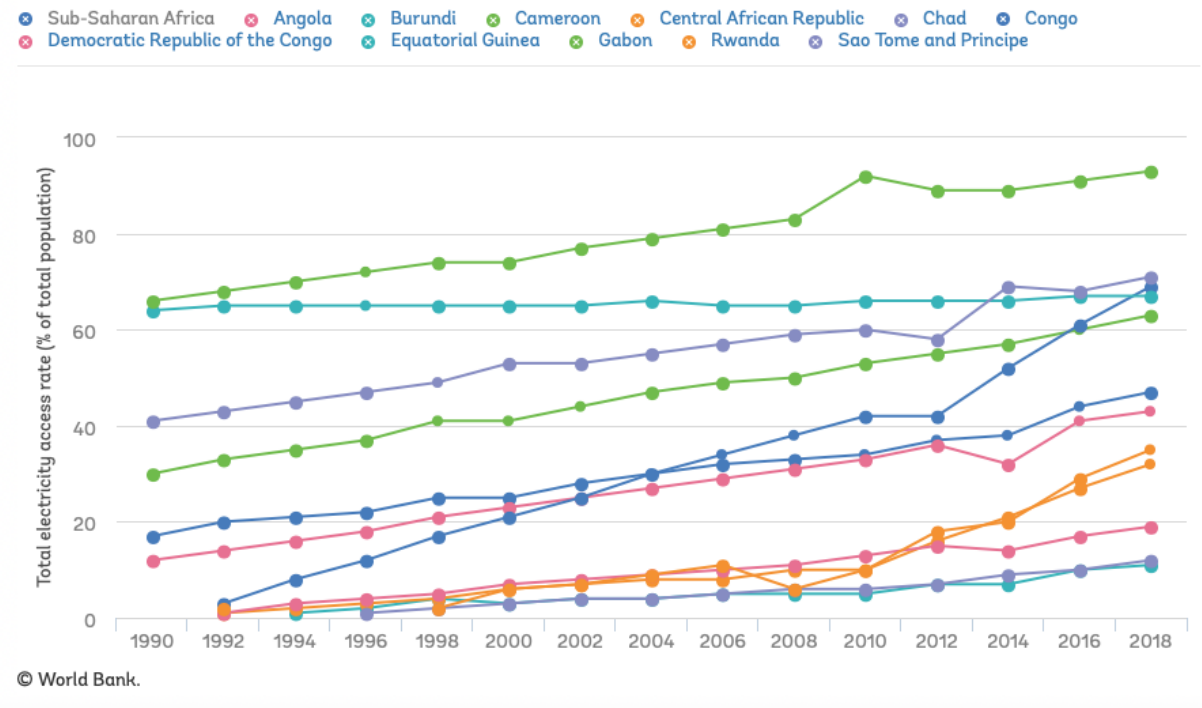


Figure 2: Electricity access rate (% total population) variation between 1990 and 2018[10]

The majority of the countries in the region suffer from unreliable supply from the grid, or a total lack of access to the grid. Generally, the ECCAS national grids have a high reliance on hydropower for their electricity supply. This supply is at an ever-increasing risk, as rainfall across the ECCAS region becomes more unpredictable, with droughts and flooding being more frequent. The overreliance on hydro, a lack of diversified RE sources, and a lack of interconnection and trading between states leads to a reduced reliability and efficiency on the system as a whole.

Off-grid electricity generation comes mainly in the form of diesel generators, RE (hybrid) mini grids, batteries and the emerging off-grid RE consumer products such, as solar home systems. Despite the growth and potential of these sectors and the work undertaken to help improve the business case for mini-grids across Africa, the primary source of energy in off-grid areas still comes from biomass, particularly for cooking and heating with wood or charcoal. It is important to note that the levels of efficiency in these forms of cooking are very poor.

In terms of access to clean cooking fuels and technologies, the region average is 29.02%, which is more than double the average of 14% in the SSA. Nonetheless, there is still a lot of work to be done in terms of adopting clean fuels and technologies for cooking, if the 2030 universal energy access targets are to be reached. This will include making biomass cooking practices and products more sustainable (e.g. efficient stoves and proper education and training to use those stoves) as well as the longer term challenge to try to introduce more sustainable solutions in the form of off-grid electricity supplies to develop clean electrical cooking, as well as other options such as sustainable biogas.

Sustained efforts are being made in the region. From a technology perspective, Rwanda is promoting the development of solar and modern biomass (peat) to meet its goal of universal access to electricity while countries like Angola, Chad and the Republic of Congo plan to intensify their rural and urban electrification by allocating a portion of their significant revenues from oil and gas to this endeavour. Despite these efforts, there is not yet a proven path towards 100% energy access, and there is a great need for sharing of ideas and resources, as all ECCAS countries jointly work towards together this shared aim.

[10] Figure built in the ESMAP website, tracking SDG7, https://trackingsdg7.esmap.org/time (August 2020)

The ECCAS region has variable electricity tariffs: there are countries with very high electricity prices such as São Tomé & Príncipe and Burundi (which have residential tariffs more than 2 times higher than the world average[11]) and countries with very low ones such as Angola (which are 7 times lower than the world average). The average electricity tariff in the region is around US$0.16/kWh and US$0.11/kWh[12] for households and business which is along the average electricity prices for the world, and above the average SSA one (which is US$0.13/kWh[13]).

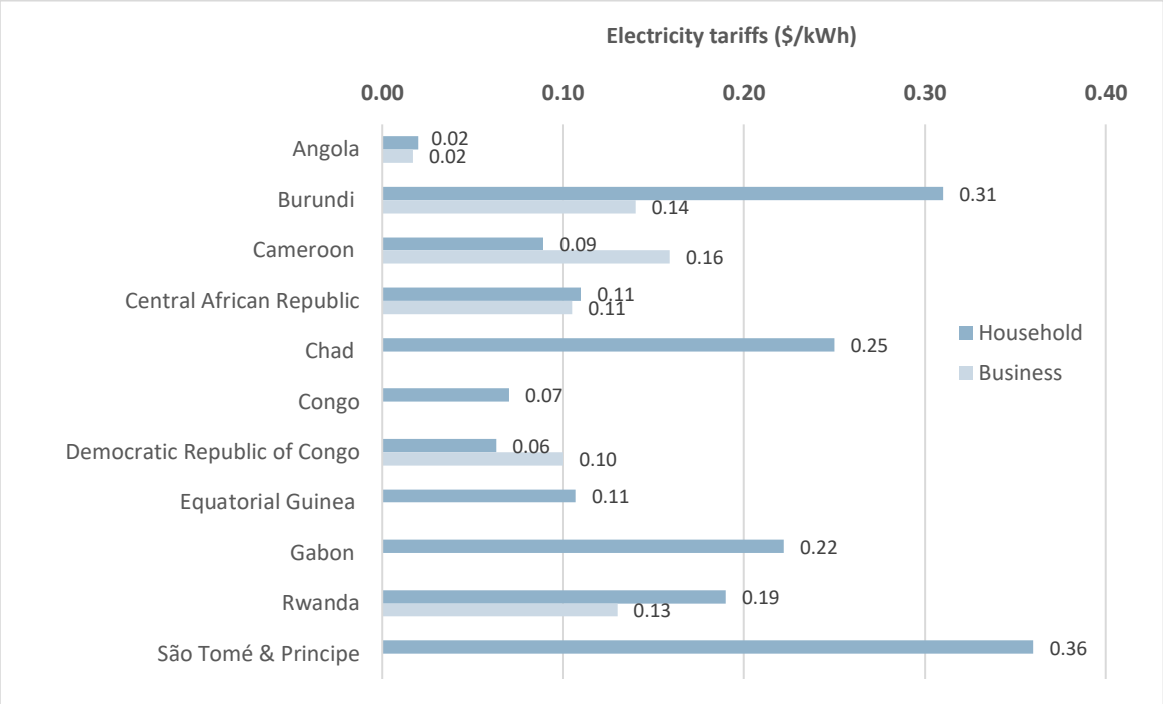


Figure 3: ECCAS Electricity tariffs[14]

2.1.4 Environmental externalities (incl. climate change)

The increasing pace and impact of climate change is something that the ECCAS region needs to be aware of and take note of in planning a future strategy with regards to RE and EE.

In terms of the contribution to global emissions, Central Africa is only responsible for a tiny fraction of what the world produces. In fact, in 2012[15] the ECCAS GHG emissions amounted to 1.66 million kt CO2 equivalent (see Table 3), which represent around 36.07%[16] of the SSA emissions for that year and 3.10%[17] of the World CO2 emissions. In terms of the GHG emissions per capita per year, the average ECCAS emission per capita (0.95 tCO2 per capita/year[18]) is above the SSA one (0.83 tCO2 per capita/year[19]). Most of the ECCAS countries (except for Angola, Equatorial Guinea and Gabon) have lower GHG emissions per capita per year than the ones registered for SSA. When analysing the evolution of the GHG emission per capita between 2000-2016

[11] Average electricity price in the world in 2019 was of 0.14 $/kWh and 0.13$/kWh for household and business, extracted from https://www.globalpetrolprices.com
[12] Own estimates based on the date used in the compilation of Figure 3
[13] Value extracted from https://www.irena.org/documentdownloads/publications/prospects_for_the_african_powersector.pdf
[14] Electricity tariffs were obtained from several different sources: https://www.globalpetrolprices.com; https://www.lexology.com/library/detail.aspx?g=8a686f01-c89c-4db6-b973-164b5abda114; https://www.doingbusiness.org; https://united4efficiency.org; http://documents1.worldbank.org/curated/en/734331492434048924/pdf/DRC-PAD-04172017.pdf; https://www.reg.rw/customer-service/tariffs/;
[15] 2012 is the most recent year with GHG emission information per country for the ECCAS region at the time of writing of this assessment
[16] Own calculations from the values in the WB data bank, https://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE
[17] ibid
[18] Own estimation of average ECCAS GHG emission per capita for 2016
[19] Value for SSA for 2016 extracted from the EB data bank, https://data.worldbank.org/indicator/EN.ATM.CO2E.PC

(Figure 4), it can be seen that in most of the ECCAS countries the level has increased, except for Central Africa Republic and Gabon.

Table 3: GHG emission reductions in ECCAS[20]

Country	GHG Emissions (kt CO2 equivalent)	GHG Emissions per capita (t CO2 per capita)	
	Year: 2012	Year: 2012	Year: 2016
Angola	41 657.00	1.36	1.20
Burundi	6 254.00	0.04	0.05
Cameroon	100 922.00	0.28	0.35
Central African Republic	515 134.00	0.07	0.07
Chad	109 796.00	0.07	0.07
Republic of Congo	35 744.00	0.66	0.66
Democratic Republic of Congo	802 271.00	0.03	0.03
Equatorial Guinea	6 374.00	6.77	4.65
Gabon	34 571.00	2.89	2.65
Rwanda	6 690.00	0.07	0.10
São Tomé & Principe	195.00	0.60	0.60
Totals	***1 659 608.00***	-	-
Average	-	***1.17***	***0.95***

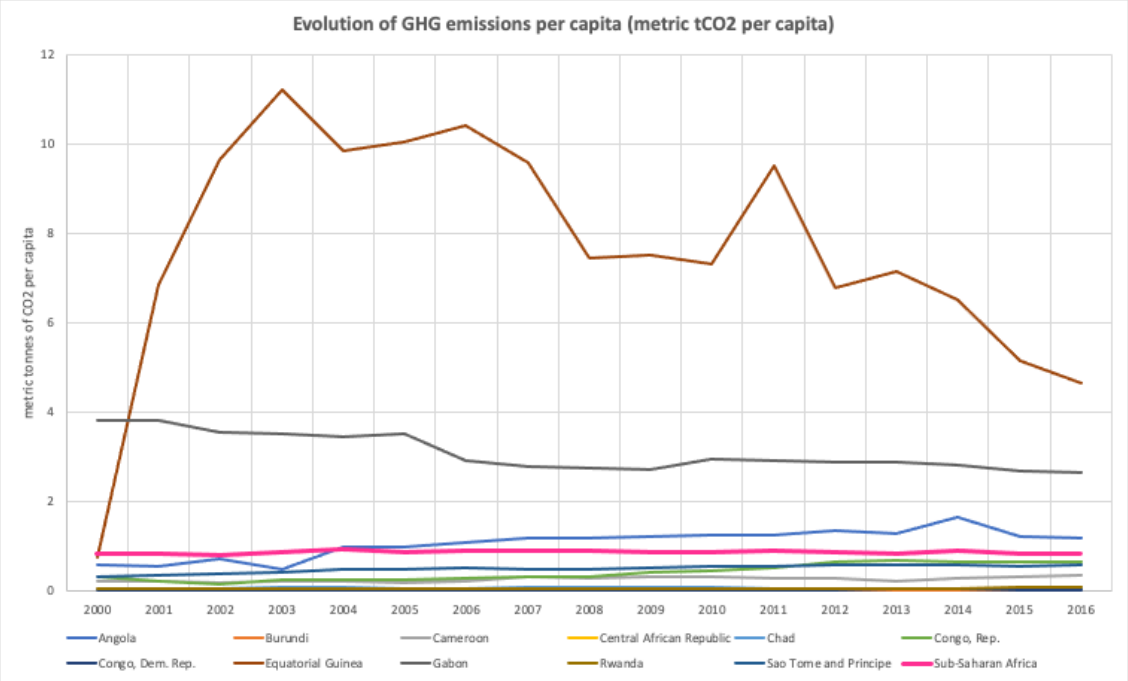


Figure 4: Evolution of the GHG emission per capita in the ECCAS countries and in SSA between 2000-2016

[20] Information extracted from the WB data Bank information on GHG emission and GHG emissions per capita, https://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE & https://data.worldbank.org/indicator/EN.ATM.CO2E.PC

If long-term economic growth is the target it will be critical to choose a sustainable path to safeguard the long-term stability of emissions in the region and ensure that ECCAS MSs can achieve their climate change commitments.

At a national level the impacts of climate change in terms of draughts and floods are already having an impact and the consideration around diversifying clean energy sources, so as not to rely only on hydropower is something, which has to be considered among the ECCAS nations.

A USAID study into 'Climate Risks in the Central Africa Regional Programme for the Environment and Congo Basin' highlight that there is vast potential for hydropower from the Congo River and other sources. However, the changing characteristics of annual and seasonal precipitation in the region will alter the Congo Basin's dynamics. This in turn could affect stability of hydropower production, as well as water availability for both household and commercial consumption. The reliability of existing and potential irrigation schemes (although currently limited) may be affected given climate impacts on the hydrological system, especially in savannas at the periphery of the Congo Basin. In addition to impacting water supply, an increased frequency of intense rainfall events can exacerbate poor water quality, especially in urban areas, and increase the risk of flooding in rivers, streams and drainage ditches. Furthermore, floods on navigable rivers can be dangerous and disrupt transportation of people and goods[21]. This serves to demonstrate the intertwined nature of the water-energy-food-health nexus and the challenges that a changing climate could bring to the region.

In general, siting and designing of new energy infrastructure will also have to be mindful of changes in climate and weather extremes and developed responsibly while refurbishment of older energy infrastructure to adapt to a changing climate may also be required. A holistic approach to sustainable development requires planning to adapt as well as mitigate against the changing climate.

At a more local level, environmental issues surrounding energy are also a matter of concern across the ECCAS. In cities, localised air pollution from generators, industry and transportation creates health issues and premature deaths. In peri-urban and rural areas where households use biomass or charcoal to cook, light and heat homes, air pollution is also a major concern.

2.1.5 Urban, utility scale and energy security

Utility scale projects across ECCAS face a range of energy security and system challenges, as listed in the IRENA's draft Renewable Energy Roadmap for Central Africa[22]:

- Low performance of thermal power plants and frequent recourse to expensive fuel.
- Significantly few combined cycles.
- Insufficient availability of inputs, water or heat, as well as low load factor compared to installed capacity.
- Insufficient power transport networks and obsolescence of distribution networks. The technical and commercial losses exceed around 25%, sometimes reaching 60% (e.g. Republic of Congo).
- Frequent power cuts and a high rate of undistributed energy.
- Significant non-technical losses due to, for example, lack of electricity metres, unpaid bills by public administrations, among other causes, creating heavy financial losses for electricity companies.
- Lack of master plans of the generation, transmission and distribution or specific plans for the continuation of network expansion or rural electrification.
- Lack of energy information and reliable tariff systems.
- Most of the electricity sector regulatory authorities are neither functional nor independent, since they rely on the royalties of electricity companies.

[21] Climate Risks in the Central Africa Regional Programme for the Environment and Congo Basin (2018) - https://www.climatelinks.org/sites/default/files/asset/document/20180604_USAID-ATLAS_ClimateRiskProfile_CARPE.pdf
[22] Draft ECCAS Renewable Energy Roadmap for Central Africa, IRENA (2020).

- Institutions in rural electrification lack the resources and expertise to design, finance, implement and monitor rural electrification master plans.

The region urgently needs to address these limitations to unlock investment in the utility scale sector and to realise the economic and social benefits of a well-functioning energy system. In order to achieve environmental benefits, this system must have a focus on maximising RE and EE when addressing these issues, while ensuring that energy security and reliability make markets attractive for business, industry and investment in general.

Overall, for utility scale renewable projects, investment levels across Africa are rising, but the ECCAS region still has steps to take to maximise that investment and to develop a hub for private sector firms. The region has potential to take advantage of increasingly available development finance for RE schemes, and to a lesser extent, development finance for energy efficiency.

Despite this potential, ECCAS is coming from a position of low regional investment and therefore a low level of private sector activity in the sector. To increase support for private finance and development support, capacity building is required across the sector including technical project preparation, management, financing and ongoing operations. Kick-starting the industry from the current position is challenging, as it will require incentives for first movers to commit to developing unproven markets, which have higher risks than others. Overcoming these challenges is essential, if the region is going to benefit from investment, economic growth and job creation in a sustained and significant way.

In terms of impact on the urban environment, some countries in the region have access rates over 50% in more urban areas, partly due to their closer proximity to power supplies and national grids. This includes countries such as Cameroon, Gabon, Equatorial Guinea and São Tomé and Principe (see Table 2). Although it is higher than in other ECCAS countries, a figure of around 50% still means that half of citizens in these urban areas lack access. A lack of access comes with other downsides and negativities, such as being potentially exposed to high levels of local pollution from using biomass and charcoal to cover energy needs, or an over-reliance on polluting, expensive and unreliable diesel generators for industry, business and domestic use in urban areas.

2.1.6 Socio-economic impacts

If activity in the sector increases and RE developments grow in number, there is clear evidence that this will lead to job creation in the region. IRENA's analysis suggests that the total potential RE employment in 2030 ranges from 126 000 to 165 000 direct jobs[23], provided a number of challenging barriers are overcome and targets are met. These job numbers increase, as the share of solar and wind enter the renewables mix but are still underpinned by employment across biomass and hydro as the dominant sources of RE in the region.

The economic value of these jobs varies, with the majority being more labour intensive and in sub-sectors such as fuel production for biomass or construction for hydro, solar and wind. However, in order for the sector to be successful, high-value jobs will also have to be created, requiring careful policies and initiatives to upskill the workforce to meet the demand from investors in modern RE technologies. The potential across the continent is high and investors will look closely at skilled local workforce in enabling development and hence investment.

Aside from job creation from the development of the renewables sector, a secure, modern and affordable energy supply can transform the fortunes of entrepreneurs and increase entrepreneurial activity in general. Business that currently have to reply on an insecure national grid or from polluting expensive diesel generators can focus on longer term and more risk-free business models if energy is more abundant and sustainable over the long term with a reduced likelihood of price fluctuations. This gives investors more confidence and allows enterprises to be far less constrained and far more innovative in addressing new problems without having to have concern about energy security. This is true across all sectors and in urban and rural areas.

[23] Draft ECCAS Renewable Energy Roadmap for Central Africa, IRENA (2020).

As well as industry and commerce, the social benefits of a secure energy supply for aspects of health, education and security are also vast. This ranges from aspects as simple of securing appropriate lighting to allow students to study, to health centres and hospitals being powered to ensuring life-saving operations can take place and medicines can be appropriately stored, to efficient food production for the whole population. Social empowerment can lead to a range of economic benefits through a better-educated and healthier populations – allowing people's talents to be directly towards productive enterprise, research and creativity rather than subsistence working.

As an example, rural areas that will obtain increased energy access through mini-grids or solar home systems, could potentially benefit from using electricity for income generating activities, for improving education by providing electricity, for lighting and studying and for improving the healthcare safety and quality (i.e. increased ability to provide services during night-time, safe and cooling storage of medicines, etc.). These are just a few of the socio-economic impacts coming from off-grid electricity provision that are within reach for millions of people in the ECCAS region.

2.1.7 Gender and disadvantaged groups

Despite the potential, as things stand, the negative impacts from poor access rates and slow growth in the energy sector, certain segments of the population are more adversely affected. In a similar trend across the continent, it is the women in the ECCAS region, who suffer the most from conditions of energy poverty.

Due to traditional responsibilities for collecting fuel and water in many developing countries, women and girls would benefit the most from improved access to energy services. The time and physical effort expended by women and girls in gathering fuel and carrying water seriously limits their ability to engage in educational and income-generating activities. Many women and girls also suffer from health problems related to the time and physical burdens involved in gathering fuel, as well as the increased danger of physical violence or accidents.

Off-grid renewable electricity eliminates the need to collect and pay for fuel, giving women and girls more time to pursue other positive activities, and simultaneously having the potential to increase their health and safety, by lighting dangerous areas in villages and providing lighting for safer healthcare delivery, particularly for delivering babies.

Apart from the demanding physical labour conditions, there is also a tendency for women to suffer from increased respiratory issues, cancers and eyesight problems associated, while cooking in poorly ventilated homes, or spaces with inefficient and hazardous charcoal or biomass stoves. Smoke from poorly ventilated indoor fires accounts for close to 8 million premature deaths per year globally.

Poorer and less well-connected urban areas, despite being closer to centres of energy demand, are quite often lacking in energy infrastructure and supplies. Furthermore, there may be little chance of them being served by national infrastructure in the short or medium term. For this reason, off-grid energy solutions are just as relevant as in rural areas and serve the same purpose, 'leapfrogging' the traditional power and energy solutions and establishing mini grids or household scale solutions in different neighbourhoods.

The ECCAS region also houses refugees from across the region and other parts of Africa who have fled from conflict or are seeking work or a better quality of life in a different country. Many of these camps have significant energy challenges, are often make-shift and have no long-term infrastructure in place. Off-grid energy has been shown to be a solution to some energy problems in such camps allowing a rapid response to production of safe, clean power to assist with basic social needs such as lighting and refrigeration.

2.2 ECCAS Sustainable Energy Opportunities

The adoption of RE and EE technologies can be considered by the ECCAS MS as an opportunity to provide energy access, especially to remote populations that are lacking access, as well as an opportunity to reduce energy production costs and diversify the energy supply. The benefits on macroeconomic level are twofold: one relates to the savings on reduced importation of fuels for power generation, the other is based on the

additional labour requirements[24] for incorporating these newer technologies, which will lead to a knock-on effect within the target countries' economies. Moreover, the costs of RE technologies have been dropping (this is the case for wind and solar – both thermal and PV – powered technologies) and they have now become more efficient and cost effective than the diesel fuel-powered generators currently used in the ECCAS countries. The other technologies, such as biomass, also have added benefits that are very cost-efficient, compared to conventional power generation, as demonstrated in Figure 5. Apart from macroeconomic benefits, there are many individual benefits for various groups (e.g. businesses, urban and rural households).

Furthermore, it is important to note that levelised costs of some RE technologies are falling below electricity tariffs in the region as well as within the ranges of fossil fuel ones, making them more competitive to be used than they were a decade ago.

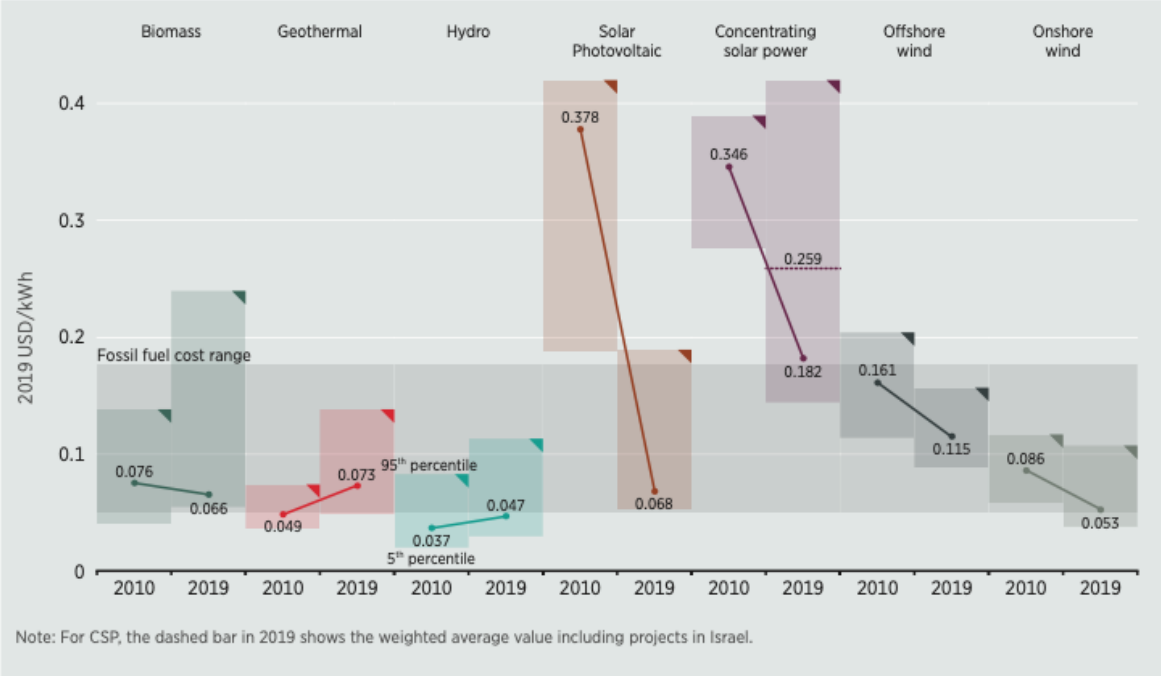


Figure 5: Global Levelized Cost of electricity from Utility-Scale RE generation technologies 2010-2019[25]

2.2.1 Renewable energy potentials and options

- Urban utility-scale and distributed dimension

As outlined previously, despite the currently low RE penetration in the ECCAS region, the RE potential is high.

IRENA has assessed the region's future power sector prospects and the absolute potential for RE deployment in the context of anticipated economic growth and regional integration by using IRENA's own power sector planning model for Central African countries, the System Planning Test model for Central Africa (SPLAT-C). The model considers, inter alia, the retirement of current power infrastructure, geographical distribution of renewable resources, transmission and distribution infrastructure requirements, and the generation adequacy of national power systems. This includes all proposed members of the CEREEAC other than São Tomé and Principe, for which limited data is available.

[24] The technical nature of RE often require more labour per unit of energy than conventional energy generation. [Green Jobs: Towards decent work in a sustainable, low-carbon world (UNEP, 2008)]
[25] Renewable Power Generation Costs in 2019, IRENA (2020), extracted at: https://www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019.

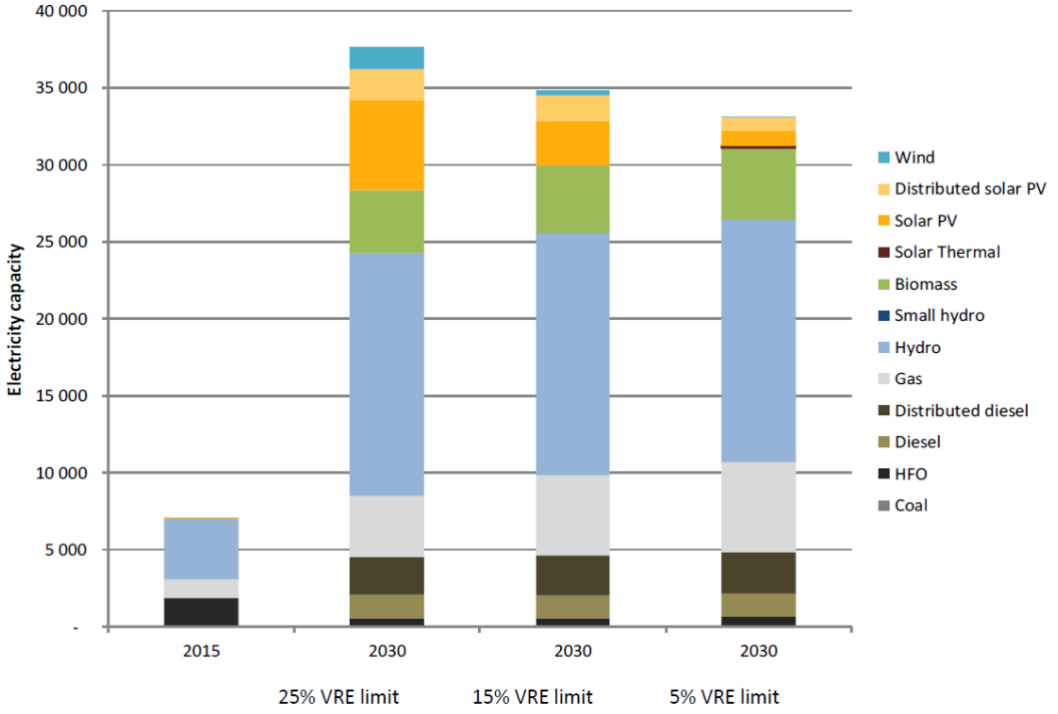


Figure 6: Potential Electricity Capacity Mix to 2030, IRENA

In these ambitious estimations the results show that by 2030 wind and solar deployment could be five times 2015 levels.. Between 2015 and 2030, the renewable share of capacity increases from 56% to 77% in that scenario, with 11 860 MW of hydropower, 7 908 MW of solar PV (including 2 017 MW of distributed solar PV as discussed in more detail below), 4 083 MW of biomass, and 1 420 MW of wind constructed over the same period. To provide a sense of the pipeline required for this scale of deployment, such results would imply an annual average of circa 650 MW of solar PV to be installed on a regional level between 2020 and 2030.

All scenarios indicate significant progress above 2015 levels. The models highlight that without significant penetration of renewables up to 2030, other fossil fuel sources may take up a greater share in the market. Therefore, it is crucial to immediately focus attention and planning on policies and procedures, which can lead to a higher penetration of RE technologies, in order to achieve positive results by 2030.

The model serves to highlight the potential of the region, but the figures also demonstrate the current gap in deployment that is required to achieve these levels, and therefore the scale of regional cooperation and progress still to be made. As noted previously, the potential for large-scale developments is clear, but there are a number of hurdles in the form of poor infrastructure, lack of finance, policies and regulations, skills, etc. to make this a reality.

- Rural decentralised and off-grid dimension

Off-grid solar products continue to increase across SSA. The Global Off Grid Lighting Association (GOGLA) reports that as of December 2019, 3.2 million people in Central Africa have benefited from improved energy access, as a result of access to off-grid solar. Almost 109 000 of these people are undertaking economic activities as a result of using off-grid solar lighting products, whereby a total of 672 000 kerosene lanterns have been replaced with solar lighting[26]. Mini-grids offer increasing potential across the African continent, although these developments are still challenging commercially and business models for these developments often rely on concessional and donor financing at this stage, preventing them from becoming widespread.

[26] Global Off-Grid Solar Market Report, GOGLA (2020) - https://www.gogla.org/global-off-grid-solar-market-report#vis

- RE options for ECCAS Key industries

As the price of standalone renewable power developments (particularly solar PV) comes down and energy storage becomes a more commercially viable option, commercial and industrial scale developments are becoming more commonplace to service businesses across countries with less reliable electricity supplies. Businesses are motivated to install these RE technologies, where a connection to the electricity grid may be unreliable, but the prices are dropping so much that even in developed economies, it can make commercial sense for a company to generate its own electricity supply. Besides the interest of the private sector, there are additional steps that the Governments in Central Africa can take to make these developments possible through appropriate regulation and incentives.

One other potential benefit to commercial and industrial power supplies is the option to supply local populations with excess power, particularly in communities that are not already connected to the electricity grid.

These advancements in RE technology and price mean some critical industries such as oil and gas and mining in ECCAS will have the opportunity to modernise and decarbonise. Clearly, there is a need for these industries to make changes to move towards a low carbon and net zero future and therefore the integration of RE and EE into these sectors, which drive economic growth in many parts of the region, is essential. Furthermore, sustainable, secure ECCAS energy use is critical to ensure these industries and new, more innovative and sustainable enterprises can emerge.

The Blue Economy, particular for island states and those countries on the west coast of Africa, holds enormous potential in areas such as aquaculture, desalination, maritime transport, offshore oil and gas, coastal protection and tourism and shipbuilding.

This also fits with the IDDA III and the vision to firmly anchor Africa on a path towards inclusive and sustainable industrial development.

- RE Entrepreneurship and Innovation

In keeping with the IDDA III and the vision to firmly anchor Africa on a path towards inclusive and sustainable industrial development, securing sustainable, modern energy services allows innovation and entrepreneurship to develop. This will be the case directly in the energy industry, where new jobs can be created to develop and build clean energy supplies, and also in other industries and businesses that have the opportunity to create growth and innovation thanks to a more secure power system. This could be a rural entrepreneur who is able to access energy for the first time or those who can now secure investment in their plans as they no long have to rely on insecure or polluting power supplies of power.

- Frontier technologies (incl. digitalisation and industry 4.0)

Technology innovation and new industry 4.0 solutions, particularly digitalization, are key drivers to accelerate the energy transformation by managing large amounts of data, allowing banking access to rural isolated populations, optimizing systems with many small generation units also enhancing revenue collection and monitoring PAYGO systems. Some innovations are entering also the ECCAS market. However, lack of standards, in particular on safety and security, might cause problems for the end consumers in the future. Other technologies (e.g. ocean energy) are expected to be ready for industrial scale-up during the next ten years.

2.2.2 Energy efficiency potentials and options

Available secondary data indicates that EE markets are yet to be developed in the region, presenting a clear potential for ECCAS to introduce new policies and projects in the field. This offers an opportunity to focus on EE improvements that are innovative and cutting-edge in terms of technology, but also other measures, such as behavioural change and increased awareness[27].

[27] Available at Page 26 of Livre Blanc CEEAC-CEMAC pour un accès universel aux services énergétiques modernes (the CEEAC-CEMAC White Paper on Energy)

Generation/distribution

Losses in energy transmission and distribution (T&D) for the ECCAS MSs, as shown in the Table 4 below, demonstrate that the average T&D losses across ECCAS countries (with the exception of Cameroon), are in excess of 20%. This highlights the urgent need to reduce losses, as well as to increase generation.

Table 4: Losses in transmission & distribution systems across ECCAS countries[28]

	Country	Average T&D losses (Percentage)
1	Angola	40%
2	Burundi	24%*
3	Cameroon	11%
4	Central Africa Republic (CAR)	NA
5	Chad	30%
6	Democratic Republic of Congo	21%
7	Republic of Congo	45%
8	Equatorial Guinea	NA
9	Gabon	28%
10	Rwanda	NA
11	São Tomé & Principe	35%
**: Independent estimates (not endorsed by Govt. documents), available at https://www.lexology.com/library/detail.aspx?g=8a686f01-c89c-4db6-b973-164b5abda114*		

In addition to electricity, the major petroleum producers in Central Africa (Angola, Equatorial Guinea, Republic of Congo, Gabon and Cameroon) have begun to take initiatives for avoiding gas flaring, and instead recover the gas for domestic use and/or export. This activity is currently being led by Equatorial Guinea, which has successfully cut down on flaring.

Buildings, Appliances and lighting

The rationale for improving EE in appliances and lighting has been clear for a number of years. This has been demonstrated by the ECCAS-CEMAC White Paper discussing efficiency standards for buildings, focusing on lighting as a specific category within buildings. With specific reference to lighting, the report recommends phasing out of incandescent lamps. It also mentions imposition of penalties (such as taxes) and incentives as instruments to encourage users to phase out old and inefficient equipment and opt for new and energy efficient equipment.

At a national level, some countries are also realising the potential for progress to be made in this area. Angola has announced a programme for improving EE in Luanda, including use of LED bulbs, prepaid meters and monitoring of quality of power supplied by *Empresa Nacional de Distribuição de Electricidade* (ENDE), a distribution utility. In the Central African Republic, a similar programme involved distribution of 4 LED bulbs to urban homes, and a programme to improve quality of power delivered. Cameroon has clearly identified buildings as a major focus area in its National Energy Efficiency Policy, Strategy and Action Plan (2014). Gabon has mandated EE norms for all new buildings, while incentivizing at the same time existing buildings to become more energy efficient through voluntary action. Most other countries are in the process of determining their EE plans and programmes in the building sector.

[28] Based on Consultants' compilation of country reports through secondary sources

Cooking

According to the 2020 IRENA Renewable Energy Roadmap for Central Africa, more than 112 million people have no access to modern fuels for cooking, 61 million of whom are in the Democratic Republic of Congo[29]. Wood and charcoal still represent over 80% of cooking fuels in Central Africa. Efficiencies in using these fuels and in traditional cooking methods and stoves are poor, leading not only to wasted critical biomass resources, but also to dangerous pollution and smoke inhalation, which in turn create health and respiratory issues, particularly among women.

The potential for progress across cooking technologies and stoves as well as to create more sustainable fuels is vast. However, this requires a multifaceted approach to tackling the issues across technology, education, finance, policy and regulation. Changing traditional and long-standing cooking methods in remote regions is ~~not only~~ difficult to achieve in itself, but without affordable alternatives, a lack of finance for modern stoves and a lack of resources for enforcement of illegal deforestation activities, the problem is exacerbated.

Transport

Inefficiency in transport across the ECCAS region is underpinned by a lack of modern infrastructure and connectivity within and between countries. Furthermore, relative to more developed and wealthier economies, vehicles are older and not well-maintained. The push for electric vehicles is limited, with some pilot schemes taking place in Rwanda (Kigali) and an overall growth in Africa of electric bikes to replace the use of mopeds, motorbikes and bicycles. This growth is, of course, limited by the general lack of reliable electricity in the region.

The 2014 paper *"Understanding Regional Economic Policies in Central Africa"* emphasises these points, particularly around connectivity, highlighting the lack of cross-border transport infrastructure, which presents a barrier that impedes greater economic integration. Moreover, vehicle fleets are made up of old, polluting and resource inefficient vehicles [30].

Further transport on land, the Blue Economy holds potential in Central Africa, including for the development of sustainable maritime transport as well as in shipbuilding.

EE in ECCAS key industries

The Africa Energy Outlook (IEA, 2019) identifies industry to be less energy efficient in Africa, compared to other global regions. The ECCAS White Paper states that most industrial business owners prefer their own diesel-powered generation. Other secondary sources of information point to the general limitations of Central African industries, and their focus on mining and extractives.

Most of the ECCAS countries are yet to develop programmes with specific EE activities for industries, although progressive countries, such as Cameroon and Gabon, have identified such a need for action. Cameroon has also emphasized the need for conducting energy audits in industries.

EE Entrepreneurship and Innovation

As with the emergence of RE, developments in EE can assist with entrepreneurship and innovation. Lowering the cost of power can possibly make or break a business plan and any advancement in efficiency that can simultaneously reduce costs and increase sustainability will be an attractive prospect for entrepreneurs and investors in new businesses. In addition, the EE industry itself offers enormous opportunities for disruptive change in markets in Central Africa, from low carbon public transport solutions to digitisation of energy delivery, discussed further below.

[29] Draft ECCAS Renewable Energy Roadmap for Central Africa, IRENA (2020).

[30] Under Standing regional economic policies in Central Africa, Bruce Byiers, European Centre for Development Policy Management (2014) https://ecdpm.org/wp-content/uploads/ECCAS-CEMAC-Background-Paper-PEDRO-Political-Economy-Dynamics-Regional-Organisations-Africa-ECDPM-2017.pdf

- Frontier technologies (incl. digitalisation and industry 4.0)

As well as in energy production, digitisation has enormous potential in EE. There are opportunities across the supply chain and into energy use to reduce waste and to optimise the amount of energy needed through digital monitoring and automation.

Data gathering technologies such as sensors and smart meters collect data on energy use and other conditions affecting energy use (like climate). Data are processed into useful information through data analysis technologies such as artificial intelligence algorithms.

Finally, the processed information is sent to devices that can effect physical changes to optimise energy use – this may be as simple as a phone suggesting the most efficient journey by car or as complex as a full energy management system for a hotel to ensure heating and lighting is utilised efficiently and automatically.

These innovations all have the potential to enter the ECCAS market and kick-start the viability of the EE sector across all industries in the commercial and industrial sectors.

2.3 ECCAS Sustainable Energy Policy Readiness

2.3.1 Global/Regional policies

The Sustainable Development Goals: The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 SDGs, which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests. SDG 7 aims to "*ensure access to affordable, reliable, sustainable and modern energy for all*" by increasing the share of RE, improving energy access and improving EE underpins the actions by which all members of the United Nations have agreed to set policy.

Third Industrial Development Decade for Africa (IDDA III): On 25 July 2016, the United Nations General Assembly adopted a resolution proclaiming 2016-2025 as the Third Industrial Development Decade for Africa (IDDA III)[31]. UNIDO was tasked with leading the implementation of the Decade, in collaboration with a range of partners. The vision for the implementation of IDDA III is to firmly anchor Africa on a path towards inclusive and sustainable industrial development. Without sustainable energy use to support a more diverse, modern and complex economy, achieving the aims of IDDA III will not be possible.

ECCAS/CEMAC: Regionally there are a number of important reference documents. These are the ECCAS Green Economy and Renewable Energy Vision, the ECCAS Vision 2025, as well as the CEMAC White Paper and Energy Policy 2035. The white paper in particular sets out the regional policy for universal access to modern energy services and economic and social development working on three guiding principles: good governance at a regional, national and local level; energy security and the development of renewables, particularly hydro; and equality, inclusivity and poverty reduction.

The vision covers all areas of the energy system including energy access, EE and RE and can be seen as a guiding document for some key reforms over this period. Despite this, the landscape has changed since 2014 and the investment potential in other renewable technologies, including wind and particularly solar, have arguably overtaken hydro in terms of attractiveness in the region. In particular, the paper notes that the vast majority of the investment over the period 2014 to 2040 will be in hydropower, with less mentioning of the growing importance that solar will have in the region. Furthermore, SDG 7 to aim for universal energy access by 2030 has overtaken the ambition of the white paper which has a goal of only 54% by that time.

[31] UN Third Industrial Development Decade - https://www.unido.org/who-we-are/idda3-third-industrial-development-decade-africa-2016-2025#:~:text=On%2025%20July%202016%2C%20the,with%20a%20range%20of%20partners.

Other overarching ECCAS policies including the EAC Industrialisation Strategy and policies in relation to transport are all interlinked with a clear strategy on sustainable energy. RE and EE are key drivers to implement any industrialisation strategy to decarbonise existing sector and to promote new more innovative industry in the region. Furthermore, transport, another key driver of industry and growth, will also have to ensure it grows sustainably utilising electrification, bioenergy and EE. This fits with the recently announced plan that, "Through a unique sub-regional industrial and economic diversification strategy, Central Africa is seeking to double, in the years ahead, industrial contribution to GDP from its current rate of 12%"[32] Building the energy value chain has been identified as a key component of this plan which aims to be part of 'building back better' after COVID-19.

World Bank – RISE: The World Bank's Regulatory Indicators for Sustainable Energy scorecard (RISE), a key element of the Sustainable Energy For All Knowledge hub, helps to assess government support for sustainable energy investment, thus assessing the policies and regulations in place that contribute to advance global sustainable energy goals. RISE uses a traffic light system to assess the policies in place on a given country/region, as shown in Figure 7.

Green zone: scores between 67 and 100. Most elements of a strong policy framework to support sustainable energy are in place

Yellow zone: scores between 34 and 66. Significant opportunities exist to strengthen the policy framework.

Red zone: scores 33 or lower. Few or no elements of a supportive policy framework have been enacted.

Figure 7: RISE Traffic Light System

In general, in terms of a regulatory frameworks, the Central African region is credited with an overall low score (28.13[33]) based on RISE, indicating that more work must be done to improve the existent legal framework of the region. Figure 8 shows the evolution of the RISE scores for energy access, EE, RE and RISE overall score[34] for the ECCAS countries for which scores were available[35]. As it can be seen, overall, most of the ECCAS countries score poorly, meaning that there is a need to enact policies that promote sustainable development. When analysing the different categories separately, it can be seen that the ECCAS countries score better on energy access policy framework, whereas on EE they score the worst. Although it is evident that since 2010, steps have been taken towards improving the legal frameworks, still a lot needs to be done for the countries and region to have a strong policy framework supportive of sustainable energy development.

[32] UN Economic Commission for Africa, News Story (June 2020) - https://www.uneca.org/stories/cemac-and-eccas-unique-industrial-and-diversification-agenda

[33] Own estimates of the average RISE overall score value for the ECCAS countries for which there was a score for 2016. RISE scores for the different countries can be found and extracted from: http://rise.worldbank.org/scores

[34] The RISE overall score considers equal weights for the three categories it integrates, energy access, RE and EE.

[35] There are no RISE scores for Equatorial Guinea, Gabon and São Tomé e Príncipe.

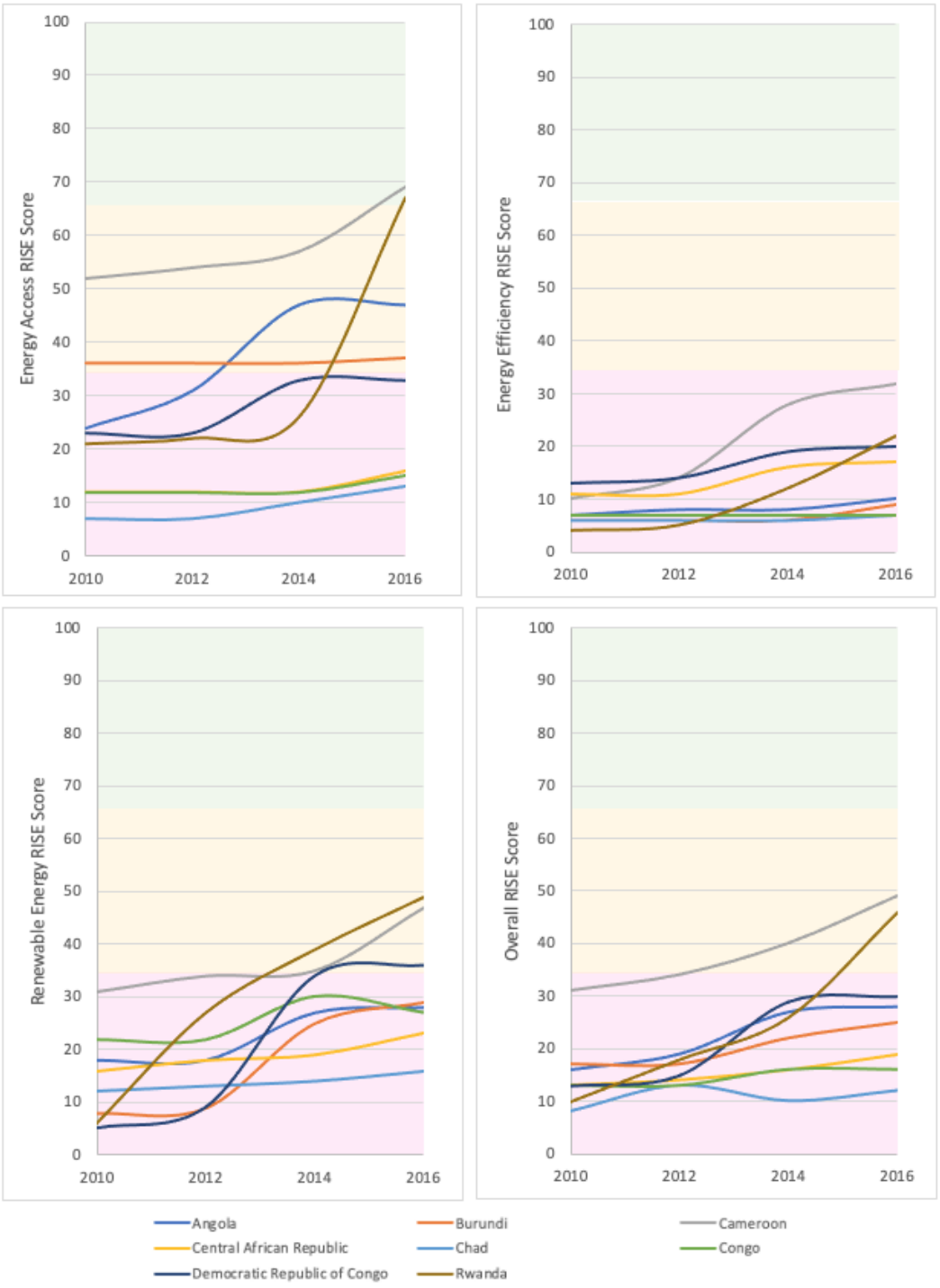


Figure 8: RISE scores for Energy Access, Energy Efficiency, RE and Overall Score (0-100)[36]

2.3.2 National policy readiness

This section outlines the current state of play in terms of produced and published policies in relation to RE and EE across the region. More detail on the need for other policies or different approaches is found in the discussion on 'Barriers related to policy and energy planning', Section 4.3.1. Table 5 and Table 6 summarize the policies and incentives for energy access, RE and EE (a full review of the policies in place for each ECCAS

[36] Figure built with information from RISE, https://rise.worldbank.org/scores

MS can be found in the respective Country Profile in Annex **Error! Reference source not found.**). The key findings of this review are as following:

- Energy access policies, including developing rural energy and access, are often mentioned in general energy policies, although this is not ubiquitous and there is still room for improvement to mainstream energy access priorities into energy planning and policy debate at a national level. There is clearly a lack of dedicated rural energy policy across the region. Most of the energy access targets are related to electricity access, although a few also include access to modern clean fuels and cooking technologies. Some of the ECCAS MS have aligned their energy access targets with the SEforAll (100% energy access by 2030). Some MS are more ambitious that the overall SE4All target, e.g. Gabon and while others still have energy access targets set over a longer term and are less ambitious, e.g. for Central African Republic and Democratic Republic of Congo.
- There have been some clear efforts to implement policies and targets for RE across the ECCAS MSs, with many of them setting long term goals (for example Cameroon's 'Vision 2035', Chad's 'Vision 2030 'The Chad We Want' and Rwanda's 'Energy Sector Strategic Plan'). Despite the progress, setting targets and clear policies is not universal and there are many countries, which are yet to set out similar policy agendas i.e. Central African Republic and Sae Tome e Principe. Furthermore, most of these policies are overall energy targets lacking a sub-division by technology type.
- Unfortunately, EE policies are far less well-defined by national governments at this point, with few strategic plans in place that incorporate clear ambitions and targets. Rwanda is one of the few exceptions with its 'Energy Efficiency Strategy' introduced in 2018. Meanwhile, other countries such as São Tome and Principe have plans for energy efficiency in production.
- RE and EE policy documents and targets also fail to cover major areas of development across almost all countries. This includes a lack of policy and targeting setting for aspects such as: heating/cooling; developing infrastructure to support the RE and EE sectors; specific info on the rural economy and the blue economy; digitisation and innovation; and how energy links to and supports other critical targets and initiatives e.g. transport, agriculture and industrial development.

In terms of incentives, there is still a lot of work to be done. There are clearly more policy mechanisms and incentives towards RE than towards EE and access to clean energy fuels and technologies:

- For RE, several countries have in place or are in the process of developing a favourable environment for IPPs, have priority dispatch for RE, have a tendering system and feed-in tariff/premium payment for RE. In terms of financial mechanisms, almost all ECCAS countries (with the exception of Equatorial Guinea and São Tomé and Príncipe) have some type of investment incentive towards RE (public investment, loans, grants, capital subsidies or rebates). There are countries that have reductions in sales, energy, CO2, VAT or other taxes and investment or production tax credits.
- There are only a few countries with incentives towards EE, some have industrial, commercial, public and utility incentives / mandates in place (i.e. Angola, Cameroon, Democratic Republic of Congo, Gabon and Rwanda); two (Cameroon and Rwanda) have some financial incentives, such as tax incentives and credit lines, towards EE; whereas two (Gabon and Rwanda) have included EE in their building codes.

In terms of access to modern clean fuels and technologies for cooking only two out of eleven MSs (Angola and Rwanda) have relevant policies and targets in place; whereby only Rwanda has already in place financial mechanism for consumers/suppliers to purchase/develop clean cooking solutions.

It thus emerges from the assessment that there is a lot to be done in the region in terms of harmonisation of policies and creation of incentives for RE, EE and access to electricity and to modern clean fuels and technologies for cooking.

Table 5: Summary of the policies and incentives for access and RE in place in the ECCAS region[37]

Country	Energy Access Targets	RE Targets	RE & EE in the INDC or NDC	Regulatory Policies for RE							Fiscal Incentives and Public Financing for RE			
				Feed-in tariff / premium payment	Electricity utility quota obligations / RPS	Net-metering /billing	Biofuels blend obligation /mandate	Priority dispatch	Favourable environment for IPPs	Tendering	Reduction in sales, energy, CO2, VAT or other taxes	Investment or production tax credits	Energy production payment	Public investment, loans, grants, capital subsidies or rebates
Angola	● 60% of electricity access, with 70% from RE by 2025	● 800MW of RE by 2025; >85% of RE in electricity production & 42% RE in final energy consumption by 2030	● GHG emission reduction up to 35% by 2030	●		○	●		○	○				●
Burundi	● 25% of electricity access by 2025	○ RE strategy draft dated from 2013	☆ Reduce GHG emissions by 3% by 2030 compared with BAU	○		○			●		●	●		●
Cameroon	● 100% of energy access by 2030	● 25% of RE in electricity generation in 2035	● Reduce GHG emissions by 32% in 2035 compared to the BAU					●		●	●			●
Central African Republic	● 50% of energy access by 2030		● GHG emission reduction of 5.5 MTCO2e in 2030 and 47.3 Mt CO2 eq in 2050, compared with BAU											●
Chad	● 30% access to electricity by 2030; 25% of households with RE by 2030		● Reduce GHG emission by 18.2% in 2030 compared with BAU						●					●

[37] Own compilation, based on data compiled in the Country Profiles from RISE, INDCs, WB, national policies and questionnaires carried out during the assessment.

Country	Energy Access Targets	RE Targets	RE & EE in the INDC or NDC	Regulatory Policies for RE							Fiscal Incentives and Public Financing for RE			
				Feed-in tariff / premium payment	Electricity utility quota obligations / RPS	Net-metering /billing	Biofuels blend obligation /mandate	Priority dispatch	Favourable environment for IPPs	Tendering	Reduction in sales, energy, CO_2, VAT or other taxes	Investment or production tax credits	Energy production payment	Public investment, loans, grants, capital subsidies or rebates
Republic of Congo	• National Electrification strategy	• 85% RE in electricity generation by 2025	• Reduce GHG emissions by 48% in 2025 and 55% in 2035 compared with BAU						•					•
Democratic Republic of Congo	• 60% electrification by 2025 and universal access by 2050	•	• Reduce GHG emissions by 17% in 2030 compared with BAU (~70 MtCO2eq)					•	•	•	•			•
Equatorial Guinea	• 100% of electricity access by 2020	• 55% of RE in electricity generation by 2025	• Reduce GHG emissions by 20% in 2030 and 50% in 2050 compared with 2010 levels											
Gabon	• Universal access to energy by 2020	• 70% of RE by 2020 and 80% by 2025	• Reduce GHG emissions by 50% in 2025 compared with BAU			•				•				•
Rwanda	☆ Universal access by 2024; 100% household electricity access by 2020 100% electricity access for productive users for 2024	• 52% of RE in energy generation by 2024; 60% of RE in on-grid electricity generation by 2030	• Reduce GHG emissions by 16% in 2030 compared with BAU (~1.9 MtCO2eq)	•				•	•	•	•	•		•

Country	Energy Access Targets	RE Targets	RE & EE in the INDC or NDC	Regulatory Policies for RE							Fiscal Incentives and Public Financing for RE			
				Feed-in tariff / premium payment	Electricity utility quota obligations / RPS	Net-metering /billing	Biofuels blend obligation /mandate	Priority dispatch	Favourable environment for IPPs	Tendering	Reduction in sales, energy, CO2, VAT or other taxes	Investment or production tax credits	Energy production payment	Public investment, loans, grants, capital subsidies or rebates
São Tomé & Principe		• 50% RE in the national energy system by 2030	• Reduce GHG emissions by 24% in 2030 compared with BAU								•			

Legend:

- ● Existing national policy/strategy or tender framework / in preparation
- ○ Draft national policy/strategy or tender framework or policy strategy in revision
- ☆ Policy revised (from previously existing)

Table 6: Summary of the policies and incentives for EE and modern clean fuels and technologies for cooking in place in the ECCAS region[38]

Country	EE targets	Strategic document aimed at increasing EE	Modern clean fuels and technologies for cooking targets	Incentive / Financing Mechanisms for EE				Incentives / Financing Mechanisms for Clean Cooking solutions		
				Industrial (I) & Commercial End Users (C) incentives & mandates	Public (P) & Utility (U) incentives & Mandates	Financial incentives for EE	Minimum Energy Performance Standards (MEPS) / Energy Labelling Systems (ELS), Building codes (BC)	Financial mechanisms (financial facilities, subsidy programmes)	Supplier incentives (tax benefits, commercial investment programmes)	Standards and labelling
Angola	• Improve efficiency by 2030: by 1% yearly		• 100% of population with improved cookstoves by 2030	• I	• U					
Burundi	• Reduce unit energy consumption in building from 10% to 14% by 2020	•								

[38] Own compilation, based on data compiled in the Country Profiles from RISE, INDCs, WB, national policies and questionnaires carried out during the assessment.

Country	EE targets	Strategic document aimed at increasing EE	Modern clean fuels and technologies for cooking targets	Incentive / Financing Mechanisms for EE				Incentives / Financing Mechanisms for Clean Cooking solutions		
				Industrial (I) & Commercial End Users (C) incentives & mandates	Public (P) & Utility (U) incentives & Mandates	Financial incentives for EE	Minimum Energy Performance Standards (MEPS) / Energy Labelling Systems (ELS), Building codes (BC)	Financial mechanisms (financial facilities, subsidy programmes)	Supplier incentives (tax benefits, commercial investment programmes)	Standards and labelling
Cameroon	• At least 20% energy savings in energy consumption by 2025	•		• C	• P, U	•				
Central African Republic		•								
Chad		•								
Republic of Congo										
Democratic Republic of Congo	•	•		• C	• U					
Equatorial Guinea										
Gabon	• Improve energy efficiency by 3.8% per year	•					• BC			
Rwanda	• Reduce T&D losses from 22% to 15%	•	• 100% of population with efficient cookstoves by 2030		• P, U	•	• BC	•		
São Tomé & Principe										

Legend:

- Existing national policy/strategy or tender framework / in preparation

- ○ Draft national policy/strategy or tender framework or policy strategy in revision
- ☆ Policy revised (from previously existing)

3. Results of the Consultative Needs Assessment Survey

In order to identify the need and added value of CEREEAC a survey was undertaken as part of a need's assessment among the RE and EE stakeholders to ascertain the Centre's mandate, priority activities and issues that should be addressed.

3.1 Method

Questionnaires were disseminated via email and electronically (online questionnaire) to representatives of National Focal Institutions in each country, alongside groups of key RE and EE as well as regional and international donors and other prominent organisations in the RE and EE space. The questionnaires distributed focused on the following issues[39]:

1. The Value, Functions and Mandate of the CEREEAC
   a. Added Value of the CEREEAC
   b. Key functions of the CEREEAC
   c. Scope of the technical mandate of the CEREAC
   d. Institutional design of the centre
2. Country Assessment Questions for RE and EE
   a. Country situation
   b. Promotion of Renewable Energy
   c. Promotion of Energy Efficiency

After working with ECCAS to identify National Focal Institutions across the 11 countries, the questionnaire was then distributed to them, and assistance was given where required to complete the questionnaire from local consultants. As it can be seen in the table below of the 11 NFIs, we received answers from 6. The e-mail and online questionnaire were also distributed to other key stakeholders in country and further afield. Additional responses were received from 22 institutions (public and private) with majority being in full support of the CEREEAC's establishment, and none being wholly opposed.

Table 7: Summary of the NFI Stakeholder response

Country	NFI Identified?	Response Received?	Additional questionnaires completed	Total questionnaires filled
Angola	Yes	Yes	0	1
Burundi	Yes	Yes	2	3
Cameroon	Yes	No	5	5
Central African Republic	Yes	Yes	0	1
Chad	Yes	No	0	0

[39] The questionnaire sent by e-mail mainly targeted the appointed National Focus Institutions, and thus covered both issues mentioned there. The online questionnaire was a simplified version of the questionnaire sent by e-mail, with a main focus of the Value, Functions and Mandate of the CEREEAC.

Republic of Congo	Yes	Yes	0	1
Democratic Republic of Congo	No	No	0	0
Equatorial Guinea	Yes	No	0	0
Gabon	Yes	Yes	1	2
Rwanda	No	No	0	0
São Tomé and Principe	Yes	Yes	4	5
Wider/International Contacts	n/a	n/a	3	10
Total				28

We recognised that the response rate to the questionnaire (55% for the NFIs) was lower than desired and despite the efforts of ECCAS, UNIDO, ITPE and our local partners, we were unable to identify all NFIs and ensure that they completed the questionnaire.

3.2 Results Summary

A summary of the key statistical results as well as qualitative feedback of the initial in-depth questionnaire are found below. A summary of the supplementary questionnaire to other stakeholders is found following the initial analysis.

3.2.1 Do you think a specialised regional ECCAS centre to promote the uptake of RE and EE markets is needed and would add value?

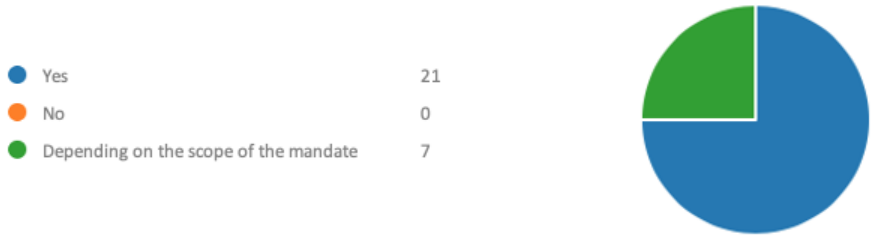


Figure 9: creation of a specialised region ECCAS centre to promote RE and EE

There was a clear trend for respondents to support the establishment of the Centre, with over three quarters in agreement that this would add value. Encouragingly, no respondents said the Centre would not add value.

Those that noted that the value would 'depend on the scope of the mandate' highlighted the following points, and that the CEREEAC should:

- promote an integrated and inclusive energy market development;
- promote relations between countries as well as supporting the private market;
- be a specialised regional centre and a leading hub for RE and EE;
- gain the support of the member states in order to be effective;
- focus on the cities and the regional areas;
- coordinate work with the CAPP and ensure rural areas are not left behind;
- begin to tackle the less focussed on issue of energy efficiency;
- focus on all technologies and take advantage of the rich resources of the region;
- involve local people in the development of regional and off-grid projects;

- work in line with existing aims and targets such as the 2015 Paris Agreement;
- work with international experts to take advice across ECCAS states.

3.2.2 Which key functions should the regional centre have?

There was broad support across the board for the options presented to respondents in the questionnaire regarding the key functions of the Centre – potentially indicating a gap in delivery of most of these services in the region which presents an opportunity for the CEREEAC.

All respondents highlighted involvement in policy, regulations and standards as well as support for local energy entrepreneurs as being important. Also, almost all pointed out the joint learning and knowledge exchange as a very important function of the Centre.

Key function	% of responses in support
Set regional RE AND EE targets and priorities to ensure equal progress among all ECCAS countries	71%
Strengthen technical capacities of the ECCAS Secretariat to assist and advice Governments on key questions of the energy transformation	82%
Address barriers for RE AND EE more cost-effectively through joint coordination and cooperation on programs and projects	64%
Set regional RE AND EE policies, regulations and standards and support/monitor their national implementation	89%
Promote economies of scale and business opportunities through the creation of harmonised markets for sustainable energy products and services	82%
Set regional content requirements to promote the participation of local energy entrepreneurs in value chains of sustainable energy manufacturing and servicing	89%
Coordinate international donor support in line with regional priorities and ensure coordination and synergy building	68%
Act as regional focal point for international climate sustainable energy finance and assist countries in the development and implementation of programs and project proposals	79%
Act as knowledge and information hub for the region	79%
Create opportunities for domestic companies and training institutes through regional programs and the creation of tailored financial facilities	79%
Promote the region as attractive place to invest in RE AND EE	79%
Promote joint learning and knowledge exchange	93%

As well as the options provided individual respondents also reported that they would like to see support for R&D, for industries to be encouraged to develop in rural areas by providing reliable power and for technical support to be offered to various stakeholders.

3.2.3 Is there anything the CEREEAC regional centre should not do?

When asked if there was anything the centre shouldn't do, the following general feedback was received:

- The centre should be open to various groups, and not just focus on scientific research.
- The centre should avoid belonging to one country and being overly political.
- The centre should leave room for national flexibility in policy while supporting a regional approach.
- The centre should not replace the role of national authorities.
- The centre should not entry in commercial activity in the area of RE and EE.

- The centre should not compete with the private sector and already existing national institutions/centres. It should be a facilitator and enabler.

3.2.4 Please indicate in which technology areas regional coordination and cooperation could add value?

The following figures rank the RE, EE and cross-cutting areas where regional coordination and cooperation could add a value in the view of the stakeholders.

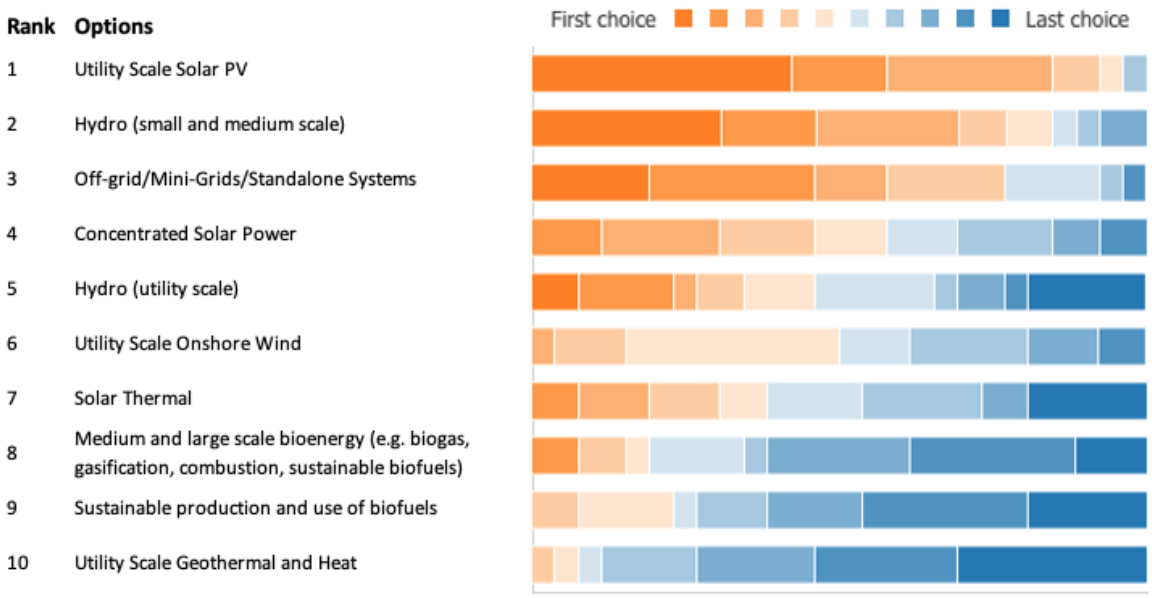


Figure 10: Ranking of RE technology areas

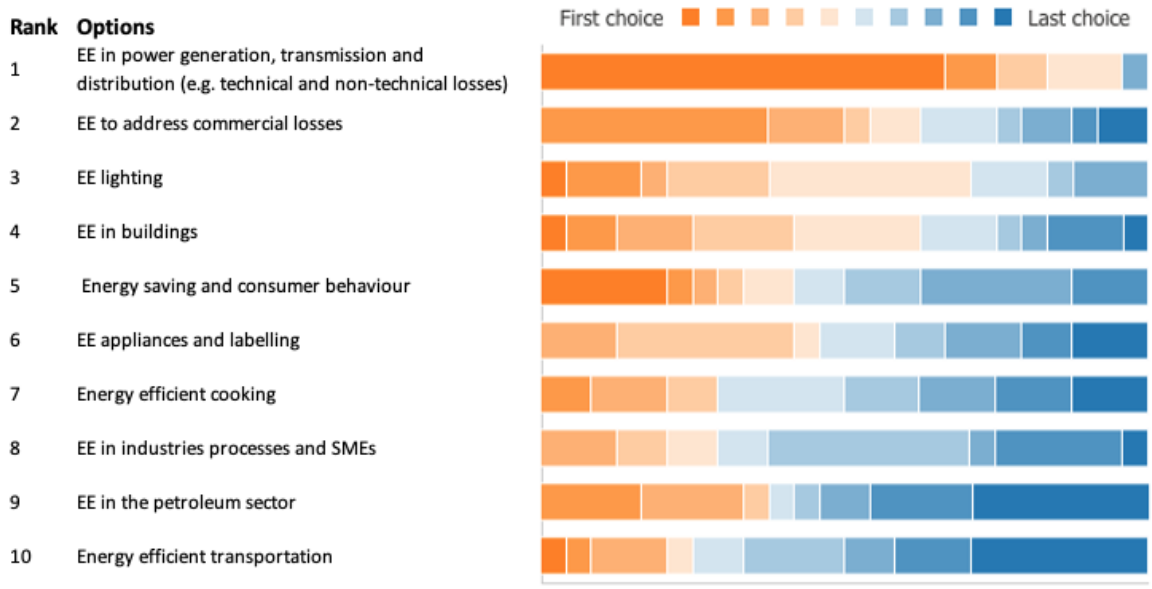


Figure 11: Ranking of EE technology areas

Rank	Options
1	Digitisation for RE and EE
2	Innovative business models
3	Battery storage and other storage systems
4	Sustainable cities

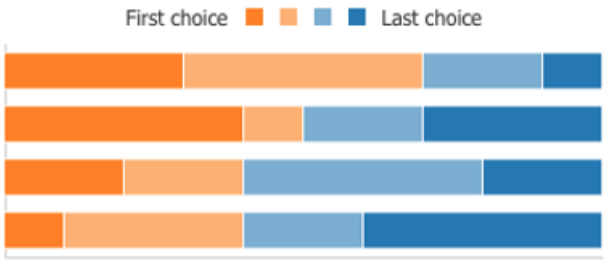


Figure 12: Ranking of cross-cutting areas

In terms of statistical analysis, utility scale solar PV, small scale PV and energy efficiency in the power sector were ranked in the 1st position by almost all those who responded. This reflects the extremely high potential of solar PV in terms of costs coming down at the utility scale, the potential of small-scale PV in rural areas as the most viable electricity access technology and the issues with grid networks and management across the region (in terms of power system efficiency).

Other technologies are supported broadly along similar lines although there is relatively less support for Geothermal heat and for sustainable cities.

In terms of other more qualitative feedback respondents outlined a number of interesting points about the needs of countries in each renewable technology area as well as potential regional activities which could be carried out.

Utility Scale Solar PV

- PV can help balance an overreliance on hydro
- PW can be deployed to assist with persistent power cuts and to boost the economy
- Some feedback suggested attention on utility scale wasn't required and focus should be on rural schemes
- Where terrain is difficult to install utility scale PV in some markets, rooftop PV should be promoted
- Possibility to exchange experiences and training between countries in solar PV
- Exchange of information through data collection is possible

Concentrated Solar Power

- Some feedback suggests this isn't required on a large scale and it could only be used as backup (note: CSP can be used as a less intermittent supply of power than solar PV).

Small to medium scale hydro power (excl. large hydro)

- Huge potential in rural and mountainous regions in different countries.
- Potential to boost rural economies
- Can assist in removing the reliance on gas.
- There could be a drive to recuperate and complete unfinished or old schemes in the region.
- An inventory of the resource at a rural level would help.
- Schemes could be part of an eco-tourism scheme

Large Hydro Power dams

- Although the region has a lot of large hydro, the potential is by no means fully realised.
- Low levels of industrial activity hamper growth in the technology to meet any extra demand.
- Developing hydro could be a catalyst for grid extensions or upgrades.
- Again, this has the potential to be used instead of natural gas.

- Not all countries in the region have potential and this should be considered.
- Where potential is well known, training is required.
- Potential to develop interconnectivity and country cooperation with large scale hydro plants.

Utility scale onshore wind

- Large scale potential
- Can be used to serve isolated industrial developments.
- Other feedback suggests the demand is not high for the technology and no studies to highlight potential as yet – so differing views and readiness levels exist across the region.
- Studies to be carried out regionally for the demand for the technology and also the potential for regional manufacturing.
- International donors may be able to assist with developing this technology.

Utility scale geothermal power and heat

- General feedback that there was no potential or no proof of potential in geothermal.
- Knowledge exchange events could be useful.

Medium and large-scale bioenergy (e.g. biogas, gasification, combustion, sustainable biofuels)

- Limited need or lack of knowledge.
- Potential to utilise waste from the household sector.

Sustainable production and use of biofuels (incl. 3rd generation)

- Necessary to move away from fossil fuel.
- Still studies to be complete, although there is legislative support in some countries.
- Research and exchange of information on this technology could be facilitated by the centre.

Offshore wind, wave, tidal and ocean energy

- Note that potential exists, but only for those not landlocked.

Small-scale distributed solar PV systems

- Given the large rural populations and lack of access, this is an attractive option.
- Rooftop PV should also be considered.
- The technology is still embryonic
- The role out of these schemes can be very quick and efficient.

Solar Thermal for warm water heating

- Useful for public institutions.

Rural mini-grids/standalone systems

- Essential for many rural areas
- Micro networks can be very efficient and serve a number of different purposes for commerce, industry etc.

EE in power generation, transmission and distribution (e.g. technical and non-technical losses

- EE is essential, especially with the growth in the energy system.
- The efficient use of networks is key to the success of the energy system, this increases power available.

- It is also important to have capabilities to monitor and understand power networks and where energy is being produced.

EE to address commercial losses

- A call for smart meters and better overall management of metering and billing.
- Losses in national electricity companies reported.
- Already a lot of World Bank programmes in this area.
- CEREEAC could set goals and targets for this area.
- Technical training is required.
- A review of the pricing system is needed with new strategies and businesses models.

EE in the petroleum sector

- Gas currently wasted for flaring needs to be captured and utilised

EE buildings

- Standards are important here, especially for new build housing.
- Mandatory impact studies should be introduced for buildings of a certain scale.
- Better energy management practices and knowledge required.
- Certification for electrical installations.

EE appliances and labelling

- Life cycle knowledge of different appliances should be studied and better data on all appliances developed.
- Certification mechanism for electrical equipment, installation and materials is needed.
- Inventories of manufacturers, distributors and wholesalers required.
- Setting up recycling centres.

EE lighting

- More data required on lighting in general.
- Intelligent management for public street lighting.
- A multi-year programme for the elimination of inefficient lamps is required.
- Gradual introduction of solar PV lights.

EE in industries processes and SMEs

- Better understand the knowledge and consumption mix in industry.
- Mandatory energy audits of industries of a certain scale.

Energy saving and consumer behaviour

- Need to better inform consumers given the efficiency loss from behaviour.
- Focus on the energy and environmental savings.
- Consideration of projects that produce mass dissemination.
- Mass training programmes and upgrading on school and university programmes on EE.

Energy efficient transportation

- Gradually decarbonise public transport.
- Introduce cycle paths.

- Make energy supply more reliable to allow for use in transport.
- Support from international donors likely in this sector.

Energy efficient cooling

- Mechanisms do not exist in this space.

Energy efficient cooking

- Enormous need for intervention given the use of biomass in cooking.
- Need to improve cooking methods in rural areas.
- Integrated programmes for the mass use of biogas and introduction of improved cooking stoves.

Innovate industry and digitalisation

- Technology can assist rural areas in terms of lack of infrastructure for energy services in the form of block chain and mobile banking.
- Connected smart meter systems and payment digitally.

Innovate business models (rural energy services, grid to vehicle and vice versa)

- Innovation of business models will benefit rural ventures.
- Opportunity for business models to be shared across the region.
- Mobile payments and digital banking also important here.

Battery & other storage systems

- Intermittency a key issue, especially in off-grid solar PV systems – critical for rural energy development.
- Hydrogen generation an option here to be considered.
- Local engineering skills should be utilised in this field.

Sustainable cities (e.g. low-carbon urban development)

- A need to adapt and modernise management of energy in cities.
- Also focus on rural areas to stop exodus to cities.

3.2.5 Please explain which regional interventions/services of the CEREEAC would be a priority for your country/institution/company

Figure 13 shows the ranking attributed by the responders for the CEREEAC interventions/services.

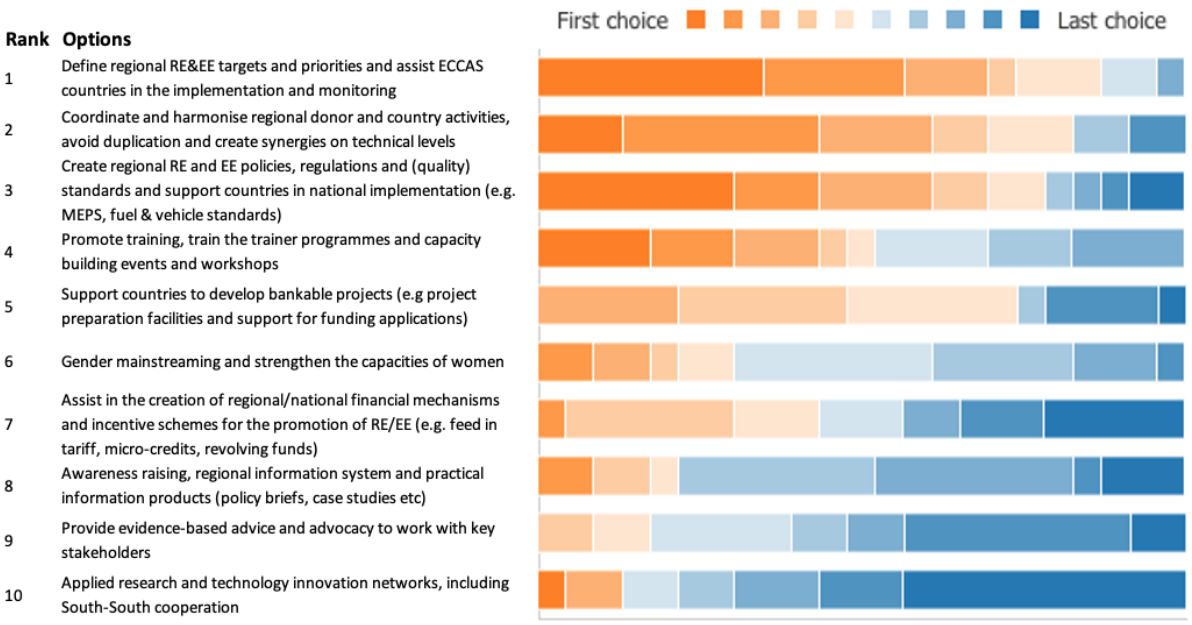


Figure 13: Priority ranking of regional intervention/services of CEREEAC

Respondents most commonly noted that they would like to see CEREEAC assist in definition of regional RE and EE targets and priorities, the coordination and harmonisation of regional donor and country activities and capacity building- Support in the development of bankable projects and the creation of regional/national financial mechanisms and incentive schemes for the promotion of RE/EE and to support countries in the development of climate mitigation programmes to be submitted to international climate fund, scores in the middle, suggesting that finance issues are at the forefront of the region's priorities.

Although there were no areas which were least popular, advocacy work to fix market distortions, the creation of policy briefs and other the knowledge sharing products and applied research and technology innovation networks were the one that ranked the lowest.

3.2.6 Please prioritise the sectors for RE/EE interventions

The following figure shows the sector ranking attributed by responders for RE and EE interventions. The three highest ranks respondents want the CEREEAC to focus on are the off-grid sector, the industrial sector, residential and the commercial sector. This fits with the challenges of people across the region whether in the city or in rural areas and also, in terms of the industrial sector, represents enormous opportunity for the introduction of RE and EE measures which have a big impact on the supply of energy to industry. Industry is also important for economic prosperity and jobs.

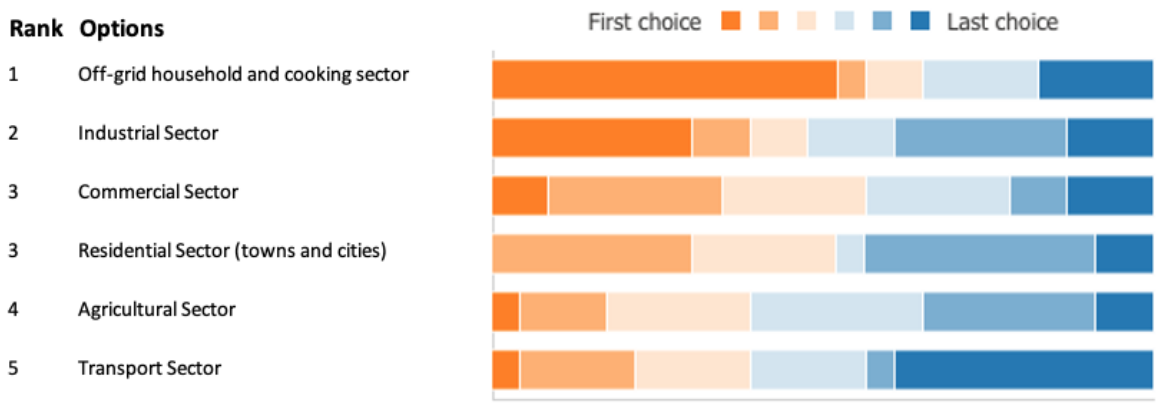


Figure 14: Sector priority for RE and EE interventions

3.2.7 In which areas CEREEAC should not work as it is already covered on national level or by other ECCAS institutions, programmes or projects?

Although there are no clear patterns emerging in terms of statistics from this question, qualitative feedback suggested that there is no areas that are totally off-limits from the respondent but that the CEREEAC should remain in close collaboration with Ministries to coordinate the work of the Centre and ensure there is no overlap.

It was also noted (by Cameroon) that regulation of the energy sector is not required as this is already dealt with. This is the case with most countries although there is still an argument to say that CEREEAC could play a coordination or advocacy role in this space.

3.2.8 How do you see the Centre assisting with the current and future RE and EE efforts in your country?

The general view given by respondents was that the centre would play an important role given the critical nature of RE and EE to the region. There were positive requests for aspects including assistance with master plans, standards and quality, training and human capital, strengthening capacity and awareness raising. One respondent did note that EE should perhaps be a focus given it is still further behind RE and that the private sector is already playing a bigger role in RE.

3.2.9 Which measures/actions could bring faster results and increase confidence in CEREEC in the short-term?

Again, there was a general view that the CEREEAC should focus on the range of barriers in place currently holding RE and EE back related to finance, technology, regulation, policy and capacity. A number of specific measures and ideas were suggested by respondents, as listed below:

- Capacity building and regional workshops, including online training.
- Project preparation support for bankable projects as well as support for a TA facility.
- Defining policies and incentives for RE and EE
- A regional database to outline products, suppliers and costs.
- Promotion of solar or hybrid plants in remote and rural areas.
- Promotion of the region as an attractive area for investing in RE and EE.
- Build consensus and drive the adoption of national and regional RE targets.
- Promotion of the use of quality equipment's.
- Raise financing, recruit the right human resources and ensure standards are respected.
- Promote technology transfer

There was no clear single action or actions which were supported by a number of different respondents.

3.2.10 Do you agree with the current name of the proposed centre, the 'Centre for Renewable Energy and Energy Efficiency of ECCAS', which in French is the *'Centre des Energie Renouvelable et Efficacité Énergétique de la CEMAC* (CEREEAC)'? The acronym by which the centre will be referred to in all languages is CEREEAC.

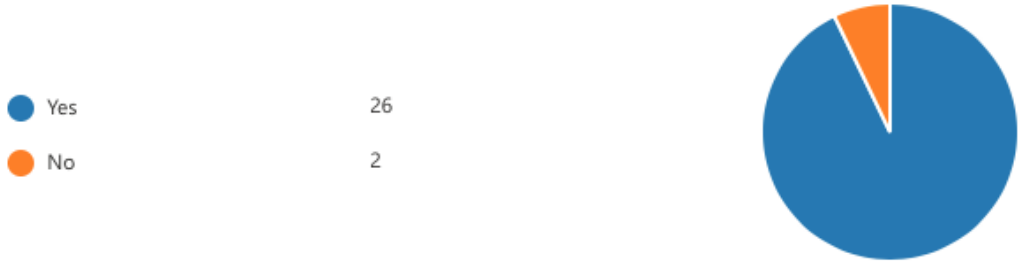
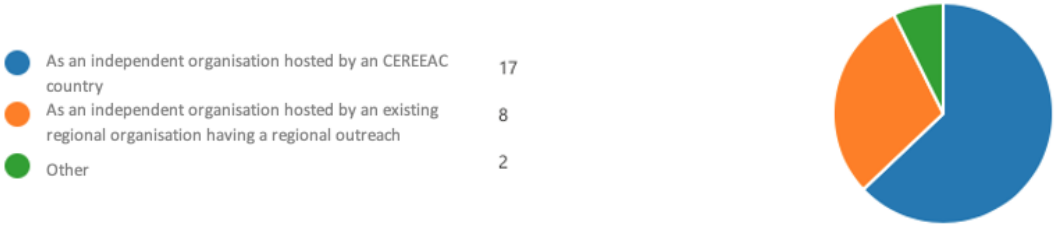


Figure 15: Name of the Centre

There was clear consensus from respondents on the name in English and in French with 'CEREEAC' to be used as the acronym in all languages. Two responders proposed two different names:

- One respondent wanted the word 'promotion' to be included in the name – i.e. Centre for the Promotion of Renewable Energies and Energy Efficiency in Central Africa. Given the mandate of the CEREEAC is set to be wider than this, the alternative name should not be considered.
- Another responder thinks that the link with ECCAS/CEEAC should be more evident on the name and thus proposed that the Centre would be called: "ECCAS Centre for Renewable Energy and Energy Efficiency" and in French "*CEEAC Centre des Energie Renouvelable et Efficacité Énergétique*".

3.2.11 In your opinion how should the Centre be set-up?



More than 60% of the respondents to this question wanted the CEREEAC to be an independent organisation hosted by a CEREEAC country. This is in line with many of the GN-SEC centres around the world. Around a third of respondents felt the organisation should be hosted by an existing regional organisation (e.g. CAPP, ECCAS etc). Interestingly, all those who wanted an alternative configuration suggested that given the Republic of Congo was already establishing a centre of excellence for RE and EE, it could perhaps expand its scope and take on the regional responsibilities of CEREEAC.

3.2.12 Countries and/or organisations to host such a regional centre

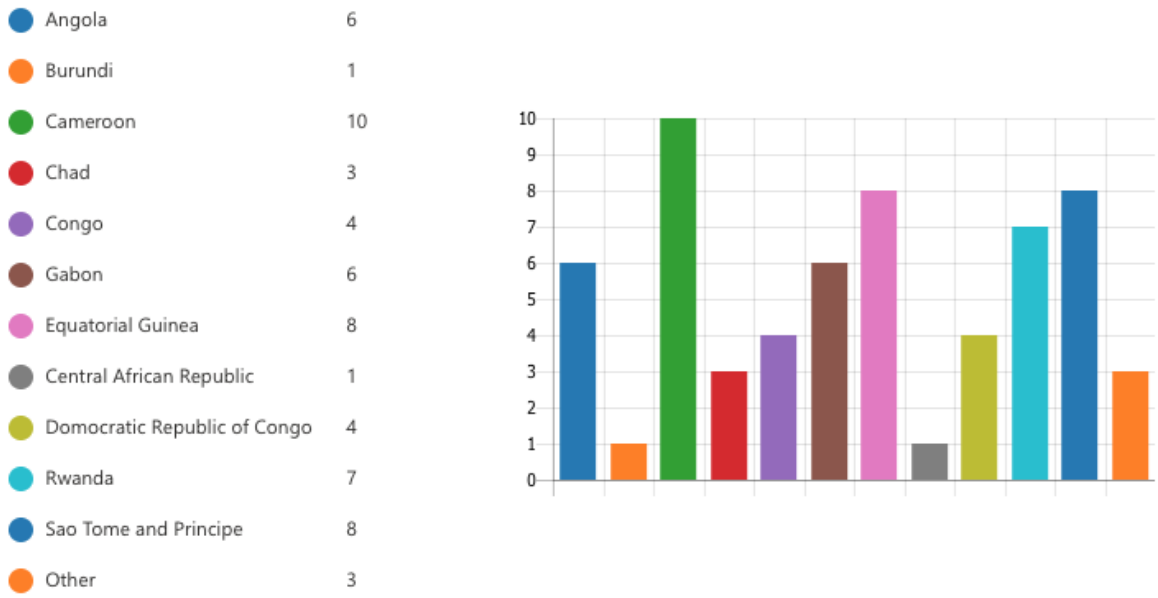


Figure 16: Countries to host the Centre

As it can be seen from the figure above, there was a broad range of views around who could host the centre. There was, however, a clear preference for Cameroon, Equatorial Guinea and São Tomé e Príncipe. There was no clear second choice among the respondents. One interesting point was that respondents didn't tend to be partisan and didn't often select their own country to host the centre. Note that respondents were asked to select three countries/organisations in order of preference for this question and given inconsistencies in the way respondents marked this question we scored each preference with equal weighting. We do not think this made a material difference to the overall result.

3.2.13 Would your country be willing to host the Centre? (Question to Government representatives only)

Despite not suggesting they host the country in the previous question, when asked directly, three countries did say they would be willing to host the CEREEAC – São Tomé e Príncipe, Republic of Congo and Cameroon. Only one country, Angola, did not want to host the centre while the rest were unsure or didn't respond.

3.2.14 Would your country be willing to provide support to the Centre? (Question to Government representatives only)

Most countries declined to answer this question, perhaps as it may require more detailed consideration or sign-off from Ministers – particularly in offering financial support. However, São Tomé e Príncipe, Cameroon, Burundi and Angola both offered in kind support.

3.2.15 How can it be ensured that CEREEAC responds to the needs of ECCAS countries?

A wide range of views were presented by respondent to this question with no general consensus. This included:

- The organisation structure needs to be robust to respond to challenges
- The Governing bodies should have Government representation from Energy Ministries and Civil Society.
- Encouraging energy trading between states.

- Supporting a range of technologies, from commercial schemes to off-grid and across electricity and heat/cooking.
- Should work to support NGOs as well as technology suppliers.
- Should get involved at the feasibility stage of projects (which could be viewed as further support for a TA facility or PPF).
- Responding to the challenges set out by the SDGs.
- Through building the capacity and sharing of knowledge.
- Adequate funding for set up and initial running costs (including resources to hire adequate human resources)
- Inclusion of the Centre within the ECCAS structure
- Good structuring and serious field studies.
- Substantial funding by states and partners
- Through the assignment of specific objectives to the Centre; provision of appropriate human resources; respect its independence

3.2.16 In your view which stakeholders should be represented in the governing bodies of the centre?

Most respondents to this question noted the importance of the involvement of Governments and focal points for the CEREEAC. This fits well with the existing model of GN-SEC organisations elsewhere and it is encouraging that Governments see themselves as being important in the functioning of the Centre.

Other feedback from respondents included a request to involve the following stakeholders:

- Donors and development agencies
- Scientific and research institutions
- Engineers
- Private sector businesses and professionals
- Target groups and beneficiaries

4. Barriers for RE&EE markets in ECCAS

4.1 Introduction

With the SDGs, the global community has committed to work towards a new global business model that incentivises an increased production of goods and services required to meet the needs of a growing world population, while using fewer resources and producing less waste and pollution at the same time. There is a trend towards circular economy policy concepts against the background of the increasing scarcity and price volatility of raw materials, including fossil fuels, as well as the need to internalize the costs of environmental externalities, such as air, soil and water pollution and climate change caused by global greenhouse gas emissions.

The deployment of RE&EE products and service is considered by ECCAS as an effective tool to tackle economic/industrial productivity and competitiveness, energy security, energy access/affordability and negative externalities of conventional energy systems (e.g. GHG emissions, local pollution) simultaneously and in an integrated way. In this context, also developing countries have introduced far-reaching targets for scaling-up SECT markets (e.g. NDCs) throughout the next decades. Most of these efforts are closely aligned with economic, industrial and environmental policies targeting increased competitiveness, productivity, inclusiveness, sustainability and resilience to climate change impacts.

By looking at the moderate growth rates of RE&EE markets in many developing regions, including ECCAS, it becomes obvious that SDG-7, SDG-9 and SDG-13 cannot be attained by 2030 in business-as-usual scenarios. There is an urgent need to accelerate the market development in order to reach economies of scale. Despite growing investments in RE&EE over the past decade, markets have not reached economies of scale particularly in least developed countries (LDCs) in Sub Sahara Africa.

Key economic and industrial sectors in ECCAS face challenges, when it comes to availability and use of RE&EE quality products and services (e.g. manufacturing, construction, agriculture, food-processing, tourism, transport, waste management, desalination, water and sanitation). The increased supply and use of RE and EE products and services remains hindered by a broad range of barriers and shortcomings related to policy and regulation, fiscal and non-fiscal incentives, technical limitations, economics, finance, capacity, quality infrastructure, R&D and innovation frameworks, knowledge and awareness.

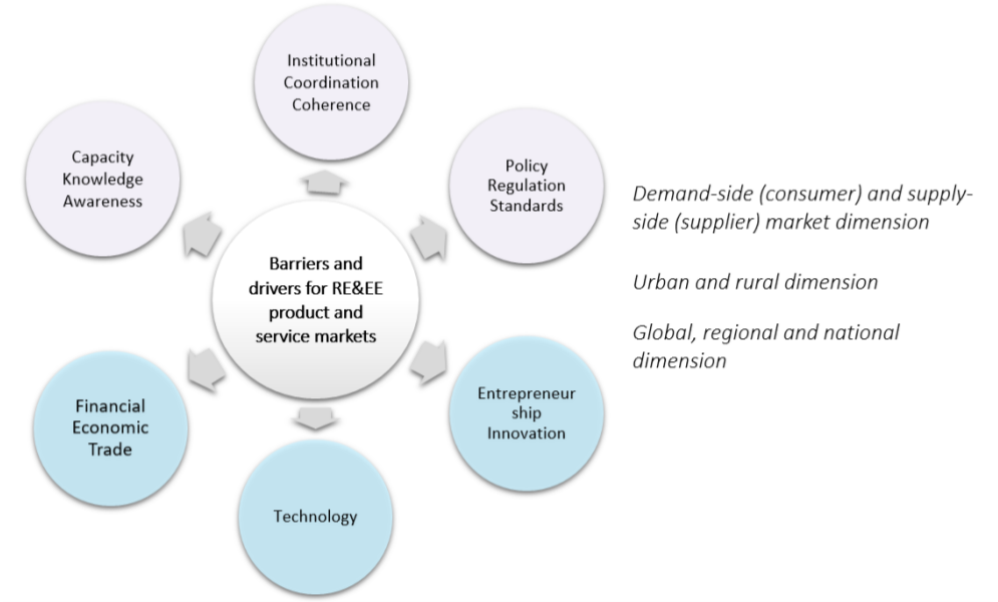


Figure 17: Barriers for the uptake of integrated and inclusive sustainable energy technology markets[40]

4.1.1 Lack of regional institutional capacity and cooperation

The experience of the GN-SEC has demonstrated the potential contribution of regional cooperation to accelerate the energy and climate transition.

Regional partnerships, cooperation and integration between countries, including the private sector and civil society, can be an effective tool to address some of the existing demand and supply barriers for RE&EE market development. Integrated markets, which follow joint standards and a common framework, are an important prerequisite to reduce investment risks and foster trade with RE&EE products and services. However, for several reasons, the regional level has been ignored and remains a missing link in the international sustainable energy and climate cooperation. It has not bused systematically as a (cost-effective) tool to promote equal progress, coordination and economies of scale.

Regionally, the energy transformation tends to remain uncoordinated between countries and common barriers and opportunities are not addressed jointly for the benefit of all. Duplication, fragmentation and lack of agenda-setting on a regional level often lead to inefficient use of international funding and opportunity costs. Simultaneously, global climate agreements and funding instruments face implementation challenges due to the limited national absorption capacities and the absence of regional arrangements.

[40] Based on UNIDO practical experience

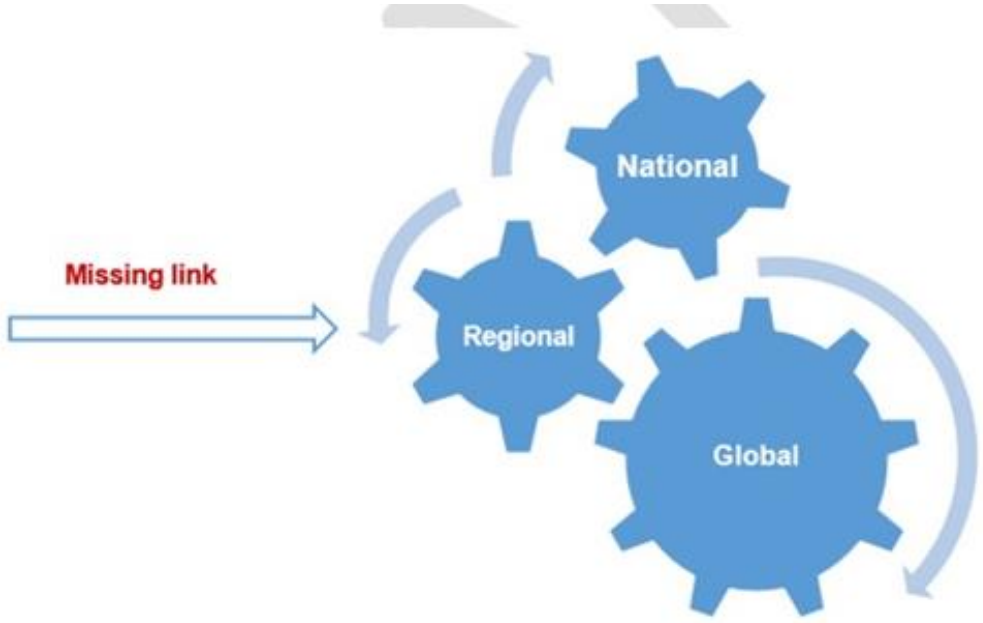


Figure 18: Regional cooperation as the missing link of sustainable energy and climate cooperation[41]

In many parts of the developing world, including ECCAS, the institutional capacities to coordinate and promote regional sustainable energy cooperation and integration are weakly developed. The traditional regional organisations/communities and their energy institutions (e.g. regional utility organisations and regulators) are dealing with wider energy and/or interconnection issues and often focus more on traditional energy sources (e.g. gas, coal, large hydro). In most cases, regional organisations lack of resources and capacities to overlook and monitor complex political and technical sustainable energy policy and implementation processes.

Therefore, the ECCAS institutional capacities in the RE&EE sector need an urgent strengthening. There is need for a technical arm to coordinate the efforts to implement regional policy commitments (e.g. CEMAC White Paper and Energy Policy 2035, ECCAS Green Economy and Renewable Energy Vision, ECCAS Vision 2025). The current situation tends to support donor driven approaches and agenda setting. There is a need for a stronger use of local implementing systems (e.g. procurement) and experts (e.g. consultants, companies). A regional entity is needed to ensure projects coordination on a technical level and to avoid duplication of efforts and loss or resources. The ownership and local setting of the agenda and priorities need to be strengthened.

There is a real need for a regional coordination system/entity that considers specific characteristics of individual territories and provides solutions that maximize individual and regional strengths and reduces individual and collective vulnerabilities. This could have a large scope of applications, ranging from knowledge transfer between countries, to intra-regional electricity transfer to promote regional energy security. In addition, timely implementation of RE and EE initiatives could be supported by coordinating best practice approaches and highlighting the scope for rapid implementation, where such opportunities exist.

That is, established frameworks focusing on electricity generation, transmission and distribution need to be established at a regional level so that individual countries can take advantage of combined opportunities for exploiting RE and EE potentials and improving economies of scale. Another interesting area for the involvement of the centre might be the EE area of preventing gas flaring. The major petroleum producers in Central Africa (Angola, Equatorial Guinea, Republic of Congo, Gabon and Cameroon) have begun to take initiatives for avoiding gas flaring, and instead recover the gas for domestic use and/or export. Moreover,

[41] UNIDO GN-SEC rational

there is demand for a hub, which advices on technology transfer issues, including the fostering of access to new technology innovations (e.g. digitalisation, frontier technologies) at fair terms.

4.2 General barriers

Despite the potential RE&EE contribution to resolve some of the most pressing energy challenges in the region, markets for these products and services remain largely underdeveloped. This is mainly due to unfavourable market environment and bottlenecks that are faced by the different market players. The desktop review and needs assessment has identified some of the key challenges/barriers to the development and expanded use of RE and EE technologies in the region, which the establishment of the CEREEAC hopes to address, as presented below.

4.3 Specific barriers identified

Taking into account the desktop assessment and the consultative needs assessment results, Table 8 shows the specific challenges and opportunities for adoption and development of sustainable energy in the ECCAS region, and thus the areas where the Centre may assist the MS. More detail on these is provided below. Much of the information on the table, particularly around policies and regulations, is based on the World Bank's Regulatory Indicators for Sustainable Energy.

Table 8: Summary of specific identified barriers[42]

	Policy and Regulation					Capacity Building			Coordination & Information					Investment				
	No long-term national targets for RE	No long-term national targets for EE	Inadequate electrification plan	Inadequate RE regulations	Inadequate EE standards (labelling, energy codes etc)	Lack of capacity in regulators and utilities to regulate or liberalise markets	Lack of educational options for RE and EE	Skills gaps (entrepreneurship, management and/or technicians)	Absence of RE/EE agency	Absence of RE or EE trade association	No national database of existing and planned developments	No national constraints maps (e.g. grid constraints, environmental considerations etc)	No national database of available support from Govt or donors	Lack of consumer affordability for energy	Inadequate Government incentives or subsidies to encourage investment	Utility has poor creditworthiness	Lack of financing mechanisms for RE	Lack of financing mechanism for EE
Angola	·	·	·	·	✓	✓	✓	✓	✓	✓	✓	✓	✓	·	✓	✓	✓	✓
Burundi	✓	✓	✓	✓	✓	·	✓	✓	✓	✓	✓	✓	✓	✓	·	✓	✓	✓
Cameroon	·	·	·	·	✓	·	✓	✓	·	·	✓	✓	✓	·	✓	·	✓	·
Central African Republic	✓	·	✓	✓	✓	·	✓	✓	·	·	✓	✓	✓	✓	✓	·	✓	✓
Chad	✓	✓	✓	✓	✓	·	✓	✓	·	·	✓	✓	✓	✓	✓	✓	✓	✓
Republic of Congo	·	✓	✓	✓	✓	·	✓	✓	✓	·	✓	✓	✓	✓	✓	✓	✓	✓
Democratic Republic of Congo	✓	✓	✓	✓	✓	·	✓	✓	✓	·	✓	✓	✓	·	✓	·	✓	✓
Equatorial Guinea	·	✓	·	✓	✓	·	✓	✓	·	·	✓	✓	✓	✓	✓	✓	·	·
Gabon	·	·	·	✓	✓	·	✓	✓	✓	·	✓	✓	✓	✓	✓	✓	✓	✓
Rwanda	·	·	·	·	✓	·	✓	✓	·	✓	✓	✓	✓	·	·	·	·	✓
São Tomé and Príncipe	·	✓	✓	✓	✓	✓	✓	✓	·	·	✓	✓	✓	✓	✓	✓	✓	✓

[42] Developed with RISE (https://rise.esmap.org/), needs assessment questionnaires and desk-based research from country profiles.

4.3.1 Barriers related to policy and energy planning

The desktop research and needs assessment revealed **that energy access is often mentioned in general energy policies, and most MS have energy access targets established**, although they are mainly related to electricity access and thus do not include access to modern clean fuels and technologies for cooking as well as not all having universal access targets stipulated yet. **Thus, there is room for improvement to mainstream energy access priorities into energy planning and policy conversations at a national level, as well as to define universal energy access targets that include both electricity and modern clean fuels and technologies for cooking.**

ECCAS MS have set up overall targets for RE but the existent policy framework is still incipient. The RE policies are very general and lack sub-division by technology and are still in the initial stages of development and thus need to be backed up by policy, fiscal and financial incentives to promote real investments and create a vibrant market for use of these technologies. The area of small and medium-sized grid-connected RE plants as well as off-grid developments in different sectors (e.g. commercial, industry) need a further boost. **There still exists a broad range of barriers which need to be addressed, in order to take full advantage of the existent RE potentials.**

EE policies are far less defined by ECCAS national governments than the RE ones, with only a couple strategic plans in place with clear ambitions and targets, and very limited incentives. A lot needs to be done in terms of EE, from the demand side and the supply side. EE can have a significant role in reducing the energy demand of the region as well as reducing inefficiencies at both the supply and consumer side. But, **similarly to RE, in order to take full advantage of the EE potential a broad range of barriers need to be addressed.**

In fact, the ECCAS region would benefit from a similar exercise as the one that was carried out in the ECOWAS region, a process that would support the development of national RE and EE action plans, SEforAll Action Agendas and Investment Prospectuses.

There are some international partners' programmes and projects that **assist some of the ECCAS MS in addressing some of the remaining RE and EE barriers** (e.g. coordination, policy advisory, (pre-) investment support for projects). Through the ECCAS Green Economy and Renewable Energy Vision, the ECCAS Vision 2025, as well as the CEMAC White Paper and Energy Policy 2035 sets up the **common regional vision for the development for universal access to modern energy services and economic and social development working on three guiding principles: good governance at a regional, national and local level; energy security and the development of renewables; and equality, inclusivity and poverty reduction**. Development Finance Institutions (DFIs) such as the African Development Bank (AfDB), USAID and European Union Africa are supportive of sustainable energy projects, but a lot more funding is needed to contribute towards the implementation of the regional vision.

The development and execution of policy, legal and regulatory framework for RE and EE can be seen as one of the priority areas of intervention for the CEREEAC, particularly given the number of policy gaps identified in the country profiles work undertaken. Furthermore, it is clear from feedback form the questionnaires that an enabling framework is lacking across many of the technologies also discussed. This is also confirmed by the World Bank's RISE indicators as well as our own review of policies and regulations across the region, underlining that the requisite legal and regulatory framework is yet to be established in support of the existing energy policies. Specific policy gaps/barriers identified across different research methods include:

- **Weak enabling framework:** The lack of tailored policies, as well as regulatory and legal frameworks in the ECCAS region, is a key constraint for the wider usage of RE and EE technologies. Most of the efforts made in the region are still insufficient to make a difference, for various reasons:
- Lack of evidence-based energy planning and scenario development
- While there are existing drafts or final energy policies that have been identified, **there is a noticeable deficiency as it relates to clear sustainable national energy action plans/road maps and supporting policies/legislation** that would be expected to provide the enabling environment for the development of RE and EE projects. CEREEAC presents an opportunity to coordinate a policy review and assist in setting concrete roadmaps and action plans. **Inadequately defined policy**

targets: As identified by the targets set in some documents reviewed, some of these policies may need to be refined to ensure that the defined targets are achievable and actionable. Moreover, policies are mostly not gender sensitive. Regional policies are also outdated and need to better reflect reductions in prices of emerging technologies, such as solar and wind, and the role they can play in the mix alongside hydro.

- **Oversight of the RE and EE policies to make sure they are adequate, coherent and aligned with policies for other sectors** like, education, health, agriculture, trade and industry is necessary. In some cases, policy statements have largely remained broad statements of intention and have not been guided by evidence-based analysis. Essentially, policies have tended to be monolithic, focusing just on the energy sector, yet renewable energy is a cross-cutting issue, where there is a clear need for linkages with other sectors, such as agriculture, health, education, etc. For example, **the existing subsidies to fossil fuels** are one of the key constraints to investments in RE and EE. The existence of mechanisms such as the fuel surcharge also reduces the attractiveness of RE projects to the utilities. The subsidies undermine the principle of cost-recovery.
- This could be addressed by **considering other SDGs and how energy can relate and contribute to them** and the region's other goals. For example, SDG 9 in relation to industrial development or SDG 2 in relation to ending hunger and by relation, increasing sustainable agriculture practices.
- There is also a **lack of specific policies relating to key aspects of RE and EE development**, for example renewable heating and cooling, with the focus tending to be on electricity. This is an issue globally, and not just in Central Africa. Similarly, although there is a recognition that energy access is crucial, there is a lack of specific policies and regulations geared towards solving rural energy problems and realising rural energy opportunities. As well as key barriers, opportunities in digitisation and innovation of RE and EE could also be addressed with specific targets or incentives. **Existing RE and EE support policies in many cases are considered insufficient by the private sector:** Project developers usually require financial support from bilateral and multilateral institutions, in the form of grants and concessional loans, to pass the different stages of project development. Moreover, they do not often consider EE improvement as a complementary activity.
- In most countries, practical issues such as **applicable feed-in tariffs and technical standards for power generation do not address all RE technologies** and often are not clear regarding the connection costs.
- Governments often **lack the capacity to design clear and effective tenders/auctions** for energy projects. Although some of the ECCAS countries have Power Purchase Agreements (PPAs) established, there is no regional PPA and the PPAs established vary from country to country. Moreover, the region lacks capacity to guide negotiations between utilities and IPPs and potential investors.
- There are **weak or no minimum energy performance standards** for new buildings, building renovations, appliances, lights, air conditioning and refrigeration among other items – this was confirmed by respondents to the survey. This leads to uncertainties in standards and a lack of willingness to invest due to risk, particularly from institutional or international investors.
- In most countries, the **import of RE equipment remains highly taxed and labelling standards for appliances or building codes are not in place**.
- Lack of supply-side orientation of RE&EE policies, standards and incentives addressing energy entrepreneurship and innovation – e.g. manufacturing, assembling and servicing and lack of policies to promote RE/EE in rural/urban industrial sectors There is a general recognition in ECCAS policies that RE and EE policy can benefit gender issues and assist in providing opportunities and greater equality for women and girls, for example. However, there is a **lack of specific policy targeting at maximising the benefits of E and EE for gender issues**.

As well as the policy barriers and addressing these, there is a need to ensure there is accountability and enforcement of these aspirations at the national and regional level. Although ECCAS does not have the ability to set binding targets for member states the forum should be used to showcase where policies are well-functioning and to also highlight regions and countries which require more assistance.

4.3.2 Knowledge and Awareness Barriers

Stakeholders/General public sometimes do not possess sufficient RE AND EE knowledge and awareness to make informed decisions. As such, there is a definite need for advocacy, awareness raising, information dissemination and stakeholder engagement efforts. Several respondents to the questionnaire noted that campaigns, particularly around clean cooking. External support is required in order to effectively engage stakeholders and obtain their buy-in. This support is usually required to be in the form of an objective and authoritative voice that can provide informed, relevant and expert advice, based on up-to-date empirical data. For example, stakeholder engagement support and awareness activities may be required in issues related to cooking but also other complex issues such as electricity tariffs, entrepreneurial advice and setting business models. The CEREEAC will have to build a reputation as a trusted advisor to be able to play this role and also bring in support from a range of expert partners.

Incomplete and decentralized regional data collection, compilation and analysis: There is a lack of data among most countries in Central Africa. Where data is collected it is decentralised and not coordinated regionally. In most cases in ECCAS, pertinent data is yet to be collected on a consistent basis. If the region is to collectively move forward, these efforts need to be coordinated at a regional level so that relevant comparisons, possible collaborative ventures and mutual support between countries can be identified and implemented. In essence, there is a need for energy information compilation, energy statistics and analysis to facilitate strategic planning and effective decision-making at a country, sub-regional and regional level. Currently, there is no gender-specific data available, making positive interventions in this area more challenging.

Lack of feasibility studies for RE and EE assessments and projects (technical Assistance (TA and Project Preparation Facilities): There was a clear trend among respondents that additional support for TA and project preparation is required. The CEREEAC needs to strike a balance between setting policies and roadmaps and also providing practical interventions to develop projects on the ground, thus increasing the sense of a practical contribution to the region and recognizing economic progress as well as political progress. Again, there are many organisations who already support project preparation that are involved in other GN-SEC institutions so there is knowledge to be shared here.

Lack of knowledge of frontier technologies and innovation e.g. digitalisation in policies

4.3.3 Financial Barriers

The RE and EE market in most of the ECCAS countries is nascent or emerging, and in some cases in the very early stages, and a range of support mechanisms are required to promote growth and investment within the market. Potential investors or project promoter are confronted with barriers and high investment risks. The specific needs of individual countries in the form of finance and investment are as follows:

RE and EE market structure not (fully) defined: There is little or no data to suggest how the individual markets and the collective regional market can grow. As such, there is a need for market definition and sustainability guidelines as well as showcasing clear examples of proven business models through case studies and knowledge sharing. ECCAS does not present itself as an interesting market to invest in RE&EE.

Inadequate support mechanisms for increasing the market share of RE and EE. In some countries, RE and EE potentials remain largely unexploited and untapped. This is on account of several reasons relating to location of the resources, investment costs and lack of technical expertise and local capacity. However, in many instances it is on account of the fact that market drivers are lacking. For example, tariffs for RE projects are sometimes too low, discouraging market growth. In other instances, there is not enough knowledge of the grid networks to understand if adding capacity can be added. This speaks to a need for these kinds of studies to be done to inform the market potentials within the various markets.

Inadequate low-interest and innovative financing programs: There is a definite need for low-interest financing mechanisms, “Pay as you Save Programs” and other innovative financial mechanisms and incentives for small and large enterprises operating/seeking to develop RE/EE projects. Specific barriers for women entrepreneurs to access credit will also need to be considered and addressed by new financing

mechanisms. There is also a requirement to support rural energy schemes to try to act as proof of concepts and cover current risks (e.g. guarantees, insurance) .

Inadequate financial policies: Policy and regulation needs to be developed to provide financial incentives for RE and EE initiatives. This will help to stimulate growth and investment within the industry.

Local companies and industry are currently not taking sufficiently advantage of the growing sustainable energy market, interest from investors and job opportunities. There is a need for strengthening the capacities of the local private sector to promote entrepreneurship. Although we do not have specific data – it is very likely women are underrepresented in the ECCAS energy market.

Limited data is available for linkage industries/sectors, such as agriculture, transport, food storage, etc. which tend to be large energy users and offer opportunities in remote regions. Limited baseline studies have been carried out in most energy using industry sectors within the region, but respondents highlighted this as a potential growth area.

Markets still not liberalised: Utilities ECCAS are still vertically integrated in some instances, combining generation, transmission and distribution. There are instances where the state- owned utilities are regulated by the Government. This can be seen as a conflict of interest on the part of the utilities in terms of dealing with independent power producers. Furthermore, this acts as a disincentive to private sector investment if there aren't clear terms and market rules in place.

Inadequate framework to promote foreign direct investment and private participation in the RE/EE sector

Metering: A number of respondents mentioned the need to control metering, improving energy efficiency and ensuring utilities are properly compensated to allow for future growth.

Apprehension in making new investments: The economic slowdown due to COVID-19 will have led to a slow-down in investment, but it is the case that sustainable investments have performed better over the period and should feature as part of the recovery process.

4.3.4 Barriers related to qualification and certification

Regional capacity, particularly as it relates to development of RE and EE projects is limited, and many respondents called for mass training and capacity building across technologies. As the region lacks this capacity, external capacity, in the form of imported labour, is usually brought on to support project implementation. One of the concerns with this type of arrangement is that knowledge transfer is typically very limited and so local capacity is not enhanced or developed. The capacity challenges/barriers were outlined as:

- **Lack of qualification and certification frameworks for products, services and personal** – also related to quality infrastructure – lack of data on the status and lack of regional cooperation between vocational and academic institutions – lack of applied research in partnership with businesses (e.g. clusters)
- **Lack of technical capacity to formulate and implement policies:** In some instances, governments and regulators lack the resources to formulate consistent sustainable energy policies and regulations in line with the local environment and social aspects. This is frequently due to the limited number of persons in these institutions but also due to lack of technical skills – which are often found in utilities, but less so in Government.
- **Inadequate project development and implementation expertise:** Similar to other regions in Africa, within the region, several energy projects have failed/stalled on account of a range of issues relating to environmental, social, technical, and/or financial factors. For example, assistance (human resource, technical, legal, financial, administrative) in developing RE and EE solicitations understanding and evaluating RE and EE proposals is required so that the best proposals are chosen to meet the specific needs of the individual country and/or region. Coordination on a regional level can play an important role to strengthen national efforts.

- **Limited existing local capacity in both public and private sectors to develop and sustain local RE and EE technologies:** In many cases, personnel need to be trained/retrained, in order to effectively implement projects. There is a need for continuous training and development to upgrade staff skills and capabilities.
- **Brain drain:** Local trained human resources may migrate (outside the region) to seek better opportunities. There is a need for programmes focused on succession planning and that minimises attrition rates and engender capacity retention. A fast-growing sector is one way to stop brain drain as opportunities continually emerge.
- The distinct differences in the geographical, environmental, cultural and social aspects in the region make it difficult to create a **one-size-fits-all approach**. This is an issue when developing capacity-building activities and selecting appropriate technologies and business models for different countries.

In fact, **technical knowledge is required to establish a critical mass of policy makers, project financiers and engineers who will be able to manage all aspects of sustainable energy development**. For successful dissemination, it is necessary to foster trained manpower capable of developing and manufacturing equipment and offering energy services. The following table summarises some of the identified capacity requirements of the different stakeholder groups.

Table 9: Capacity requirements of various stakeholders' groups

Stakeholder group	Capacity needs
Policy makers in the renewable energy and energy efficiency sectors and the energy sector in general.	• Developing and operationalize coherent, comprehensive and evidence-based policies, laws and regulations that create a level playing field for RE and EE technologies • Implementing existing policies and rural energy planning • Negotiating PPAs with IPPs and setting viable feed-in tariffs
Policy makers from non-energy sectors like agriculture, health, water, private sector, transport sectors etc.	• Basic design of RE systems • Integrating RE and EE components into their projects • Operation and maintenance of RE and EE systems
Entrepreneurs, project developers, equipment manufacturers, consultants and industry support bodies	• Development of vocational and higher education courses adapted to the RE AND EE requirements of the region • Identifying, developing and packaging a pipeline of potential RE AND EE investment projects • Negotiating viable PPA with policy makers • Preparing business plans that are consistent with existing financing mechanisms • Identifying and developing potential carbon financing projects • Carrying out environment and social/gender/poverty impact assessments for proposed projects to comply with established legal requirements • Manufacture high quality equipment that complies with set standards • Labelling the performance of electrical equipment • Mobilizing and structuring investments in RE and EE projects • Carrying RE and EE projects financially, technically and overall project management
Financial institutions and other financial services providers	• Assessing risks of potential RE and EE projects • Providing innovative financing products (ESCOs, guarantee funds, micro credits) that are suitable to the financing needs market actors who sell, finance, install and maintain these technologies • Bundling small-scale projects to reduce transaction costs and achieve scales that justify investments

	• Financing RE and EE projects that qualify for carbon financing • Setting up and taking part joint financing mechanisms that bring together private capital and public funds
National institutions such as rural electrification agencies, energy commissions, sustainable energy promotion centres, investment and trade promotion organizations, etc.	• Providing effective support services to market players • Matchmaking local investment opportunities with potential investors • Carrying out awareness raising programmes on RE and EE • Identifying potential RE and EE projects • Carrying out environment and social/gender/poverty impact assessments
Utilities	• Ability to tender RE and EE projects • Negotiate PPAs • Integrate a significant share of RE generation in their energy mix
Recipients/buyers of energy services and technologies	• Willingness and ability to pay for the services or technologies • Ability to assess the energy implication or cost in daily choices and decisions such as selecting electric equipment

4.3.5 Technical barriers and limitations

There are significant technology gaps, particularly as it relates to the use of advanced energy technologies. Maintenance of equipment is another area for which assistance is required, as some countries do not have a good history of repair and maintaining equipment. There has been the perception, among some respondents that training and knowledge would need to increase before being able to take advantage of modern technologies, especially those requiring more complicated operation and maintenance schedules, such as biomass plants, biofuel production, or just in general more modern technology to run the grid networks efficiently. Additional gaps/barriers include:

Need for technology and knowledge transfer. Technical knowledge and capacity transfer within and between countries is necessary so that individuals embarking on new RE/EE initiatives can learn from those who have already successfully implemented such projects. That is, south-south and north-south technology and knowledge transfer is required to spur growth and development.

Need for demonstration projects. Demonstration projects are required to highlight the benefits of EE & RE technologies that are yet to use on a large scale in the region. This is to be supported through donor financing and capacity development.

Need for quality standards. The presence in the market of low-quality equipment can lead to a negative uptake of RE technologies. Consumers need to be educated regarding the options when purchasing equipment. It is also urgent to address waste management issues once the equipment reaches the end of its intended life cycle.

Climate resilience of infrastructure and impacts limit use of certain technologies (e.g. hydropower)**Grid Readiness:** The infrastructure for integrating RE into the existing grids is seen as an area of need. These activities would need to be coordinated with CAPP but there is clearly still demand from respondents to the questionnaire. A grid that can feed back information to the grid operator and at the same time be adaptable is the ambition to reach but that is not currently feasible in most of the region. The readiness of the grid would also support the uptake of electric vehicles, where it was seen in most countries as a desirable need.

Inefficiency of the existing grid: the existent grids are generally characterised by high electricity losses, load shedding and blackouts. The overall efficiency of the power systems needs to be tackled, so that the ECCAS countries can fully make use of the explored potential.

Low grid stability: The reliability of some ECCAS power systems is low due to lack of investments in the generation, transmission and distribution networks. Adding intermittent sources of energy, as is the case of the majority of RE sources such as solar and wind, could contribute to further interruptions in the grid when the power plants are not able to meet the demand.

Land use/availability on the ECCAS islands: Land in small islands is limited as its use is often sensitive. As most RE technologies require significant land usage, investors can be weary of projects that entail land acquisitions/leases. This is particularly a challenge for grid-connected PV and wind power projects.

4.3.6 Barriers energy entrepreneurship and innovation

In most ECCAS MS exists an inability of the domestic private sector to supply RE&EE quality products and services under competitive prices. The domestic manufacturing and servicing sector remain weakly developed and the growing demand remains underserved by international suppliers and supply chains due to high market entry costs and risks. Moreover, policies and technology transfer programs tend to focus on creating demand for RE&EE products and services and tend to ignore supplier-oriented actions focused on strengthening domestic innovation systems, productive industrial capacities and entrepreneurship. SECTs are often not considered systematically as priority in industrialisation strategies.

The absence of an equilibrium between demand and supply leads in some countries to high and hindering prices for RE&EE products and services. Such trends raise also concerns regarding the inclusiveness of technology transfer processes. This offers opportunities, but also bears the risk that the local value and job creation effects of such investments remain low and are not sustained in the long run. In ECCAS even basic equipment and services (e.g. consulting, energy auditing, installation, and maintenance) continue to be imported.

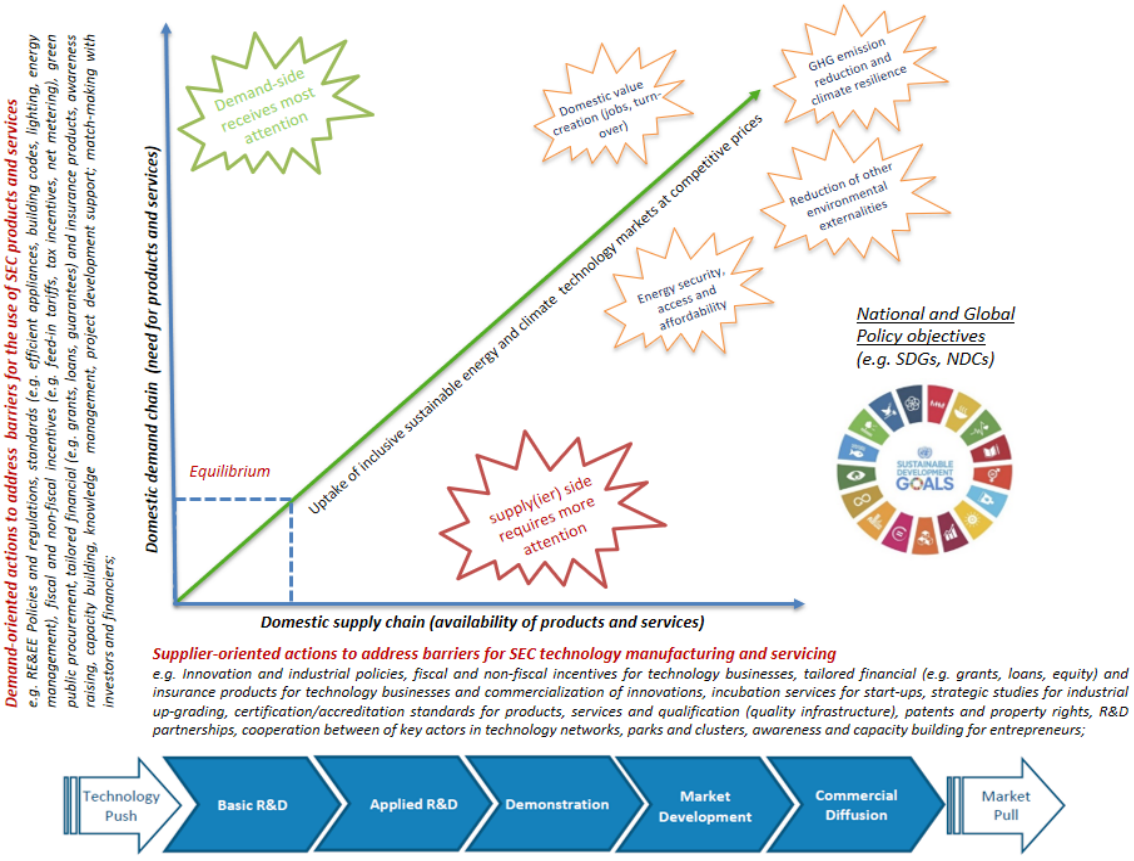


Figure 19: An inclusive ECCAS market for RE&EE products and services requires demand- and supply(ier)-side actions[43]

The absence of domestic suppliers and service providers puts into question the long-term sustainability of already undertaken RE investments in ECCAS (e.g. lessons learned from mini-grids and public solar lighting projects in Sub-Sahara Africa). The lack of domestic R&D and entrepreneurship hinders the

[43] UNIDO, Lugmayr

commercialisation of RE&EE solutions adapted to the local realities and needs. There is a lack of IPPs and energy prosumers combining for example agricultural activity with energy production (e.g. food processing plants). In general, there is need to promote RE&EE systematically in key industries in ECCAS.

The number of local RE&EE manufacturing and servicing companies is very limited in some countries and associations remain weak or are not existing. There are hardly RE&E incubation programs for start-ups in place. Moreover, RE&EE associations are weakly organised and there are no cleantech cluster and/or acceleration programs. Therefore, public interventions and finance is required to work towards a balanced demand and supply-side approach when it comes to the promotion of RE&EE markets.

The ECCAS centre has an important role to set policies, standards and local content requirements, which consider the interest of the domestic private sector, and maximises local added value of the energy transition in terms of turn-over and jobs. Moreover, the centre could run relevant programs on behalf of the regional and strengthen local cleantech associations, clusters or incubation/acceleration programs. In this context, UNIDO programs such as the Global Clean Tech Program (GCIP) or the BLOOM Clean Cluster Program might be interesting.

Add some further text if u have – e.g. opportunities for entrepreneurship in ECCAS

4.3.7 Gender gap

The energy sector in most of the countries, specifically for highly technical occupations, tends to be comprised of primarily males. In terms of gender participation gaps, there is a real need for initiatives that target females and that help to remove the perception that the energy- sector jobs are primarily for males. Moreover, with a growing demand for sustainable energy, it is expected that there will be a need for trained labour to fulfil the demand for experienced and skilled technicians at various levels, capable of designing, developing, installing, operating, and maintaining, and managing RE and EE projects. This represents an opportunity to foster the participation of women in this nascent sector by entering the labour force and by helping them become entrepreneurs/creating new businesses.

It is women who suffer the most from conditions of poverty, because of their responsibilities for collecting fuel and water for the household. Reduced drudgery for women and increased access to non-polluting power for lighting, cooking and other household and productive purposes can lead to dramatically improved effects on women's levels of empowerment, education, literacy, nutrition, health, economic opportunities and involvement in community activities. These improvements in women's lives can, in turn, have significantly beneficial consequences for their families and communities.

5. Justification for and added value of the centre

The analysis conducted revealed **that the existing regional institutional support framework is not prepared to support MS effectively to reach the established RE and EE targets**. There is an urgent need for enforced regional technical and institutional capacities to assist the Governments and the ECCAS effectively to implement the established policy commitments. This goes hand in hand with the need for better technical coordination, donor harmonisation and assurance of long-term sustainability of project interventions as well as documentation of lessons learned. The assessment has identified a common understanding that some soft barriers for RE AND EE can be addressed more effectively and at lower cost through regional approaches and methodologies in the ECCAS. The centre is expected to be a key partner and facilitator of sustainable energy project initiatives.

The assessment **identified major regional thematic opportunity gaps** in the areas of capacity development, knowledge and data management, awareness raising as well as investment and business promotion in the sustainable energy sector. Growing sustainable energy investments and the introduction of appropriate regulations and standards go hand in hand with the need for local institutional capacities and qualified human resources. There is a need to create a sustainable energy market from which **the local private sector**

and industry can take advantage of. Also, this will bring additional social and economic benefits to the MS such as health improvement, increased job opportunities, etc). If no critical mass is created to operate in the created sustainable energy market, the long-term sustainability of existing and future investments will be endangered as they are often conducted by external enterprises without local representations (e.g. it is often the case in Africa that sustainable energy projects are implemented with external support and once the external support leaves and there is an issue with the project, the project is abandoned as there no in-country knowledge to assess and solve it).

The **creation of a specialised regional RE AND EE promotion agency under the umbrella of the existing institutional and decision-making framework of ECCAS is recommended**. The centre will address RE and EE holistically and in an equal way. The centre will act as a **think-tank and hub for sustainable energy** and will play a key role in creating economies of scale and a competitive sustainable and gender sensitive energy market and business sector. It will address existing barriers and strengthen drivers through regional methodologies and tools. All the centre's activities shall demonstrate high relevance for the local private sector and industry. It will act as a central service provider for the development and implementation of SDG-7, SDG-9 and SDG-13 related activities. Moreover, it will work closely with the other regional sustainable energy centres in Africa and establish a platform of knowledge exchanges on sustainable energy-related issues. The centre and its interventions are fully in line with the priorities of ECCAS. Climate change adaptation and mitigation was identified as one of the priority activities.

The centre demonstrates local ownership and will **work according to the local rules under the umbrella of ECCAS decision making process and policy framework**. The centre has a technical mandate and action and service-oriented operations. It will work closely with the ECCAS Secretariat's and Council of Ministers. It will provide the ECCAS Secretariat and other local and international partners with the required technical implementation and execution capacities. To ensure ownership **UNIDO suggests the execution of a competitive selection process be launched for determining the host country of the Centre's Secretariat**. ECCAS Member Countries (and opt-in countries) would be invited to submit offers in accordance with the proposed draft format and selection criteria included in the annex of the project document. The host country will need to provide co-funding support (e.g. costs of office and operational costs) and grant the centre relevant diplomatic rights and immunities.

The institutional set-up of CEREEAC reflects the principles of **maximising the impact, avoiding duplication of efforts, strengthening and up-scaling of already existing local capacities**. CEREEAC will develop and **execute its activities through a network of National Focal Institutions (NFIs) and Thematic Hubs (THs)** among all ECCAS countries. **The centre will be guided by an Executive Board (EB) and a Technical Committee (TC)** which will be established during the Preparatory Phase. The centre will work on the basis of a long-term business plan and annual work plans.

CEREEAC **complements and strengthens ongoing national/regional activities** in the areas of policy and capacity development, knowledge management and awareness raising, as well as investment and business promotion. CEREEAC will position itself as a regional RE and EE promotion agency rather than an implementer on micro-and grass-root levels. To **maximize the local added value** the execution of specific assignments or services will be, in many cases, delegated to national institutions and/or the private sector. In general, the Centre is expected to perform only up to the level of programme/project development, fund raising, oversight, quality assurance as well as coordination, monitoring and evaluation of project/programme implementation. CEREEAC will establish a network of Thematic Hubs (THs) and delegate certain tasks to existing national institutions, which have the capacity to serve the entire region in this specific area (e.g. solar thermal).

The **centre will demonstrate a strong local identity, employ local staff and operate in all relevant local languages** (e.g. English, French and Portuguese). It will be strengthened through the secondment of temporary international experts (e.g. UNIDO). The small initial staff structure will expand gradually in accordance with the mobilised funding. During the First Operational Phase the centre will **reach financial sustainability** through core funding from donor partners, ECCAS, local partners, the host country, mobilised project funding and provision of remunerated services. During this phase, ECCAS MS will not be expected to make monetary contributions to the Centre.

The following added value of CEREEAC shall be highlighted:

- **Regional Agenda Setting, Coordination and Coherence**: There is a common understanding that a coordinated regional approach is a cost-effective way to boost existing drivers and address barriers for sustainable energy investments and markets in the ECCAS. The centre will become the official voice of the region on RE&EE and climate issues in international policy and decision-making process. It will also work towards inclusive technology transfer modalities, which will open up opportunities for local entrepreneurs and businesses.
- **Support for Emerging Technologies**: The centre will particularly focus on integrated RE and EE projects, programs and activities. The centre will also deal with sustainable energy areas that do not get a lot of attention (e.g. waste-to-energy, sustainable transport, sustainable cooking, solar thermal heating and cooling, sustainable energy storage systems). It will strengthen existing national organisations to have a regional outreach. It will assist national institutions to develop regional programs and projects with other partners to be presented to international donor partners.
- **Improved access to sustainable energy services**: The Centre will focus on improving access to sustainable energy services, which are adapted to the local environment and social factors. The Centre will assist the private sector in tapping the existing market potential for mini-grids (in countries where this is relevant). Training to local companies will be provided to facilitate the identification of appropriate technologies and business approached which take into consideration the needs of the population. Businesses will also be prepared to assist the local populations in engaging in productive activities in order to generate an income to safeguard the long-term sustainability of the projects.
- **Energy Planning Support**: Energy planning within this context refers to the process of developing long-range policies to help guide the future of a local, national and regional energy systems. The Centre will utilise methodologies and modelling tools for energy systems to support decision-making in the priority area of transition planning for the deployment of sustainable low carbon technologies and their supporting infrastructures within ECCAS countries.
- **Finance and Legislation Support**: The Centre will focus on the identification of mechanisms to eliminate barriers and gaps that currently retard or prohibit the development of suitable regulatory systems and fiscal policies which can provide greater incentives for the development of sustainable renewable energy and energy efficiency markets within the realities of the ECCAS economy.
- **Project Planning and Management**: The Centre is expected to support and execute renewable energy and energy efficiency activities and projects within ECCAS countries, focusing primarily on activities and projects with regional impact or national projects which demonstrate high potential for scaling-up or regional replication.
- **Policy Advocacy and Awareness**: It is apparent that the current economic situation and its impacts on the ECCAS have made it difficult for policymakers to sufficiently focus on the medium-term strategies that are required for sustainable economic development; this is exacerbated in countries that are constrained by limited technical capacity within the public sector. The Centre should seek to address market distortions that unreasonably "discriminate" against sustainable energy systems and serve to increase their cost relative to conventional sources. Advocacy for appropriate policies, and simultaneous awareness building on the issues identified, is deemed important to "re-balancing" of the regional energy markets.
- The Centre **will work with its partners in order to identify sources of finance for RE and EE projects** that directly benefit local companies.
- The Centre **will train local experts** (men and women) and companies in the installation and maintenance of RE and EE systems and equipment through regional train-the-trainers and certification programs. The training will be associated to certification programme(s) to promote quality and the long-term sustainability of projects. The centre will work and provide training materials in the local languages.

- The centre **will promote south-south knowledge and technology transfer** with other centres through the GN-SEC facilitated by UNIDO and with SIDS DOCK when it comes to islands. Islands share some challenges and potential for sustainable energy solutions that differ from land-locked countries and in ECCAS, both exist, and so solutions will have to take care to recognise the diverse set of challenges.
- The Centre will **pay a special focus to the development of EE**: it will assist local research centres in the development and promotion of energy efficiency standards, qualification and certification of local companies
- The Centre will have a very important **role on knowledge gathering and dissemination**. The Centre will be an active repository of sustainable energy information (such as existent potential, policies and incentives) as well as for sustainable energy project information and studies for the region. Also, it will have a key role in the assessment of capacity needs and establishment and dissemination of capacity building activities in this area. The maintenance of a physical centre with regional core staff is expected to address this.
- The centre will **contribute to the strengthening of the human capital of ECCAS and its institutions in the area of sustainable energy**. The Centre will be able to respond to requests from governments seeking to implement projects and develop and execute energy policies more effectively. There is also a wide field of possible cooperation with other institutions in the region. The capacities need to be strengthened particularly regarding RE grid integration and demand side and supply side efficiency.
- The application of **train-the-trainer approaches** can facilitate national follow-up activities and regional research projects can strengthen the capacities of universities and vocational centres with regard to the development of adapted technologies. This will contribute to the creation of a critical mass of professionals acting in the sustainable energy field, that is crucial for building a sustainable market for this type of products and services.
- The centre can contribute to **sustainable energy data quality, harmonisation and reliability** in the region and **improving the accessibility** for local key market enablers to RE and EE information. CEREEAC has partner already with IRENA in the development of the renewable energy roadmap and during the preparatory phase of the centre already collected information available in terms of EE. The CEREEAC expects to continue to cooperate with IRENA and other institutions in the collection and validation of data in the sustainable energy field.
- The barriers for the dissemination and usage of sustainable energy technologies are common among the different ECCAS MS. Through regional knowledge exchange, lessons learned, capacity building and awareness raising, individual MS countries can learn from existing experiences in the region.
- The experience of the European Union (EU) has shown that regional standards for equipment and training can be a useful tool to facilitate the adoption and implementation of RE and EE technologies at national levels (e.g. EU Directive on RE and EE). The introduction of minimum quality standards and labelling for RE and EE equipment or appliances can be more effective than introducing isolated and non-harmonised rules on national levels. In other neighbouring regions, such as the SADC and EAC, a project is being implemented that works on it (the EELA project), and some of the ECCAS countries are also included on it (as some of the ECCAS countries belong as well to the EAC and SADC regions). The Centre will work try to expand/replicate the existing projects EELA project to the ECCAS region.
- The establishment of a **specialised institution for RE and EE helps to coordinate ongoing activities in the region on access to energy and capacity building activities**. The CEREEAC in cooperation with ECCAS shall become an early check-point for determining the relevance of regional and local level initiatives and programmes.
- Regional cooperation can also be an effective tool to facilitate the expansion of sustainable energy markets being transformed into local added value, businesses and jobs in the ECCAS. For example,

regional cooperation in the field of applied research and manufacturing can contribute to the strengthening of local business sector.

- The creation of the centre is fully in line with the Paris Declaration on Aid Effectiveness and the principles of donor harmonisation and alignment with local country systems. The centre will apply local regulations and proceedings (e.g. procurement, financial rules) and employ exclusively local staff from the ECCAS. The CEREEAC will contribute to the creation of a strong sustainable energy network in the region, contrary to some ongoing donor-driven initiatives in the sustainable energy sector which do not make use of local capacities and procedures.

Annex: ECCAS Country Profiles

5.1 Angola

Population	Electricity Access [44]
• Total Population [45] (2018): 30.81 million inhabitants Total Population (2015): 27.88 million inhabitants • Rural Population [46] (2018): 10.63 million inhabitants Rural Population (2015): 10.19 million inhabitants	• Population with Electricity (2018): 43.26% (73.68% in urban) Population with Electricity (2015): 42.00% (64.00% in urban and 3.82% in rural) • Electricity consumption per capita (2014)[47]: 312.23 kWh per capita per year

5.1.1 Laws and Regulations

Policies to promote Renewable Energy, Energy Efficiency and Energy Access

Type	Legislation	Implemented or in Discussion	Main content	Responsible Institution
Renewable Energy	New Renewables Strategy	Implemented	Strategic goals for improving access to electricity through grid connected renewable energy technologies as well as promoting and accelerating public and private sector investments in new renewable energies	Ministry of Energy and Water (Ministério da Energia e Águas, or MINEA)
	Biofuels Law (2010)[48]	Implemented	Mandates for producing biofuel[49], regulations on the use of ethanol and fiscal incentives for ethanol producers	Ministry of Petroleum (MINPET)
Energy Efficiency	NA	NA	NA	NA
Energy Access	Angola Energia 2025 (Angola Long Term Strategy)	Implemented	Increasing electricity coverage to 60% by 2025	MINEA
	New Renewables Strategy	Implemented	Activities that will support the rural development and that relieve them from poverty, as	MINEA

[44] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=AO
[45] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=AO
[46] https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=AO
[47] World Bank Database. https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=AO
[48] Law on Sugar Cane Production for Biofuels (Law No.06/10). https://www.iea.org/policies/5847-law-on-sugar-cane-production-for-biofuels-law-no0610
[49] Under this law, foreign companies producing biofuel must sell part of it to the state-owned oil firm Sonangol

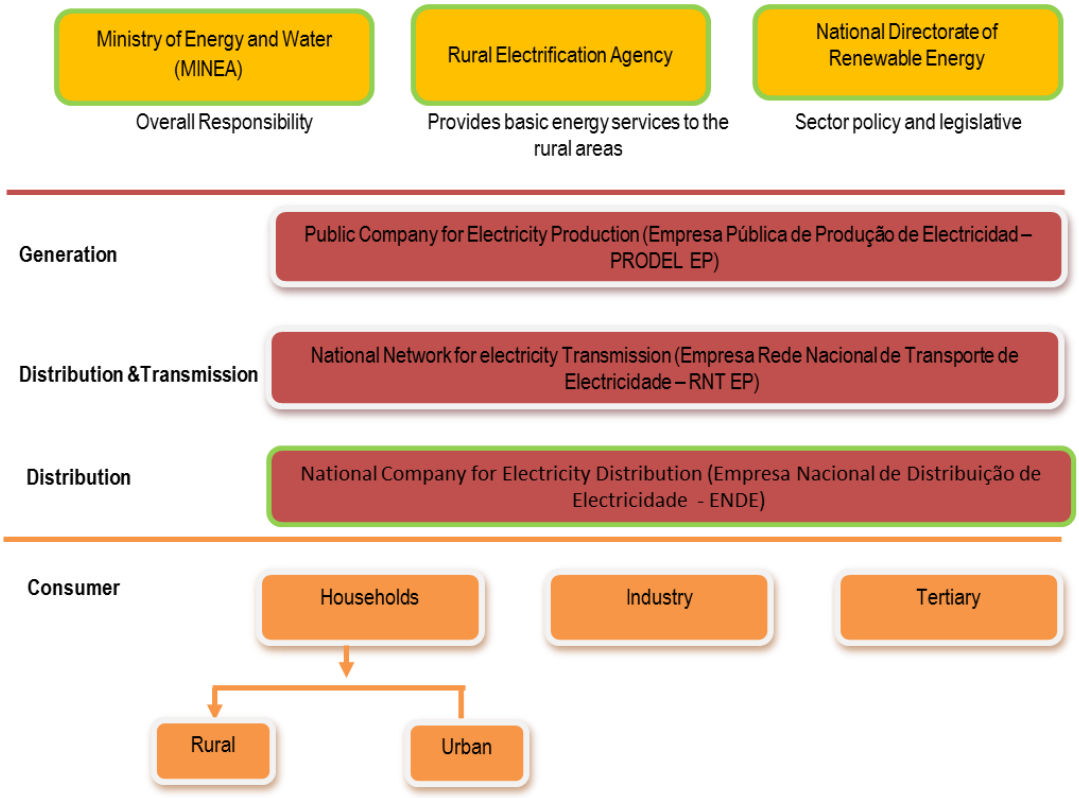
Type	Legislation	Implemented or in Discussion	Main content	Responsible Institution
			well as to guarantee that communities living in non-electrified areas may access to safer and better-quality energy sources	
	White Paper for a Regional Policy for Universal Access to Modern Energy Services and Economic and Social Development (2014)	Implemented	Sets out targets for electricity access, renewable energy and energy efficiency to achieve by 2030 in the ECCAS countries.	Ministers of Energy of the ECCAS (Economic Community of Central African States)
Cross-Cutting Policies	Intended Nationally Determined Contribution (INDC) of the Republic of Angola (2015)	Implemented	Outlines targets and strategy to reduce GHG emissions up to 35% by 2030. Also includes mitigation and adaptation contributions along with sectoral plans for implementation	MINEA
	Policy and Strategy for National Energy Security (2011)	Implemented	Strategic guidelines for the energy sector including policy reformation across 6 areas- generation park growth; usage of renewable energies; electrification and grid expansion; tariff review and economical and financial stability; restructuring and strengthening power operators; promotion of private capital and capacity building	
	General Electricity Act (2014- approved in 2015)	Implemented	Outlines responsibilities of all public sectors involved in generation, distribution, transmission, and commercialisation of electricity, including those from RE projects (with >1 MW capacity or less if serving more than 50,000 citizens)	
	General Environmental Law (1998)	Implemented	Outlines the principles for the protection, preservation and conservation of the environment and use of natural resources. Also provides for mandatory Environmental Impact Assessments (EIA) for all undertakings	
	Angola Energia 2025 (Angola Long Term Strategy)	Implemented	Global strategic objectives in development of the power sector and includes the 2013 - 2017 Action Plan for Energy	MINEA

Type	Legislation	Implemented or in Discussion	Main content	Responsible Institution
	National Strategy for Climate Change (2008)	Implemented		
	Organic law on justice and human rights	Implemented		Ministry of Justice and Human Rights
	Gender policy	Implemented		Ministry of Social Action Family and Women Promotion

Note: NA- Not Available

5.1.2 Institutional Setup

The various ministries/agencies looking after the different components across the energy generation and distribution value chain for Angola is given below:



The Ministry of Energy and Water (MINEA) is responsible for the overall coordination of activities in the energy sector and for the strategies, planning and monitoring of the implementation of the different programmes. The ministry also plays an important role in attracting private sector investment and coordinating support of development partners. It is also responsible to ensure that the development of policies and strategies concerning national infrastructure are in line with regional integration and harmonisation policies.

The Public Company for Electricity Production (PRODEL- Portuguese acronym) is responsible for electricity production in Angola. National Network for electricity Transmission (RNT- Portuguese acronym) is

responsible for electricity transmission. National Company for Electricity Distribution (ENDE- Portuguese acronym) holds the responsible for electricity distribution.

The Ministry of Energy and Water oversees distribution of power and water in Angola. It is responsible for proper management of electricity infrastructure, gas, petroleum products, water and sanitation and coordination of all activities related with programmes aimed at development and exploitation of energy sources.

5.1.3 Renewable Energy Market Benchmark and Potentials

RE Target for 2025[50]: Goal of 800 MW, with a share of 500 MW in biomass and 100 MW for each of the other sources (wind, solar and small hydropower plants). Increase installed production capacity by 9 900 MW by 2025 using 66% water sources, 19% natural gas sources and 8% renewable energies.

Installed capacity (MW) [51]	Generation (GWh) [52]
• RE Installed capacity (2018): 2 763 • Non-RE installed capacity (2018): 1 761	• RE generation (2017): 7 897 • Generation from fossil fuels (2017): 3 086

RE Potential Identified (MW)[53]

Hydro (Large/ Medium / Small)	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal
6 732	438	NA	681	NA	640	NA

Note: NA – Not Available

5.1.4 Energy Efficiency Market Benchmark and Potentials

EE target: Improvement of Energy Efficiency by 1% yearly (SEforAll Action Agenda for Angola)

- Angola Energy 2025 seeks to introduce energy efficiency measures including improved transmission and distribution or power and efficiency in energy use in residential and agricultural communities.
- Angola New Renewable Energy Strategy has a target of 100,000 improved cookstoves and efficient solutions for productive uses of energy in agriculture.
- The national Rapid Assessment and Gap Analysis (RAGA) Report on Sustainable Energy[54] (SEforAll) further expands the context for energy efficiency at the national context, discussing national targets for universal LPG access by 2025 and a host of other measures.
- At regional level, Head of State of Angola has adopted a White Paper for a Regional policy for Universal Access to Modern Energy Services and Economic and Social Development (2014 – 2030), which was produced under the aegis of ECCAS (October 2014), and officially adopted by Heads of State in the ECCAS N'Djamena Conference (Decision no. 52/CEEA/CCEG/15).
- The White Paper has identified targets for the region across RE, EE and overlapping topics such as electrification and LPG use. Although these targets are applicable for all countries in the ECCAS fraternity, targets for EE are explicitly reflected in the RAGA report for Angola. These include:

[50] Angola Energia 2025, Angola Power Sector Long Term Vision
[51] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Angola_Africa_RE_SP.pdf
[52] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Angola_Africa_RE_SP.pdf
[53] Intended Nationally Determined Contribution (INDC) of the Republic of Angola, November 2015
[54] https://www.seforall.org/sites/default/files/l/2015/05/Angola_RAGA.pdf

- Reduce to a third, the level of energy losses;
- Increase efficiency in public buildings by 25%; in new buildings / houses by 50% by 2030;
- Progressive phaseout of inefficient technologies: incandescent lamps to be phased out by 2020;
- To have all urban households and 90% of rural households dependent on biomass for domestic uses (cooking), with efficient cookstoves, with at least 40% improvement (in thermal performance);
- To increase efficiency in charcoal production to 35%

In addition to these regional targets, the RAGA report for Angola has identified a few measures for addressing energy efficiency. These are:

1. Use of energy efficient light bulbs; and a programme for replacement of existing, inefficient light bulbs with efficient ones;
2. Use of prepaid meters will serve a dual purpose of improving revenue collection for ENDE (distribution utility) and also encourage customer to optimise electricity use;
3. Quality of distributed power in the capital Luanda and other provincial cities;

5.1.5 Energy Access

Energy Access Target: 60% of access to energy, with 70% sourced from renewable energy, by 2025[55]

- Angola National Census, 2014 highlighted that only about 32% of the Angolan population (1.8 million household) had a connection to a public power grid. In the urban areas, this share is 52% (1.7 million households), while in the rural areas it is only 2% (only 50,000 households).
- Ministry of Energy and Water (MINEA) aims to provide basic energy services to the people and has set a goal of increasing the percentage of population with energy access to 60% by 2025, with the main focus on electrifying rural areas that are not connected to the national grid.
- Angola's long-term strategy 2025, mentions about electrifying the remote areas with renewable energy sources such as small hydro, solar PV, and even non-renewable sources such as diesel-based generators, depending on the best technical and economically feasible solution, considering that the target population has low income. Therefore, rural electrification in Angola is foreseen under three implementation models:
  1. Rural electrification through grid extension- The network extension will allow, from the interconnected system, to electrify 174 locations and 1.7 million people by 2025
  2. Electrification through isolated systems- The electrification by means of isolated systems is considered for 31 localities, supplied through mini-hydro, diesel or solar
  3. Electrification through individual systems- creation of "solar villages" or small local networks in communal townships and settlements with more than 3,000 inhabitants.

Modern cooking target: Improved cookstoves target for Angola of 100% of population by 2030[56]SE4All Action Agenda.

[55] Angola Energia 2025, Angola Power Sector Long Term Vision

[56] Sustainable Energy for ALL, Africa Hub: Angola. https://www.se4all-africa.org/seforall-in-africa/country-data/angola/#:~:text=Angola%20electricity%20access%20reaches%20more,more%20than%2050%25%20in%202016

5.1.6 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	Angola Energia 2025	2018 - 2025	MINEA	Increase access to electricity by 60% by 2025, of which 70% will come from renewable energy sources. Increase installed production capacity by 9,900MW by 2025 using 66% water sources, 19% natural gas sources, 8% renewable energies, and 7% thermal energy
	Angola Renewable Energy programme		MINEA	Encourage private investment into renewable energy and reduce the country's dependence on fossil fuel resources. Long-term objective is to set up a dedicated framework that will act as a single entity for all future competitive procurement for independent power producers
	SEforAll action agenda	2014 - 2030	MINEA	>85% of RE in electricity production and 42% RE in final energy consumption by 2030
	Aldeia Solar (The Solar Village Programme)[57]	2013 - 2025	MINEA	Implement 100 MW solar PV in rural areas that are not connected to the main grid, with particular focus on public buildings. 505 solar photovoltaic systems (SHS) and 83 solar streetlights were installed, benefitting 100,000 families
	BIOCOM project	2014	Companhia de Bioenergia de Angola (BIOCOM)	Produce 100 MW of electricity from biomass sourced from sugarcane
	Mapping of the Winds and Solar of Angola		MINEA	Aimed at identifying the most suitable sites for the development of endogenous energy resources. Potential of 8,491MW of renewable sources were identified
	Lion Works Fund	2004 - ongoing	Lion Works Capital	USD 750 million private equity funds focussed on RE development
	African Development Fund	1974 - ongoing	African Development Bank (AfDB)	Long-term loans and grants up to USD 1.4 million in development of RE
	EU-Africa Infrastructure Trust	2007 - ongoing	European Union (EU) Africa	Interest rate subsidies, investment grants, equity or quasi-equity investments or participations

[57] Angola: Solar village of cabin. https://www.edp.com/pt-pt/angola-aldeia-solar-de-cabiri

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
	Sustainable Energy Fund for Africa	2012 - ongoing	AfDB	Grants USD 1 million to stimulate renewable energy investments in Angola
Energy Efficiency	'Vida, Energia e Eu' (English to: 'Life, Energy and Me')	2019	MINEA	Seeks to encourage energy efficiency in residential and public buildings
	SEforAll Action Agenda for Angola	2014 - 2030		Improvement of Energy Efficiency by 1% yearly
	SADC Project Preparation and Development Facility (SADC/DBSA)	2008 - ongoing	Development Bank of Southern Africa (DBSA)	Assistance in project identification, preparation and feasibility studies developing bankable projects to investors and lenders in development of power infrastructure
Energy Access – Mini-grids	National Programme for Rural Electrification of Rural Areas (PNER)	2008 - ongoing	MINEA	Access to electricity to 8 million people, 1.2 million households
	Energy Sector Efficiency and Expansion Project (ESEEP)[58]	2020	AfDB jointly with the National Electricity Transmission Network Authority (Rede Nacional de Transporte de Electricidade, RNT-EP), and the Angolan Power Distribution Utility (Empresa Nacional de Electricidade, ENDE)	Improve power quality and availability to "households, industries, businesses, small and medium sized enterprises in Angola, who will gain access to cheaper, more reliable and sustainable electricity from more than 1 GW excess power from the Northern part of the country
	SEforAll action agenda	2014 - 2030		83% population with access to grid connected electricity by 2030
	Power Africa	2015 - ongoing	USAID	Enable electricity access by adding 30 GW of new and cleaner power generation
Clean Cooking	SEforAll action agenda	2014 - 2030		100% population with access to clean cooking stoves and LPG by 2030

[58] https://www.afdb.org/fr/documents/gpn-angola-energy-sector-efficiency-and-expansion-program-eseep-phase-1

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Cross-Cutting	Transformation program for the Electricity Sector (PTSE- Portuguese acronym)			Ensure economic and financial stability of the sector and create opportunities for private sector investments through compensation regimes in PPAs and special feed-in-tariffs and creation of private ownerships of government energy generation plants, etc
	National Adaptation Programme of Action			

5.2 Burundi

Population	Electricity Access[59]
• Total Population [60] (2018): 11.18 million inhabitants Total Population (2015): 10.16 million inhabitants • Rural Population [61] (2018): 9.72 million inhabitants Rural Population (2015): 8.93 million inhabitants	• Population with Electricity (2018): 11.02% (61.67% in urban areas and 3.44% in rural areas) Population with Electricity (2015): 8.63% (57.38% in urban areas and 1.93% in rural areas) • Electricity consumption per capita: N/A

5.2.1 Laws and Regulations

Policies to promote Renewable Energy, Energy Efficiency and Energy Access

Type	Legislation	Implemented or in Discussion	Main content	Responsible Institution
Renewable Energy	Sectoral Strategy for the Energy Sector in Burundi (2011)	Implemented		Ministry of Energy and Mines
	Law 1/13 of 23 April 2015 reorganizing the electricity sector in Burundi	Implemented		Ministry of Energy and Mines
	Ministerial decree No 530/777 (May 2013)	Implemented	Established Burundi Renewable Energy Association (BUREA) as a non-profit organization with	Ministry of Energy and Mines

[59] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=BI
[60] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=BI
61 https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=BI

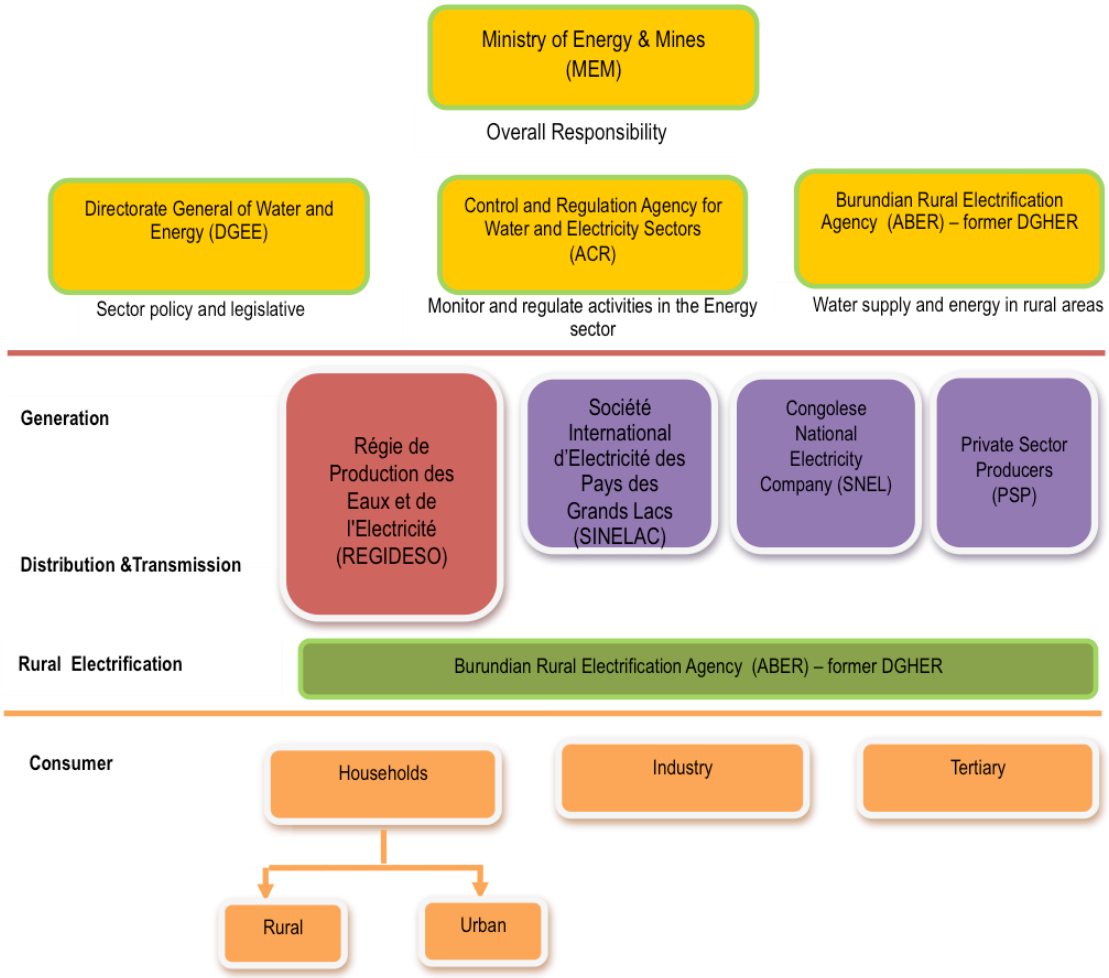
Type	Legislation	Implemented or in Discussion	Main content	Responsible Institution
			an aim to promote the accessibility and utilization of energy for all in Burundi	
Energy Efficiency	Vision Burundi 2025[62]	Implemented	Contains actions and goals that the government will take to assure sustainable development of Burundi until 2025. Specifically, it consists of context and challenges; objectives; pillars of vision; cross-cutting issues; and institutional framework	Minister in charge of planning and development
	National Energy Policy (Lettre de Politique Energétique Nationale)[63]	In discussion	Constitutes the coherent framework of interventions to guide the Government and coordinate actions in the following sub-sectors: Biomass, Petroleum Products, Electricity, Renewable and non-Conventional Energy, Governance	Ministry of Energy and Mines
Energy Access	Vision Burundi 2025[64]	Implemented	The document looks at 8 pillars of development[65] and recommends policies and strategies from the viewpoint of sustainable development. Aims to achieve 25% electrification rate by 2025	Ministry of Planning and Municipal Development (Ministère du Plan et du Développement Communal)
Cross-Cutting Policies	Intended Nationally Determined Contribution (INDC, 2015)	Implemented	Strategies to reduce greenhouse gas emissions by 3% by 2030. Specifically, for energy, the aim is to increase the national electrification rate to 35%	Ministry of Energy and Mines
	National Adaptation Programme of Action (NAPA, 2017)	Implemented		
	National Climate Change Policy (2012)[66]	Implemented	Vision, principles, objectives, and strategic actions for implementation of the national policy for combating climate change	-

[62] http://www.undp.org/content/dam/burundi/docs/publications/UNDP-bi-vision-burundi-2025_complete_EN.pdf
[63] http://www.eueipdf.org/sites/default/files/field_publication_file/EUEI_PDF_Burundi__Strat%C3%A9gie_%C3%A9nerg%C3%A9tique_Lettre_de_Politique_Jan2011_FR.pdf
[64] http://www.undp.org/content/dam/burundi/docs/publications/UNDP-bi-vision-burundi-2025_complete_EN.pdf
[65] These 8 pillars are: (i) Good Governance and Capacity Building of State; (ii) Human Capital; (iii) Economic Growth and Struggle Against Poverty; (iv) Regional Integration; (v) Demographics; (vi) Social Cohesion; (vii) Spatial Planning and Urbanisation; and (viii) Partnership
[66] http://bi.chm-cbd.net/implementation/questions-transectorielles/changements-climatiques-et-biodiversite/etude-de-vulnerabilite-et-dadaptation-aux/politique-nationale-sur-le-changement-climatique-au-burundi.pdf

Type	Legislation	Implemented or in Discussion	Main content	Responsible Institution
	National Strategy and Action Plan on Climate Change (2012)	Implemented		

5.2.2 Institutional Setup

The energy institutional framework in place in Burundi is shown in the figure below.



The Burundi's Ministry of Energy and Mines (MEM) has the overall responsibility for managing the energy sector and is also responsible for developing appropriate policies and regulations which are implemented through the Directorate General of Water and Energy (DGEE) and the Burundian Rural Electrification Agency (ABER). MEM is also responsible for supervising REGIDESO. According to the Investment Opportunities in RE in Burundi Report (MEM/UNDP, 2012) MEM would like to enhance its internal and technical capacity to be able to: directly evaluate and negotiate projects with private investors; and better support the development of these projects.

The main function of DGEE is to co-ordinate with MEM to prepare the energy sector policy, formulation of investment programs, controlling operation of the power utility and drafting the tariff policy.

The Control and Regulation Agency for Water and Electricity Sectors, created in 22 December 2011 by the Decree n.º100/320 has the main objective to ensure the development of an orderly and profitable water and energy sector in the Country. Its main functions are to control, regulate and monitor activities related to

water and electricity (ensuring contract compliance) as well as ensure implementation, monitoring and application of tariffs in accordance with pricing established by regulations.

ABER, on other hand, deals purely with the water supply and energy sector in rural areas. ABER, established as well in the 22 December 2011 Decree, has the main responsibility to: develop and implement rural electrification projects and programmes (RE projects and other energy access projects that can improve access to electricity for rural population) and thus manage the budget allocated for rural electrification programmes and other projects as well as the sales of electricity produced from rural facilities.

REGIDESO is responsible for managing the national electricity grid and for ensuring the supply of electricity and water in Bujumbura as well as in other 23 urban centres in Burundi. Another supplier of electricity is *Société Internationale des Pays des Grands Lacs (SINELAC)* which was established as a joint venture by Burundi, Rwanda and the Democratic Republic of Congo to develop and operate international electricity projects and supplies the electricity produced to REGIDESO.

5.2.3 Renewable Energy Market Benchmark and Potentials

Installed capacity (MW) [67]	Generation (GWh)[68]
• RE Installed capacity (2018): 57 • Non-RE installed capacity (2018): 51	• RE generation (2017): 273 • Non-RE generation (2017): 36

RE Potential Identified (MW)[69]

Hydro (Large/ Medium / Small)	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal
1700	NA	NA	NA	NA	NA	18

Note: NA – Not Available

5.2.4 Energy Efficiency Market Benchmark and Potentials

- There is no specific legal framework to encourage adoption of EE technologies exists in Burundi.
- The National Energy Policy Letter[70] guides the energy sector policy. It contains key objectives to aid the recovery and expansion of the energy sector.
- The Vision Burundi 2025[71] describes actions and goals that the government will take to assure sustainable development of Burundi until 2025. Although Vision 2025 did not specifically mention energy efficiency, improvement of energy efficiency could contribute to the objectives of improving the energy infrastructure for development of industry and services.
- National Climate Change Policy[72], established in November 2013, include promotion of energy efficiency through import/use of energy-efficient equipment[73] as one of the strategic actions.

[67] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Burundi_Africa_RE_SP.pdf
[68] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Burundi_Africa_RE_SP.pdf
[69] Renewables for Energy Access and Sustainable Development in East Africa, Hafner, Tagliapietra, Falchetta, Occhiali (2019) https://link.springer.com/chapter/10.1007/978-3-030-11735-1_3
[70] http://www.euei-pdf.org/sites/default/files/field_publication_file/EUEI_PDF_Burundi__Stratégie_énergétique_Lettre_de_Politique_Jan2011_FR.pdf
[71] http://www.undp.org/content/dam/burundi/docs/publications/UNDP-bi-vision-burundi-2025_complete_EN.pdf
[72] http://bi.chm-cbd.net/implementation/questions-transectorielles/changements-climatiques-et-biodiversite/etude-de-vulnerabilite-et-dadaptation-aux/politique-nationale-sur-le-changement-climatique-au-burundi.pdf
[73] https://practiceguides.chambers.com/practice-guides/alternative-energy-power-2019/burundi

- The World Bank's 'Energy efficiency project' has prepared an energy efficiency (EE) law that mandates an improvement in energy efficiency at the national level through use of more EE equipment in buildings; EE in transport sector; promotion of EE products and measures; implementation of periodic energy audits for the large consumers; and creation of an autonomous National EE Agency under authority of the Ministry of Energy and Mines responsible for the implementation of the EE Law.
- This project has also developed regulations regarding the import and sale of equipment and appliances, and the establishment of labelling program for appliances. However, these laws and regulations have not been approved by the Cabinet yet.

  Within the same project, 200,000 CFLs were distributed to households, administrative and government clients which led to substantial energy savings.
- Market research studies have indicated that residential sector is responsible for 51% of total energy consumption, followed by the tertiary sectors (hotels, hospitals, administration, SMEs, etc.) in Burundi. Household appliances are generally of poor quality and standards.
- The losses on the electricity network are close to 20% due to old and poorly maintained infrastructure.
- No consistent and coordinated government energy efficiency programs had been launched since the end of Burundi's long-term conflict.

5.2.5 Energy Access

Energy Access Target: 25% of access to energy by 2025[74]

- More than 80% of the population in Burundi resides in rural areas. The electrification rate in rural areas is less than 2%. Most of Burundi's energy supply (95 per cent) comes from hydropower.
- High dependence on hydropower makes the country vulnerable to climate extremes such as drought. For instance, during the 2009 and 2011 droughts, electricity supply was reduced by as much as 40 per cent[75] drastically affecting the economy.
- Solar energy is the most common off-grid electricity source in Burundi, although the number of systems installed is very low[76]. With the global price dropping of solar technologies a small solar sector emerged in the recent years, that offer smaller systems for private households, businesses, and public institutions. However, the market is very competitive, and the main activities are donor driven.
- Concerning the energy sector, the Vision has as a principal objective to ensure that by 2025 both the rural and urban populations have access to reliable, clean sources of energy and at competitive prices, and to provide energy in quantities sufficient for the industrial, artisanal and mining activities. Further efforts will be made to build hydroelectric power stations and invest in renewable energies.
- The REN 21 Report has specified renewable power targets for specific amount of installed capacity or generation for Burundi[77]. The targets have been set for Bio-power from solid biomass, Hydropower, Solar PV, and Wind power have been set as 4 MW, 212 MW, 40 MW and 10 MW, respectively. However, there is no fixed date mentioned for when these targets are supposed to be achieved.

[74] Vision Burundi 2025. http://www.undp.org/content/dam/burundi/docs/publications/UNDP-bi-vision-burundi-2025_complete_EN.pdf

[75] https://wedocs.unep.org/bitstream/handle/20.500.11822/20486/Energy_profile_Burundi.pdf?sequence=1&isAllowed=y

[76] https://energypedia.info/wiki/Burundi_Energy_Situation

[77] Renewables 2019 Global Status Report (Table R8. Renewable Power Targets for Specific Amount of Installed Capacity or Generation, 2018, Page 188). https://www.ren21.net/wp-content/uploads/2019/05/gsr_2019_full_report_en.pdf

5.2.5.1 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	Solar Electric Light Fund		Solar Electric Light Fund (SELF)	Invests in solar photo voltaic systems for public buildings such as health and education centres
	Solar Electricity service with Mini Grids in Africa-Burundi (SESMA-Burundi)			Project aiming to bring online the first 7 mini grids of the country (currently at the feasibility study stage)
	Sustainable Energy Fund for Africa (SEFA)	2012 - ongoing	African Development Bank (AFDB)	Grants USD 1 million to stimulate renewable energy investments
	Solar Energy Project for Rural Communities, or Nyakiriza project[78]	2020	International Development Association (IDA), World Bank	Grants USD 100 million to electrify 91,000 homes, 4,000 small businesses, 800 schools and 400 health centres via off-grid solar systems in rural areas
Energy Efficiency	Energy Strategy and Action Plan for Burundi[79]	November 2009 – April 2011	Ministry of Energy and Mining EU Energy Initiative Partnership Dialogue Facility (EUEI PDF)	Support the Ministry of Energy and Mines in developing a new national energy policy in line with the country's national poverty reduction strategy adopted in 2007
	Energy Efficiency Project[80]	2012 - 2015	The World Bank (WB) EIES	(i) to develop and adopt selected policy frameworks for energy efficiency and (ii) to selectively improve the energy efficiency of households and buildings in Bujumbura city
Energy Access – Mini-grids	Decentralized Rural Electrification Strategy[81]	2015 - 2017	Ministry of Energy and Mines	Plans to establish a National Agency for Renewable Energy and Energy Efficiency
Efficient Cookstoves				
Cross-Cutting				

5.3 Cameroon

Population	Electricity Access[82]

[78] http://www.eqmagpro.com/burundi-ida-grants-100-million-for-electrification-via-mini-solar-grids/
[79] http://www.euei-pdf.org/sites/default/files/field_publication_file/FF_EUEI_PDF_Burundi_Energy_strategy_Nov2009_EN.pdf
[80] http://documents.worldbank.org/curated/en/429781475270629365/Burundi-BI-Energy-Efficiency-Project
[81] Renewables for Energy Access and Sustainable Development in East Africa, Hafner, Tagliapietra, Falchetta, Occhiali (2019) https://link.springer.com/chapter/10.1007/978-3-030-11735-1_3
[82] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=CM&view=chart

• Total Population [83] (2018): 25.22 million inhabitants Total Population (2015): 23.30 million inhabitants • Rural Population [84] (2018): 11.00 million inhabitants Rural Population (2015): 10.58 million inhabitants	• Population with Electricity (2018): 62.66% (93.30% in urban areas and 23.00% in rural areas) Population with Electricity (2015): 58.72% (90.50% in urban areas and 20.50% in rural areas) • Electricity consumption per capita (2014) [85]: 275.20 kWh per capita per year

5.3.1 Laws and Regulations

Policies to promote Renewable Energy, Energy Efficiency and Energy Access

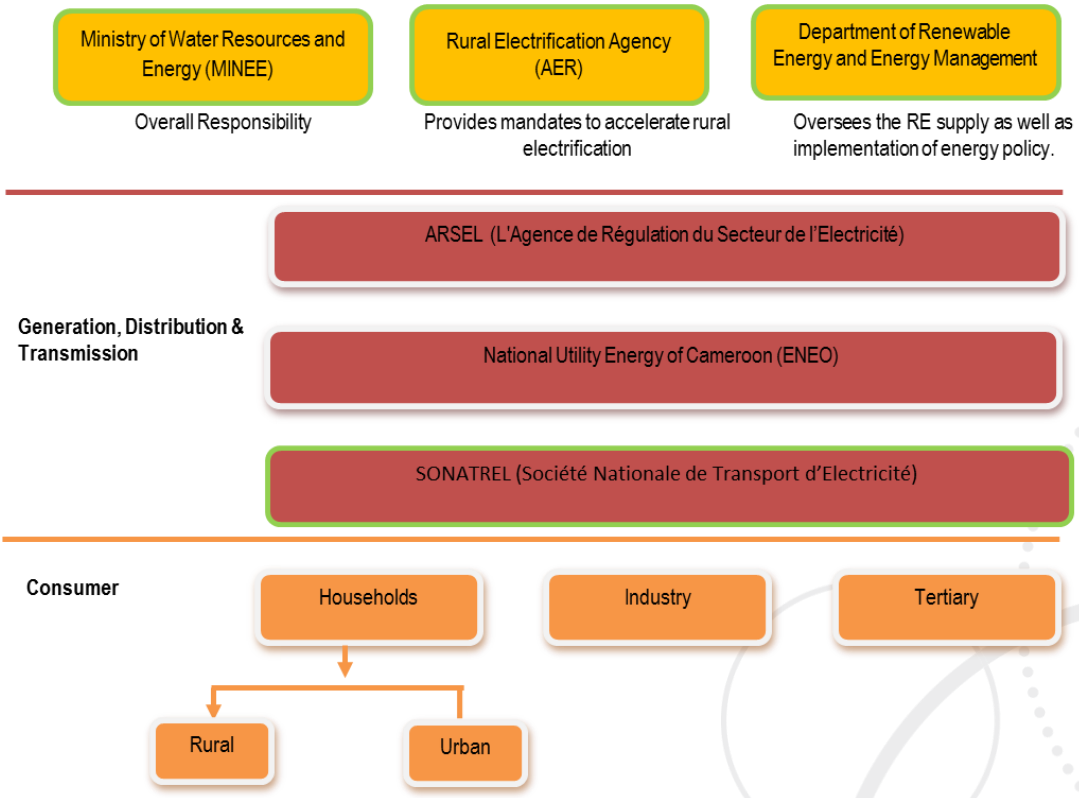
	Legislation	Implemented or in Discussion	Main content	Responsible Institution
Renewable Energy	Vision 2035	Implemented	Includes target and vision objectives and implementation strategies across three sectors – (i)economic and social, (ii) human and cultural, and (iii) political and administrative. It also focuses on development of energy infrastructure including alternative energies including solar, wind along with hydroelectric power	Ministry of Economy, Planning and Regional Development
	Law Governing the Electricity Sector in Cameroon (2011)	Implemented	Outlines the regulations related to the development of electricity sector. Part IV of this law focuses on rural electrification, renewable energy, and energy efficiency	MINEE
	Law on the Organization of the Ministry of Water Resources and Energy (2012)	Implemented	Establishes government strategies and plans related to the supply of water resources and energy	Ministry of Water Resources and Energy (Ministère de L'eau et de L'energie; or MINEE)
	Renewable Energy Master Plan for Cameroon	In discussion	Includes the national vision and deployment goals for RE sector	MINEE
Energy Efficiency	National Energy Efficiency	Implemented	Comprehensive plan for the EE sector in Cameroon	MINEE

[83] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=CM
[84] https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=CM
[85] https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=CM

	Legislation	Implemented or in Discussion	Main content	Responsible Institution
	Policy, Strategy and Action Plan (NEEPSAP) in the electricity sector in Cameroon (2014)			
Energy Access	Vision 2035	Implemented	Addresses strategies on energy access through: (i) increased electricity production; (ii) intensification of exploration, and development of oil resources; (iii) development of alternative energies; and (iv) extension and modernisation of transport and distribution facilities and equipment	Ministry of Economy, Planning and Regional Development
Cross-Cutting Policies	Intended Nationally Determined Contributions (INDC)	Implemented	Includes targets and strategies to reduce 32% reduction in GHG emission by 2035. Target to meet 25% energy demand through renewable sources by 2035	MINEE

5.3.2 Institutional Setup

The various ministries/agencies looking after the different components across the energy generation and distribution value chain for Cameroon is given below:



The key energy sector institutions are the Ministry of Water Resources and Energy (MINEE), Electricity Sector Regulatory Agency (ARSEL), and national utility Energy of Cameroon (ENEO).

The MINEE is the principal ministry charged with establishing and implementing government policies related to production, transportation, and the supply of water resources and energy, as well as the promotion of RE. This ministry includes the Departments of Renewable Energy and Energy Management to manage the expansion of the RE supply and the implementation of the energy saving policy.

ARSEL (L'Agence de Régulation du Secteur de l'Electricité), the electricity regulatory agency is responsible for the regulation, control and monitoring of the activities of the operators in the electricity sector. The Electricity Development Corporation (EDC), a public institution responsible to operate and manage publicly owned electricity infrastructures, support and implement infrastructure projects and participate in the development and promotion of private and public investments in the electricity sector.

ENEO, the national utility is responsible for the distribution of electricity and is an important producer of energy. SONATREL (Société Nationale de Transport d'Electricité) is a state-owned electricity transmission company and has been in sole charge of managing Cameroon's electricity transmission network since 2018[86].

The Rural Electrification Agency (AER), created in 1999, provides mandates to accelerate rural electrification. AER is responsible for overseeing rural electrification. However, its current level of engagement is minimal as most rural electrification projects are led by the MINEE, EDC and decentralised authorities.

Ministry of Forests and Wildlife (MINFOF) and Ministry of Stockbreeding and Fisheries (MINEPIA) are charged with biomass-related services, whereas the Rural Electrification Agency (AER) and Energy Management Committee are tasked with supplying, establishing plans, and managing Renewable Energy. Ministry of Environment, Nature Conservation and Sustainable Development (MINEPED) is charged with environmental consideration related to production of sustainable energy, such as solar PV and biogas. Therefore, the work related to RE is dispersed partially among the agencies.

5.3.3 Renewable Energy Market Benchmark and Potentials

RE Target for 2035: 25% of electricity generation from Renewable Energy Sources (Cameroon INDC)

Installed capacity (MW) [87]	Generation (GWh)[88]
• RE Installed capacity (2018): 746 • Non-RE installed capacity (2018): 705	• RE generation (2017): 5106 • Non-RE generation (2017): 1884

RE Potential Identified (TWh)[89]

Hydro (Large/ Medium / Small)	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal
115	NA	NA	NA	1000	NA	NA

Note: NA – Not Available

5.3.4 Energy Efficiency Market Benchmark and Potentials

- The Rapid Assessment and Gap Analysis (RAGA) report for Cameroon (2014) states that:

[86] https://www.esi-africa.com/industry-sectors/business-and-markets/cameroon-sonatrel-takes-over-the-electricity-transmission-network/

[87] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Cameroon_Africa_RE_SP.pdf

[88] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Cameroon_Africa_RE_SP.pdf

[89] Talla, Djouedjom & Gaelle, Francine & Lucas, Andrew. (2018). Current Status of Renewable Energy in Cameroon

- A typical industry in Cameroon has an average energy efficiency level of 41%: for every 100 kWh of energy drawn, only 41 kWh on average is consumed[90]. This indicates high potential for energy savings through implementation of energy efficiency measures.
- As of the date of production (2014), there was no guideline or standards on building energy efficiency levels. However, the report mentions that individual buildings in the private sector (such as hotels and other commercial establishments) have put in place their own measures for enhancing energy efficiency.
- Agriculture and efficiency in electricity access are significant areas where energy efficiency can make meaningful impact.

- The NEEPSAP lays the foundation for a comprehensive National Energy Efficiency Policy, by an analysis of two energy efficiency scenarios. These are:
  - Low hanging fruit scenario: Discusses energy savings that could be achieved through implementation of simple energy efficiency measures incurring low to moderate costs and relatively easy to execute;
  - Ambitious scenario: Coordinated and pragmatic set of policies, regulations and incentives aimed at stimulating or mandating '*implementation of technically and economically possible measures*.
- Under NEEPSAP, by 2025, the total savings off the business-as-usual (BAU) scenario in 2012, which is characterised by an energy consumption of 3,710 GWh (in base year, 2012) and a projected BAU level of 7,040 GWh in 2025 (target year). Under the low hanging fruit scenario, a total of 20% savings is possible (so total projected consumption in 2025 falls to 5,630 GWh), while in the ambitious scenario 30% energy savings is possible (projected consumption of 4.920 GWh in 2025).
- The NEEPSAP also outlines a strategic framework to achieve the targets outlined. As an integral part of the framework, a legal structure is proposed – like a set of laws. The laws would enable:
  - Definition of roles and responsibilities of public stakeholders engaged, directly or indirectly, with the EE sector;
  - Specification of respective obligations of energy producers and consumers with regard to actions to be adopted to improve EE levels, as it applied. Thus, for a producer it might imply reducing electricity demand, while for a utility it would imply reducing technical and commercial losses;
  - Establishment of a regulatory framework that allows for the development of ESCO entities, and similar agencies that can catalyse transition to an energy efficient economy;
  - Focus on public sector entities, including but not limited to public buildings, as prime movers and leaders in the EE process;
  - Establishment of a regulatory and administrative framework for the setting of standards for buildings, energy efficient equipment, as well as guidelines for energy efficient standards and labelling etc.
  - Establishment of a financial framework for providing incentives for facilitating investments in energy efficiency through fiscal and/or monetary support.

5.3.5 Energy Access

Energy Access Target: 100% of access to energy by 2030 (SEforAll action agenda for Cameroon). The Rural Electrification Master Plan (PDER) has set an objective to achieve 20,000 connections through green mini grids by 2020.

[90] Rapid Assessment and Gap Analysis Report for Cameroon; pages 106–108. Website: https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/Country_RAGAs/Cameroon_RAGA_FR_Released.pdf

- The energy policy of Cameroon is based on Vision 2035 and Strategy Document for Growth and Employment 2010-2020 (DSCE). The document intends to guide sector and regional policies, national strategies, development plans, and cooperation.
- Policy implementation is done in accordance with sectoral policy details, such as the Electricity Sector Development Plan to 2035, (PDSE), the Strategy to Promote Access and Use of Domestic Gas in Cameroon, and the Rural Electrification Master Plan (PDER).
- In 2016, the PDER introduced the planned RE projects, suggesting them as a solution for electrification for the off-grid locations. The PDER prioritises 27 solar, biomass, and small hydro mini-grids sites (30kW to 2.4MW in capacity) across the country.
- The legal framework in Cameroon enables the development of independent mini grids, but priority has been given to grid extension. While the regulatory framework permits independent generation and distribution, the opportunity for green mini grids is limited by a policy focus on grid extension and regulatory limitations.
- The legislative framework limits the capacity of independent power distribution to 100kW and 1MW in rural areas. In addition, the Rural Electrification Master Plan heavily prioritises grid extension to achieve energy access targets.[91]
- Article 59 of the Law on Electricity Sector (2011) prioritizes providing distributed energy to rural regions by utilizing RE sources. Furthermore, the excess power generated from RE can be purchased by grid operators or regional power suppliers. Article 66 states that to encourage the use of power from RE, connections would be mandatory upon request by power producers utilizing RE. Article 63 of this law defines solar thermal, solar PV, wind, and hydropower below 5 MW, biomass, geothermal and tidal energy as RE.

5.3.6 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	Energy Sector Development Plan (PDSE 2030)			
	Cameroon 2020 Photovoltaic Power Project	2015 - 2020	MINEE and Greenquest Solar Corporation	Develop a 500 MW solar photovoltaic installation in the Northern Cameroon
	Sustainable Energy Fund for Africa (SEFA)	2012 - ongoing	African Development Bank	Grants USD 1 million to stimulate renewable energy investments in Angola
	African Development Fund	1974 - ongoing	African Development Bank (AfDB)	Long-term loans and grants up to USD 1.4 million in development of RE
	Emerging Africa Infrastructure Fund (EAIF)	Ongoing	Nachtigal Hydro Power Company (NHPC)	Lends USD 56 million to 1.4 billion to Nachtigal Hydro Power Company (NHPC) to install 420 MW run-of-the-river hydro power station on the Sanaga River in Cameroon
Energy Efficiency	Rapid Assessment and Gap Analysis Report (RAGA)	2014	SEforALL in Africa	Assessment Report on the EE sector RAGA report additionally identifies agriculture and efficiency in electricity access as other

[91] Mini Grid Market Opportunity Assessment for Cameroon, April 2017, Sustainable Energy for All, Africa Hub.

				significant areas where energy efficiency can make meaningful impact
Energy Access – Mini-grids	Energy Sector Development Project (PDSEN)			
	Rural Electrification Master Plan (PDER)	2016 - 2035	MINEE	20,000 connections through green mini grids by 2020.
	SEforALL Action Agenda	2016 - 2030	UNDP	100% access to electricity by 2030
Cross-Cutting	Strategy Document for Growth and Employment	2010 - 2020		
	National Adaptation Plan for Climate Change (PNACC)			
	Electricity Sector Development Plan (PDSE)			

5.4 Central African Republic (CAR)

Population	Electricity Access[92]
• Total Population [93] (2018): 4.66 million inhabitants Total Population (2015): 4.49 million inhabitants • Rural Population [94] (2018): 2.74 million inhabitants Rural Population (2015): 2.68 million inhabitants	• Population with Electricity (2018): 32.42% (55.25% in urban and 16.32% in rural) Population with Electricity (2015): 24.11% (44.14% in urban and 10.60% in rural) • Electricity consumption per capita: N/A

5.4.1 Laws and Regulations

Policies to promote Renewable Energy, Energy Efficiency and Energy Access

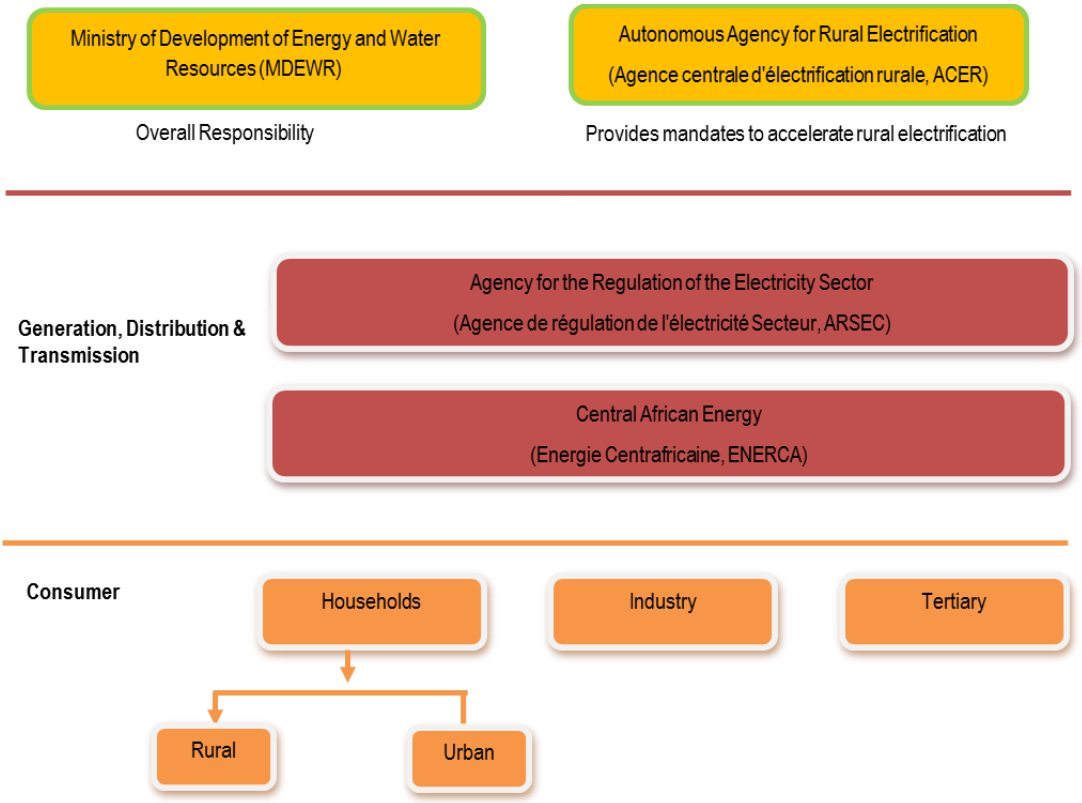
	Legislation	Implemented or in Discussion	Main content	Responsible Institution
Renewable Energy	National Energy Policy			The Ministry of the Development of Energy and Water Resources (MDEWR)
	Order No. 05.001 of 1 January 2005	Implemented	The Electricity Code	The Ministry of the Development of

[92] World Bank Database. https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=CF
[93] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=CF
[94] https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=CF

	Legislation	Implemented or in Discussion	Main content	Responsible Institution
				Energy and Water Resources (MDEWR)
	Decree No. 05.272 of 11 September 2005	Implemented	Stipulates the roles of the Autonomous Agency for the Regulation of the Electricity Sector (ARSEC)	The Ministry of the Development of Energy and Water Resources (MDEWR)
	Decree No. 05.273 of 11 September 2005	Implemented	Operationalises the Autonomous Agency Rural Electrification (ACER)	The Ministry of the Development of Energy and Water Resources (MDEWR)
	Decree No. 10.092 of March 18, 2010	Implemented	Legalises the energy policy	The Ministry of the Development of Energy and Water Resources (MDEWR)
Cross-Cutting Policies	Intended Nationally Determined Contributions (INDC, 2015)	Implemented	Targets and strategies including funds required to implement the low carbon scenario mainly focussed on the development linked to renewable energies, reforestation, improved conditions to make CAR a green economy. At least 5% reduction in emissions by 2030 and 25% by 2050	The Ministry of the Development of Energy and Water Resources (MDEWR)

5.4.2 Institutional Setup

The various ministries/agencies looking after the different components across the energy generation and distribution value chain for Democratic Republic of Central African Republic is given below:



The Ministry of Development of Energy and Water Resources (MDEWR) is responsible for the overall coordination of activities in the energy sector and for the strategies, planning and monitoring of the implementation of the different programmes. The ministry also plays an important role in attracting private sector investment and coordinating support of development partners. It is also responsible to ensure that the development of policies and strategies concerning national infrastructure are in line with regional integration and harmonisation policies. The Autonomous Agency Rural Electrification (ACER) oversees rural electrification in Central African Republic.

The Autonomous Agency for the Regulation of the Electricity Sector (ARSEC) is the energy regulator in Central African Republic. The state-owned vertically integrated ENERCA (Énergie Centrafricaine) produces, distributes, and sells electricity in Central African Republic.

5.4.3 Renewable Energy Market Benchmark and Potentials

RE Target for 2030: Increase substantially the share of renewable energy in the global energy mix

Installed capacity (MW) [95]	Generation (GWh) [96]
• RE Installed capacity (2018): 19 • Non-RE installed capacity (2018): 22	• RE generation (2017): 136 • Non-RE generation (2017): 5

RE Potential Identified (MW)

Hydro (Large/	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal

[95] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Central%20African%20Republic_Africa_RE_SP.pdf
[96] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Central%20African%20Republic_Africa_RE_SP.pdf

Medium / Small)						
2,000[97]	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Note: NA – Not Available

5.4.4 Energy Efficiency Market Benchmark and Potentials

EE target for 2030: Double the rate of improvement of energy efficiency

- The Central African Republic's economy energy intensity (the ratio of the quantity of energy consumption per unit of economic output) was 8.1 MJ per US dollar (2011 dollars PPP GDP) in 2015 down from 8.87 MJ pe US dollar (2011 dollars PPP GDP) in 2014

5.4.5 Energy Access

Energy Access Target: Ensure 50% access to affordable, reliable, and modern energy service by 2030[98]

- The national power company of Central African Republic, Energie Centrafricaine (ENERCA) within the framework of the energy conservation policy, implemented the promotion of low-energy light bulbs as well as the promotion of improved cook stoves.
- According to REN21's Renewables 2018 Global Status Report, more than 95% population did not have the access to clean cooking at the end of 2017[99].

5.4.6 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	National Biofuels Programme			
	Construction of a photovoltaic solar power plant at Bangui			
	180 MW Dimoli hydroelectric development (integration project)			
	72 MW Lobaye hydroelectric development			
	60 MW La Kotto hydroelectric development			
	Mobaye hydroelectric development (integration project)			
	Southwest Region Development Project (PDRSO)			
	Lion Works Fund	2004 - ongoing	Lion Works Capital	USD 750 million private equity funds

[97] https://wedocs.unep.org/bitstream/handle/20.500.11822/20497/Energy_profile_CentralAfricanRep.pdf?sequence=1&isAllowed=y
[98] Table R21. Electricity Access by Region and Country, 2017 and Targets (Page 223) https://www.ren21.net/wp-content/uploads/2019/05/gsr_2019_full_report_en.pdf
[99] SADC Renewable Energy and Energy Efficiency Status Report. 2018. Figure 4 Share of Population Without Access to Clean Cooking in SADC Member States, 2017, Page 31. https://www.sacreee.org/sites/default/files/documents/files/SADC_EN_%28web%29.pdf

				focussed on RE development
	African Development Fund	1974 - ongoing	African Development Bank (AfDB)	Long-term loans and grants up to USD 1.4 million in development of RE
	Sustainable Energy Fund for Africa	2012 - ongoing	AfDB	Grants USD 1 million to stimulate renewable energy investments in Angola
Energy Efficiency	Promotion of energy saving light bulbs		National power company Energie Centrafricaine (ENERCA)	
Energy Access – Mini-grids	Lighting Africa		IFC- World Bank	50% rural electrification
	National Rural Electrification Programme			
Clean Cooking	Improved cook stoves programme		ENERCA	
Cross-Cutting	Emergency Programme for Sustainable Recovery (PURD)			

5.5 Chad

Population	Electricity Access[100]
• Total Population [101] (2018): 15.48 million inhabitants Total Population (2015): 14.11 million inhabitants • Rural Population [102] (2018): 11.91 million inhabitants Rural Population (2015): 10.93 million inhabitants	• Population with Electricity (2018): 11.76% (41.84% in urban and 2.75% in rural) Population with Electricity (2015): 7.70% (32.40% in urban and 0.52% in rural) • Electricity consumption per capita: N/A

5.5.1 Laws and Regulations

Policies to promote Renewable Energy, Energy Efficiency and Energy Access

	Legislation	Implemented or in Discussion	Main content	Responsible Institution

[100] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=TD
[101] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=TD
[102] https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=TD

Renewable Energy	Vision 2030, The Chad We Want[103]	Implemented	The document describes a long-term strategic development framework to be implemented. This includes the aim to achieve that 25% of the households have access to renewable energy by 2030.	Ministry of Economy and Development Planning
Energy Efficiency	NA	NA	NA	NA
Energy Access	Vision 2030, The Chad We Want[104]	Implemented	The document describes a long-term strategic development framework to be implemented. This includes the aim to achieve a rate of access to electricity of 30% by 2030.	Ministry of Economy and Development Planning

Note: NA – Not Available

The Chad energy sector seems to be a rather immature without a defined framework for the Renewable Energy or Energy Efficiency market (see Table 10). The government and local authorities will still need to develop: Renewable Energy & Energy Efficiency Policies, Technical Standards, Renewable Energy Targets, Financial Support mechanisms, etc.

Country	Renewable energy targets[7]	Renewable energy in INDC or NDC	Regulatory Policies: Feed-in tariff/ premium payment	Regulatory Policies: Electric utility quota obligation/RPS	Regulatory Policies: Net metering/ billing	Regulatory Policies: Biofuel blend obligation/mandate	Regulatory Policies: Renewable heat obligation/mandate	Regulatory Policies: Tradable REC	Regulatory Policies: Tendering	Fiscal Incentives and Public Financing: Tax incentives	Fiscal Incentives and Public Financing: Investment or production tax credits	Fiscal Incentives and Public Financing: Reductions in sales, energy, CO_2, VAT or other taxes	Fiscal Incentives and Public Financing: Energy production payment	Fiscal Incentives and Public Financing: Public investment, loans, grants, capital subsidies or rebates
Low Income Countries														
Afghanistan	E, P								○					
Benin	E, P								○					
Burkina Faso	P	●							●	●	●	●	●	
Burundi	E, P													
Central African Republic														
Chad														

Targets
E Energy (final or primary)
P Power

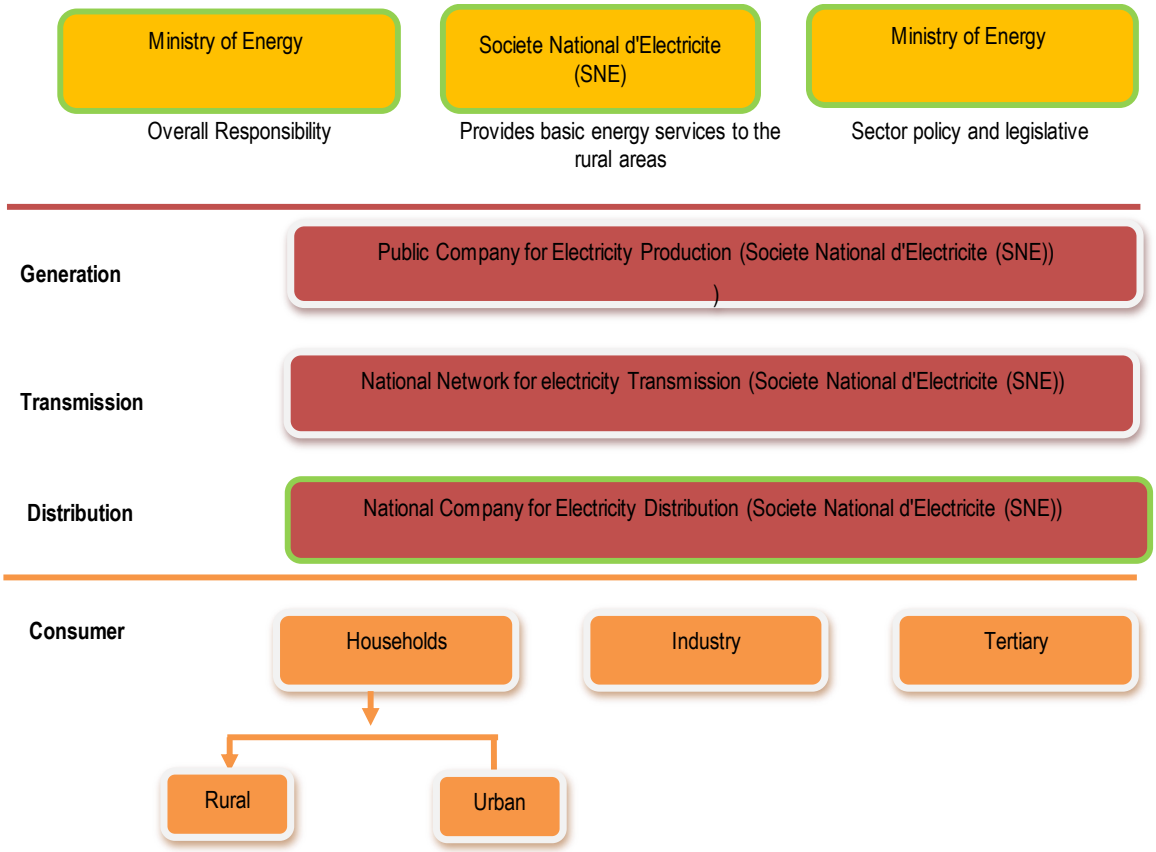
Policies
● Existing national policy or tender framework (could include sub-national)
○ National tender held in 2018

Table 10: Renewable Energy Targets and Policies (REN21, Renewables 2019 - Global Status Report) [105]

5.5.2 Institutional Setup

The various ministries/agencies looking after the different components across the energy generation and distribution value chain for Chad is given below:

[103] http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/07/8879.pdf
[104] http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/07/8879.pdf
[105] https://www.ren21.net/wp-content/uploads/2019/05/gsr_2019_full_report_en.pdf



The majority Chad's existing power capacity comes from Diesel and Heavy Fuel Oil (HFO) generation with a poorly maintained fleet with regular supply failures and logistical challenges that have meant that the country available capacity is insufficient to meet the demand.

Chad has a single distribution and retail utility company Societe National d'Electricite (SNE). There are not yet any independent power producers (IPPs) involved in the electricity production yet [106].

5.5.3 Renewable Energy Market Benchmark and Potentials

Chad has a strong solar resource potential with ranging irradiation levels of 4 - 6 kWh/m^2 day, however it is only used for solar cooking applications currently. The country has a significant wind potential in the central region with wind speeds reaching 7-7.5 m/s. The hydropower potential that is economically and technically feasible represents approximately 150 GWh/year. As a sugar producing country Chad's agricultural residues are abundant and are potentially very valuable for energy production. There are large quantities of bagasse available for energy production from cogeneration as a surplus from the sugar mills' needs. Biomass is the primary energy source for the majority of the country's rural population, with over 93% using traditional biomass fuels. Additionally, geothermal activity has been noted in mineral resource surveys in the Tibesti area of the country. However, no study has been undertaken regarding the potential of this resource for potential power generation.

Based on Intended Nationally Determined Contribution (INDC) report Chad has committed to a reduction of 18.2% of the country's emissions compared to the reference scenario by 2030[107]. Furthermore, and based on the long-term strategic development framework "Vision 2030" [108] the country aims to achieve the following:

[106] https://www.usaid.gov/powerafrica/chad
[107] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Chad%20First/INDC%20Chad_Official%20version_English.pdf
[108] http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/07/8879.pdf

- A rate of access to electricity 30% by 2030 (11.76% in 2018).
- 25% Percentage of household with access to renewable energy

Installed capacity (MW) [109]	Generation (GWh)[110]
• RE Installed capacity (2018): 1 • Non-RE installed capacity (2018): 86	• RE generation (2017): 9 • Non-RE generation (2017): 230

RE Potential Identified (MW)

Hydro	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal
NA	NA	NA	NA	NA	NA	NA

Note: NA – Not Available

5.5.4 Energy Efficiency Market Benchmark and Potentials

EE target: No reference data found.

5.5.5 Energy Access

Energy Access Target: Based on the long-term development framework "Vision 2030 Strategy: The Chad that We Want" [111] the Chad aims to achieve a rate of access to electricity of 30% by 2030 (in 2018 the rate is below 12%).

Modern cooking target: No targets defined

5.5.6 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	Vision 2030, The Chad We Want[112]	2017	Ministry of Economy and Development Planning	The document describes a long-term strategic development framework to be implemented. The framework is aimed at making Chad a united nation and an emerging regional power by 2030. The plan emphasizes social protection, gender, economic empowerment etc. but as well renewable energy.
	Intended Nationally Determined Contribution (INDC) for the Republic of Chad [113]	2015	UNFCCC	The aim of the document is amongst others to identify the mitigation measures to reduce emissions and the actions to be taken by the Chad authorities. The activities are all targeted on moving away from an oil-based economy to one based on more

[109] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Chad_Africa_RE_SP.pdf
[110] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Chad_Africa_RE_SP.pdf
[111] http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/07/8879.pdf
[112] http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2019/07/8879.pdf
[113] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Chad%20First/INDC%20Chad_Official%20version_English.pdf

				sustainable models of renewable energy.
	Chad Energy Profile [114]	2013	UNEP	The document provides an overview for the Chad's energy profile showing key consumption/production statistics and a summary of the institutional and legal framework.
Energy Efficiency	NA	NA	NA	NA
Energy Access – Mini-grids	Renewable energy-based mini-grids: the UNIDO experience	2017	UNIDO	The report presents the benefits of renewable energy as a tool for Inclusive and Sustainable Industrial Development (ISID) through building renewable energy-based mini-grids for productive uses in rural communities. The case studies include Chad amongst other countries. The report presents the technical, regulatory, financial and business approach as well as end-user and community involvement for each case study.
Efficient Cookstoves	IEA/WHO Clean Cooking Database, Chad[115]	2019	IEA/WHO	Clean Cooking Database from 2000 to 2018
	Clean Cooking Alliance Data[116]	2020	Clean Cooking Alliance	Generic country level data for polluting, open fires or inefficient fuels for cooking.
Cross-Cutting	ECCAS 2025 strategic vision on the environment	2019		The "ECCAS Strategic Vision 2025" addresses 3 strategic priorities: (i) the assessment and early warning for the management of natural and manmade disasters, (ii) the fight against climate change, and (iii) the fight against desertification, drought and land degradation.
	Country Strategy Paper 2015-2020[117]	2015-2020	AfDB	Prior to this plan a National Development Plan (NDP) was prepared for 2013-2015, the objectives of which focused on poverty reduction and improvement of the people's living conditions amongst others. This new plan was also intended to prepare the ground for Chad's transformation into an emerging economy by 2030 according to projections by the national

[114] https://wedocs.unep.org/bitstream/handle/20.500.11822/20496/Energy_profile_Chad.pdf?sequence=1&isAllowed=y
[115] https://iea.blob.core.windows.net/assets/b6baec29-6a12-40d6-8333-b89519660299/WEO2019-Clean-Cooking-database.xlsx
[116]: https://www.cleancookingalliance.org/country-profiles/9-chad.html
[117] https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/News___Partners_Docs/ECCAS_CEMAC_livre_blanc_energie_2014.pdf

				authorities. This 5-year plan is being developed based on the authorities' 2030 Vision. As part of Pillar 1 the promotion of renewable energy and energy efficiency is proposed.
	National Development Plan 2013–15[118]	2013-2015	World Bank/IMF	The NDP focuses on a sensible set of priorities, notably on the creation of new productive capacities and opportunities for decent jobs, human capital development and the fight against inequality, poverty and social exclusion, environmental protection and climate change adaptation, and improved governance.

5.6 Republic of Congo

Population	Electricity Access[119]
• Total Population [120] (2018): 5.24 million inhabitants Total Population (2015): 4.86 million inhabitants • Rural Population [121] (2018): 1.73 million inhabitants Rural Population (2015): 1.67 million inhabitants	• Population with Electricity (2018): 68.52% (92.41% in urban and 20.19% in rural) Population with Electricity (2015): 60.4% (79.50% in urban and 24.07% in rural) • Electricity consumption per capita (2014)[122]: 202.87 kWh per capita per year

5.6.1 Laws and Regulations

Policies to promote Renewable Energy, Energy Efficiency and Energy Access

	Legislation	Implemented or in Discussion	Main content	Responsible Institution
Renewable Energy	Law No. 14/2003 of 10 April 2003	Implemented	Defines the Electricity Code and liberalizing the market	Ministry of Energy and Hydraulics
	Law No. 15/2003 of 10 April 2003	Implemented	Establishment of National Agency for Rural Electrification	Ministry of Energy and Hydraulics

[118] http://documents.worldbank.org/curated/en/944701468230692713/pdf/786920PRSP0IDA000PUBLIC00Box379788B.pdf
[119] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=CG
[120] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=CG
[121] https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=CG
[122] World Bank Database. https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=CG

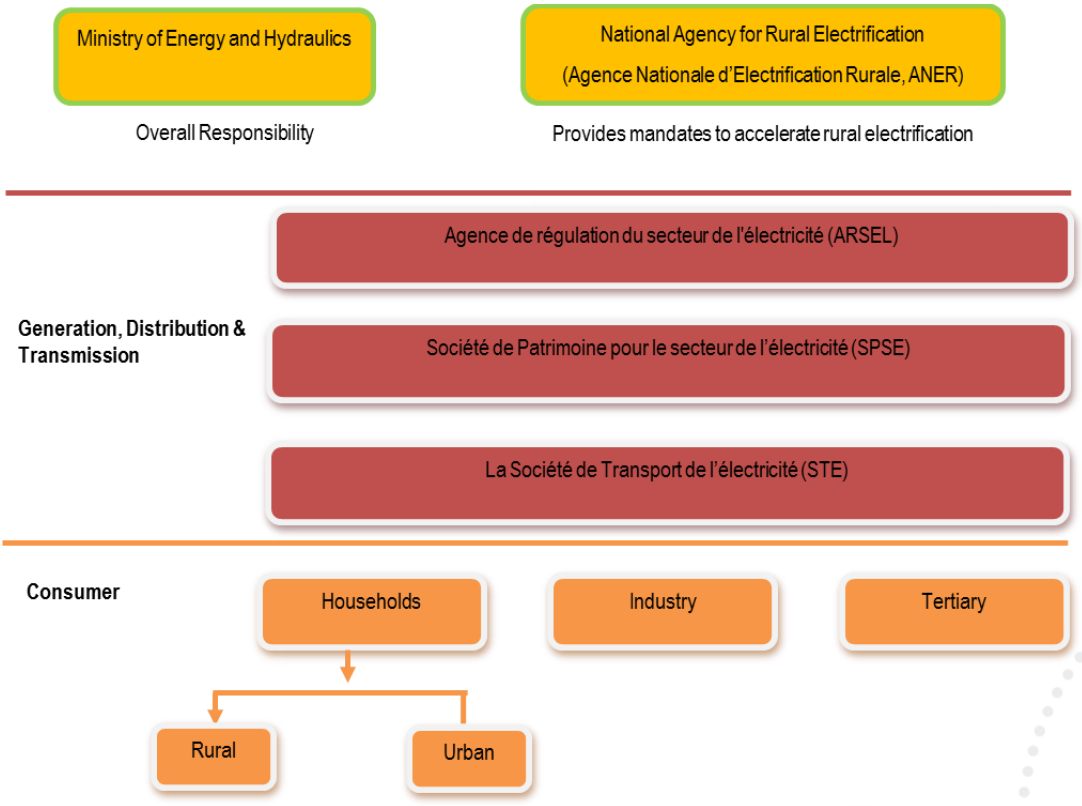
			(Agence Nationale d'Electrification Rurale, ANER)	
	Law No. 16/2003 of 10 April 2003	Implemented	Establishment of the Agency for the Regulation of the Electricity Sector	Ministry of Energy and Hydraulics
	Law No. 17/2003 of 10 April 2003,	Implemented	Establishing the Development Fund of the Electricity Sector	Ministry of Energy and Hydraulics
	Decree No. 2010-822 of 31 December 2010	Implemented	Approves the development strategy for the sectors of electricity, water and sanitation	Ministry of Energy and Hydraulics
	Electricity Act of 2013,	Implemented	independent power producers are required to obtain a licence. However, for small-scale projects of transmission, distribution and sales in rural areas, it suffices to obtain electricity generation, an authorisation by the corresponding Ministry	Ministry of Energy and Hydraulics
Energy Efficiency	NA	NA	NA	NA
Energy Access	NA	NA	NA	NA
Cross-Cutting Policies	Intended Nationally Determined Contributions (INDC, 2015)		Targets and strategies including funds required to implement the low carbon scenario mainly focussed on the development linked to renewable energies, reforestation, improved conditions to make Congo a green economy. At least 48% reduction in emissions compared to the development scenario uncontrolled (trend) in 2025 and 55% in 2035	
	Mitigation Policy for GHG emissions		Establishes two aspects: (i) mitigate	

			GHG emissions from the energy sectors and the fight against deforestation unplanned (REDD), by controlling energy consumption while having greater use of renewable energy; (ii)maintain or even strengthen the potential for carbon sequestration by forests, by better management of the sector, as well as through reforestation	

Note: NA – Not Available

5.6.2 Institutional Setup

The various ministries/agencies looking after the different components across the energy generation and distribution value chain for Congo is given below:



The Ministry of Energy and Hydraulics is responsible for the overall coordination of activities in the energy sector and for the strategies, planning and monitoring of the implementation of the different programmes. The ministry also plays an important role in attracting private sector investment and coordinating support of development partners. It is also responsible to ensure that the development of policies and strategies concerning national infrastructure are in line with regional integration and harmonisation policies. The

National Agency for Rural Electrification (Agence Nationale d'Electrification Rurale, ANER) oversees rural electrification in Congo.

The Regulatory Agency for the Electricity Sector (Agence de régulation du secteur de l'électricité, ARSEL) is the energy regulator in Congo. Two public limited companies namely- Société de Patrimoine pour le secteur de l'électricité (SPSE) and La Société de Transport de l'électricité (STE), manage the electricity sector in Congo based on public service concession contracts between the Government and public and private operators.

5.6.3 Renewable Energy Market Benchmark and Potentials

RE Target for 2025:

Hydro Power Plants up to the capacity of 10 MW are considered under Small Hydro Plants (SHP) in Congo. The potential for SHP in Congo is estimated to be 65 MW[123].

The Government envisages the development of renewable energy sources available in the country, including hydropower, biomass, solar power, and wind power, in remote areas. However, no policy or strategy promoting renewable energy has been developed to date. As a result, the available resources remain untapped[124].

It is proposed in the low-carbon scenario to increase the share of renewable energy to be used for the extraction of mining products to up to 90% in 2025 and 95% in 2035 (use of biomass from savanna plantations in addition to hydroelectricity)[125].

Installed capacity (MW) [126]	Generation (GWh)[127]
• RE Installed capacity (2018): 214 • Non-RE capacity (2018): 170	• RE generation (2017): 1242 • Non-RE generation (2017): 797

RE Potential Identified (MW)[128]

Hydro (Large/ Medium / Small)	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal
14000	NA	NA	NA	NA	NA	NA

Note: NA – Not Available

5.6.4 Energy Efficiency Market Benchmark and Potentials

EE target:

- In a conditional low-carbon scenario, it is proposed in Congo's INDC to control the increase in energy consumption linked to transport to 70% of the trend scenario in 2025, with a "renewable fuel" option (for 21 to 43% of consumption).

[123] World Small Hydropower Development Report 2019 (Page 100) https://www.unido.org/sites/default/files/files/2020-02/Africa%20Regions.pdf
[124] World Small Hydropower Development Report 2019 (Page 100) https://www.unido.org/sites/default/files/files/2020-02/Africa%20Regions.pdf
[125] https://www4.unfccc.int/sites/submissions/INDC/Published%20Documents/Congo/1/INDC_Congo_RAPPORT.pdf
[126] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Congo_Africa_RE_SP.pdf
[127] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Congo_Africa_RE_SP.pdf
[128] Intended Nationally Determined Contribution (INDC) of the Republic of Angola, November 2015

- The Republic of Congo-Brazzaville is the fifth largest producer of crude oil in Africa (as of January 2020129). As a result, the country relies heavily on the availability of its hydrocarbon fuels, and its renewable energy reserves, as well as large hydropower, are largely un-utilised.
- As of 2012, bulk of the energy consumption in Congo is attributable to petroleum industry, transport and residential sectors. As a result, energy efficiency in residential areas is expected to generate significant energy savings.
- Information obtained from a UNDP-GEF project report (2014) 130 indicates that the vast majority of Congo-Brazzaville's rural population is still without electricity, while some households have power supply through local captive diesel generators and/or diesel powered mini-grids.
- As a result, there is high demand for diesel and kerosene, which are typically used in inefficient devices.
- The Government of Congo Report: Energy for the emergence of the Congo: Energy strategies of the Congo, 2015 – 2025 discusses, as one of its primary recommendations, the need for energy efficient stoves.
- The energy yield of wood in the baseline (existing) situation was around 5% - 10% - as they are fired in a basic stove, which can be replaced by a stove with 35% - 40% energy efficiency131.
- Efficient electricity consumption (end use) is encouraged, through promotion of energy efficient lamps (like LED bulbs). Further, (residential, commercial and industrial) consumers shall be encouraged to use more energy efficient appliances and machines.
- In the medium term, public buildings shall be required to install efficiency measures in use of electricity and vehicular fuel, which would also avoid pollution.
- In the petroleum sector, enhancing sector competitiveness and avoidance of monopolistic practices is considered to be a key pre-requisite for introducing efficiency in production and supply.
- Finally, energy efficiency is sought to be achieved by introducing economic activities as viable load centres, where utilities can charge for the electricity at competitive rates. This shall introduce efficient delivery and pave way for energy efficiency in the long run.
- A World Bank report for additional financing for a Water, Electricity and Urban Development Project in 2014132 sought to enhance access to electricity in the main cities of Brazzaville and Pointe-Noire, implying that access to electricity was still far from satisfactory. As a result, the consideration for energy efficiency appears to be nebulous.

5.6.5 Energy Access

Energy Access Target:

- In Congo, the regulatory and permitting process is not clearly defined, and the country can already meet its current electricity requirements through large-scale projects. Low electricity tariffs, the lack of local skills to install, operate and maintain an SHP plant as well as the lack of local technology make the sector less attractive than other power projects.
- Congo's INDC estimates that 70% of the energy consumed in 2025 will come from renewable energy (hydroelectricity, half of which is produced locally, without calling on the grid public) and 80% in 2035 (assumption of increase on the basis of private investments), while adopting the most environmentally friendly extraction methods.
- The Republic of Congo wants to increase the share of electricity in its energy mix, with a target of around 4,000 GWh consumed by 2025. On this basis, the Congo has developed an ambitious hydroelectricity

[129] https://tradingeconomics.com/country-list/crude-oil-production?continent=africa
[130] https://www.thegef.org/sites/default/files/project_documents/PIMS%25204685%2520Congo%2520BR%2520SHP%2520Mini-Grids%2520PIF%2520v5_0.pdf
[131] https://www.hec.ca/formations-internationales/dess-congo/cohorte-1/DESS_CONGO_Strategie_rapport.pdf
[132] http://documents.worldbank.org/curated/en/980891468247276214/pdf/PAD9150PJPR0P1010Box385308B00OUO090.pdf

development plan, with the objective to ensure 85% hydroelectric power supply, and 15% gas-based power supply by 2025.

5.6.6 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	Congo Vision 2025	2015 - 2025		
	Programme National de Développement des Energies Nouvelles et Renouvelables (ENR)			
	Congo Energy Strategy	2015 - 2025		Develop solar electrification plan for isolated villages
	Hydroelectricity development plan	2015 - 2025		Ensure supply of 85% hydroelectric power, and 15% gas-based power by 2025
	Lion Works Fund	2004 - ongoing	Lion Works Capital	USD 750 million private equity funds focussed on RE development
	African Development Fund	1974 - ongoing	African Development Bank (AfDB)	Long-term loans and grants up to USD 1.4 million in development of RE
	Sustainable Energy Fund for Africa	2012 - ongoing	AfDB	Grants USD 1 million to stimulate renewable energy investments
Energy Efficiency	NA	NA	NA	NA
Energy Access – Mini-grids	NA	NA	NA	NA
Clean Cooking	NA	NA	NA	NA
Cross-Cutting	National Environmental Action Plan (PNAE)			Identifies the country's vulnerability to the effects of climate change
	National Strategy and Action Plan for Climate Change and Variability (SNPA / CCV)	2004 - ongoing		
	National Program for Development of Congo (PND)	2012 - 2016		Accelerate the modernization of society and the industrialization of the country
	Growth Strategy Document			
	National Strategy and Action Plan for the implementation of United Nations Framework Convention on Climate Change			

	National Strategy for Sustainable development			

5.7 Democratic Republic of Congo (DRC)

Population	Electricity Access[133]
• Total Population [134] (2018): 84.07 million inhabitants Total Population (2015): 76.24 million inhabitants • Rural Population [135] (2018): 46.69 million inhabitants Rural Population (2015): 43.66 million inhabitants	• Population with Electricity (2018): 18.98% (50.70% in urban) Population with Electricity (2015): 16.44% (45.90% in urban) • Electricity consumption per capita (2014)[136]: 108.52 kWh per capita per year

5.7.1 Laws and Regulations

Policies to promote Renewable Energy, Energy Efficiency and Energy Access

	Legislation	Implemented or in Discussion	Main content	Responsible Institution
Renewable Energy	LAW N ° 14/011 OF JUNE 17, 2014	Implemented	The law has established the National Electrification Agency (AGENA) and National Electrification Fund (FONEL) to increase access to energy in rural areas and secondary cities. The law indicates that renewable energy-based systems for rural areas are suited for use in remote population centres far from the grid	Ministry of Energy and Hydraulic Resources
	Electricity Code 2014	Implemented	Guidelines on development of the electricity sector policy document, including the Atlas of Renewable Energies in the DRC	Ministry of Energy and Hydraulic Resources
Energy Efficiency	NA	NA	NA	NA
Energy Access	NA	NA	NA	NA
Cross-Cutting Policies	Intended Nationally Determined		Targets and strategies including funds required to implement the low carbon	The Ministry of the Environment and Sustainable

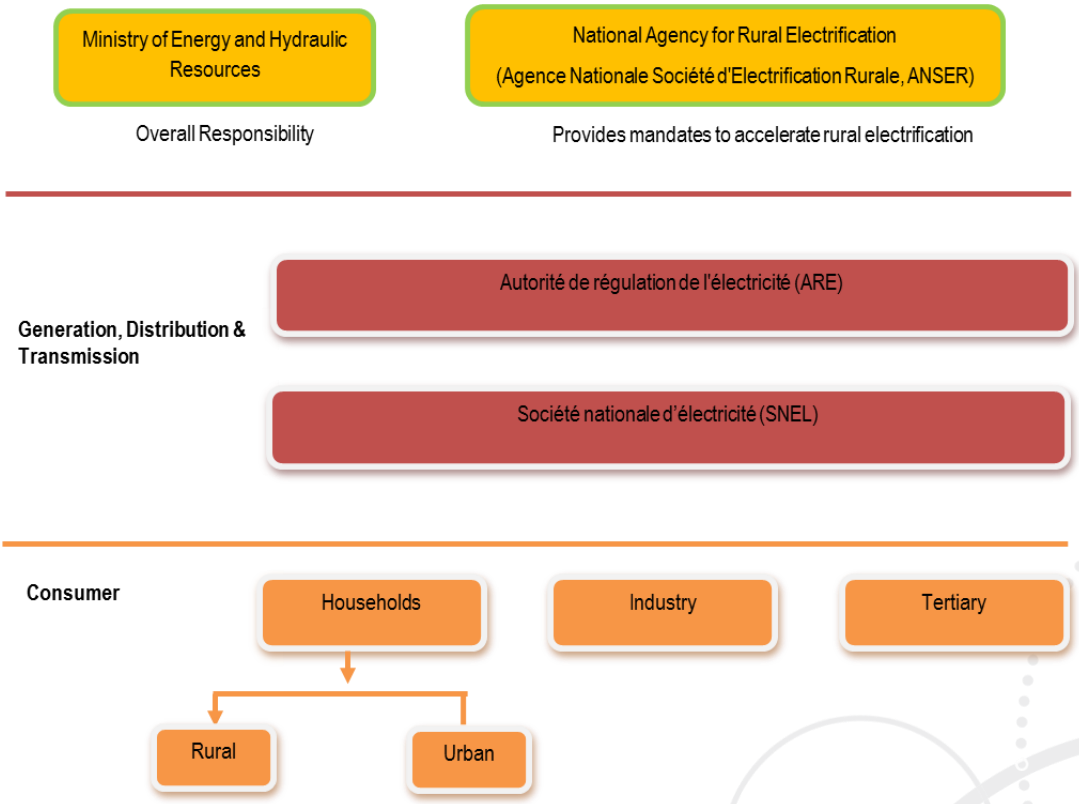
[133] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=CD
[134] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=CD
[135] https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=CD
[136] World Bank Database. https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=CD

	Contributions (INDC, 2015)		scenario mainly focussed on the development linked to renewable energies, reforestation, improved conditions to make DRC a green economy. At least 17% reduction in emissions by 2030	Development (Ministère de l'Environnement et Développement Durable, MEDD), through the Sustainable Development Directorate (DDD)
	The National Climate Change Adaptation Program, PANA (MECNT, 2006)		Established a limited mapping of the vulnerability of the DRC to the impacts of climate change	
	Low-Carbon Development Strategy (2012)			Ministère de l'Environnement et Développement Durable (MEDD)

Note: NA – Not Available

5.7.2 Institutional Setup

The various ministries/agencies looking after the different components across the energy generation and distribution value chain for Democratic Republic of Congo is given below:



The Ministry of Energy and Hydraulic Resources is responsible for the overall coordination of activities in the energy sector and for the strategies, planning and monitoring of the implementation of the different programmes. The ministry also plays an important role in attracting private sector investment and coordinating support of development partners. It is also responsible to ensure that the development of

policies and strategies concerning national infrastructure are in line with regional integration and harmonisation policies. The National Agency for Rural Electrification (Agence Nationale d'Electrification Rurale, ANER) oversees rural electrification in Democratic Republic of Congo.

The Regulatory Agency for the Electricity Sector (Autorité de régulation de l'électricité, ARE) is the energy regulator in Democratic Republic of Congo. National Electricity Company called Société nationale d'électricité (SNEL) is responsible for production, transport, and distribution of electricity.

5.7.3 Renewable Energy Market Benchmark and Potentials

RE Target for 2025:

Installed capacity (MW) [137]	Generation (GWh) [138]
• RE Installed capacity (2018): 2762 • Non-RE capacity (2018): 135	• RE generation (2017): 9287 • Non-RE generation (2017): 180

RE Potential Identified (MW)

Hydro (Large/ Medium / Small)	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal
100,000[139]	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Note: NA – Not Available

5.7.4 Energy Efficiency Market Benchmark and Potentials

EE target:

- No specific market research study or otherwise have been conducted to map the energy efficiency market and potential in DRC
- The equipment, from energy generation to distribution, is not properly maintained due to the lack of required funds and technical skills. Therefore, these turbines, generators, transformers, or power lines are operating below their design capacities.
- The residential sector contributes most to final energy demand, as in many African countries, due to the high proportion of biomass consumed for cooking and lighting. The vast majority (over 95%) of the population continue to use traditional biomass fuels for domestic energy needs.[140]

5.7.5 Energy Access

Energy Access Target: 60% access by 2025; universal access by 2050

- Power Africa is assisting the Government of the DRC (GDRC) to implement the 2014 Electricity Code by supporting the establishment, training, and operation of two new GDRC agencies: ARE, which

[137] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Democratic%20Republic%20of%20the%20Congo_Africa_RE_SP.pdf

[138] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Democratic%20Republic%20of%20the%20Congo_Africa_RE_SP.pdf

[139] UNIDO's World Small Hydropower Development Report 2019, Page 104. https://www.unido.org/sites/default/files/files/2020-02/Africa%20Regions.pdf

[140] https://www.reeep.org/democratic-republic-congo-2012

will be the autonomous regulatory agency; and ANSER, which will be responsible for rural electrification throughout the DRC's vast territory

- Power Africa has prepared a study of options for expanding grid access in Kwilu, Kasai, Kasai Central, and Kasai Oriental provinces.
- Power Africa plans to partner with private sector investors such as mines to bring the mini-grids into operation. Power Africa is supporting a number of SHS companies that are now moving into the DRC market, especially in the eastern DRC (North and South Kivu)[141].
- In addition, Power Africa will continue its work on rural electrification with provincial authorities in North and South Kivu, and potentially other provinces, to expand private sector investment.
- According to REN21's Renewables 2018 Global Status Report, the DRC clean cooking penetration as of end of 2015 was reported less than 10%. Around 95% population did not have the access to clean cooking at the end of 2017[142].

5.7.5.1 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	DRC Green Mini-Grid Program[143]	2018 - 2024		Program will pilot an innovative mini-grid model powered by solar, bringing clean and modern energy to sizeable towns Program will finance three solar hybrid mini-grid projects procured through a competitive tendering process in the towns of Isiro, Bumba and Genema
	Promotion of Waste-to-Energy Options for Sustainable Urban Management in the DRC	2018 - ongoing	Global Environment Facility	Grants USD 20.1 million to promote waste-to-energy technologies for sustainable waste management in the DRC
	DRC Electricity Access & Services Expansion (EASE)[144]	2017 - 2022	World Bank	USD 147 million project to expand access to electricity in target areas
	Power Africa	2014 - ongoing	USAID	Establishment of autonomous regulatory agency (ARE) and rural electrification agency (ANSER). Provides support on generation, transmission, and distribution concessions to attract private capital to invest in power sector in DRC Support to mini-grid investments as well as solar home systems
	Lion Works Fund	2004 - ongoing	Lion Works Capital	USD 750 million private equity funds focussed on RE development

[141] https://www.usaid.gov/powerafrica/democratic-republic-congo
[142] SADC Renewable Energy and Energy Efficiency Status Report. 2018. Figure 4 Share of Population Without Access to Clean Cooking in SADC Member States, 2017, Page 31. https://www.sacreee.org/sites/default/files/documents/files/SADC_EN_%28web%29.pdf
[143] https://www.greenclimate.fund/project/fp096
[144] https://projects.worldbank.org/en/projects-operations/project-detail/P156208?lang=es

	African Development Fund	1974 - ongoing	African Development Bank (AfDB)	Long-term loans and grants up to USD 1.4 million in development of RE
	Sustainable Energy Fund for Africa	2012 - ongoing	AfDB	Grants USD 1 million to stimulate renewable energy investments in Angola
Energy Efficiency	NA	NA	NA	NA
Energy Access – Mini-grids	Lighting Africa		IFC- World Bank	50% rural electrification
Clean Cooking	NA	NA	NA	NA
Cross-Cutting	PANA-AFE	2015 - 2020		The project builds on the achievements of PANA-ASA by strengthening the resilience of women and children in the face of climate change, in the former intervention areas of PANA-ASA.

5.8 Equatorial Guinea

Population	Electricity Access[145]
• Total Population [146] (2018): 1.30 million inhabitants Total Population (2015): 1.16 million inhabitants • Rural Population [147] (2018): 0.36 million inhabitants Rural Population (2015): 0.34 million inhabitants	• Population with Electricity (2018): 67.03 (90.36% in urban and 6.60% in rural) Population with Electricity (2015): 66.27% (91.06% in urban and 6.70% in rural) • Electricity consumption per capita: N/A

5.8.1 Laws and Regulations

Policies to promote Renewable Energy, Energy Efficiency and Energy Access

	Legislation	Implemented or in Discussion	Main content	Responsible Institution
Renewable Energy	Regulation of application of the Renewable Energies[148]	Under discussion	This is an unofficial draft document that is in the process of study and preparation, it is still subject to modification.	Ministry of Industry and Energy (MIE)

[145] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=GQ
[146] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=GQ
[147] https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=GQ
[148] http://www.se4allge.org/reglamento-de-aplicacion-de-energias-renovables/

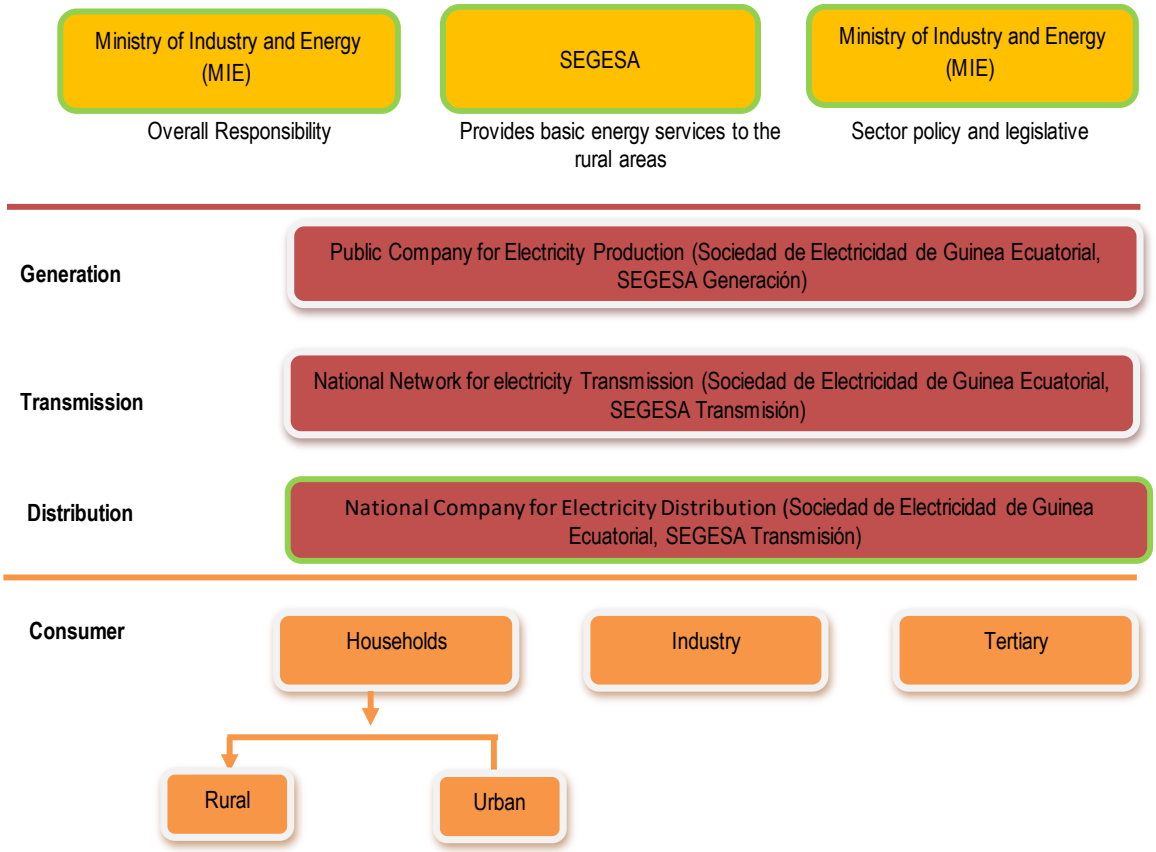
	General Law of Electric Energies[149]	Under discussion	Document defining the specific regime aimed at promoting the use of renewable energies for the generation of electricity, transport, distribution and consumption.	Ministry of Industry and Energy (MIE)
	Procedures manual for the approval and evaluation of renewable energy projects accepted and implemented[150]	Implemented	The Manual provides the stakeholders of the Guinean institutions involved in this type of project with the knowledge to evaluate renewable energy projects including solar, wind, hydro and biomass.	Ministry of Agriculture, Livestock, Forests and Environment Ministry of Industry and Energy
	The Electricity Plan of the Republic of Equatorial Guinea 2025	Under discussion	The document establishes the general guidelines for the development of sufficient electrical infrastructure to satisfy domestic demand, thus achieving access for all citizens to electrical service, promoting the productive apparatus and national electrical integration with the perspective of generating surplus electricity. energy for export.	Ministry of Industry and Energy (MIE)
Energy Efficiency	NA	NA	NA	NA
Energy Access	NA	NA	NA	NA
Cross-Cutting Policies	Renewable Energy and Energy Efficiency Policy Database	Completed	The document involves a policy and regulatory overview.	REEEP
	Equatorial Guinea Energy Sector Assessment	Completed	The document involves an	MWH Global

Note: NA – Not Available

5.8.2 Institutional Setup

The various ministries/agencies looking after the different components across the energy generation and distribution value chain for Equatorial Guinea is given below:

[149] http://www.se4allge.org/ley-general-de-energia-de-guinea-ecuatorial/
[150] http://www.se4allge.org/wp-content/uploads/2019/11/B-MANUAL-DE-PROCEDIMIENTOS-MOD.pdf



SEGESA[151] (Equatorial Guinea Electricity Company) is Equatorial Guinea's national electricity company and is the owner and operator of generation, transmission and distribution assets. The company was constituted in 2001 as the result of the merger of the national rural electrification company SONER and the national electricity corporation ENERGE. In 2013 the company was reorganized into three parts:

- SEGESA Comercial for distribution & sales
- SEGESA Generación for generation activities
- SEGESA Transmisión for transmission.

The primary law-making body for national electricity policy in Equatorial Guinea is the Ministry of Industry and Energy (MIE). The Ministry is responsible for regulation and compliance in the sector. Specific laws that deal with power sector management, tariffs and operations were passed in 2002 and 2005. Private companies wishing to invest in the sector must obtain licenses from the Ministry and can enter partnerships with SEGESA.

5.8.3 Renewable Energy Market Benchmark and Potentials

The goals to be achieved Equatorial Guinea based on the PANDER[152] include three areas of action for the electricity sector, aimed at strengthening the National Electric System (SEN), Regional Electric System (SER) and off-grid systems; to achieve access to basic household electricity service and social infrastructure; and the displacement of fossil fuel, used mainly in the Systems Isolated from the villages. These goals are:

- Goal 1: Progressive increase in installed renewable energy power plants (hydro and photovoltaic).

[151] https://segesa.business.site/?utm_source=gmb&utm_medium=referral
https://mmie.gob.gq/?p=3090
[152] https://info.undp.org/docs/pdc/Documents/GNQ/PANDER%20Final1.pdf

- Goal 2: Provide electric service to the homes and social infrastructure of settlements of the national electrical system, with the use of renewable energy sources.
- Goal 3: Incorporation of off-grid systems in towns and agencies; hybrid generation systems, which consider at least one renewable energy resource, allowing the displacement of fossil fuel in an amount equivalent to that generation.
- Goal 4: The net generation of electrical energy guarantees a minimum of 55% of participation of renewable energy sources in the country's energy mix by 2025, equivalent to 362,114 MW.

Installed capacity (MW) [153]	Generation (GWh) [154]
• RE Installed capacity (2018): 127 • Non-RE installed capacity (2018): 274	• RE generation (2017): 127 • Non-RE generation (2017): 924

RE Potential Identified (MW)[155]

Hydro (Large/ Medium / Small)	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal
11,000-26,000	NA	na	na	na	na	na

Note: NA – Not Available

5.8.4 Energy Efficiency Market Benchmark and Potentials

EE target: No reference data found.

5.8.5 Energy Access

Energy Access Target: No targets defined

Modern cooking target: No targets defined

5.8.6 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	National Action Plan for the Development of Renewable Energies (PANDER) [156]	2018 - 2025	Ministry of Industry and Energy (MIE)	The PANDER constitutes the framework of action for the fulfilment of the mandate that will define the Energy Law and the Regulations for the development of renewable energies in Equatorial Guinea, which are currently under review and approval. The net generation of electrical energy guarantees at least a

[153] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Equatorial%20Guinea_Africa_RE_SP.pdf
[154] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Equatorial%20Guinea_Africa_RE_SP.pdf
[155] https://info.undp.org/docs/pdc/Documents/GNQ/PIMS%205143%20EqGuinea%20SE4ALL%20-%20PRODOC%20Final%2009032016_doc%20final.pdf
[156] https://info.undp.org/docs/pdc/Documents/GNQ/PANDER%20Final1.pdf

				55% share of renewable energy sources in the country's energy matrix by 2025.
	Se4All "Renewable energy for everyone"	2013-2017	Ministry of Agriculture, Livestock, Forests and Environment Ministry of Industry and Energy	The aim is to create a decentralized Sustainable Energy solutions market in small islands and remote territories. The objective will be achieved by removing the barriers to generate electricity based on Renewable Energies in Equatorial Guinea and on the island of Bioko in particular.
	Vision Horizon 2020[157]	2008 - 2020	Ministry of Economy, Planning, and Public Investment (MEPIP)	The Development Plan Horizon 2020 aims to enrich society through a scientific and technical culture.
	National adaptation action plan to climate change (PANA)[158]	2013	Ministry of Environment	The PANA identifies the risks that the country in the face of climate change.
	Nationally determined contribution (CDN) [159]	2015	Ministry of Industry and Energy (MIE)?	The CDN presents the status of the country and the political will to fight against the effects of climate change. This political will is reflected in the Republic of Equatorial Guinea's ambition to reduce its emissions by 20% by 2030 from 2010 levels, with the goal of achieving a 50% reduction by 2050.
Energy Efficiency	NA	NA	NA	NA
Energy Access – Mini-grids	Resource evaluation study in Annobon, Solar hybrid system[160]	2019	PNUD Guinea Equatorial	Resource and Pre-feasibility Assessment for Solar Hybrid System Projects in Annobón
	Research evaluation study in Batete, Photovoltaic plant project[161]	2019	PNUD Guinea Equatorial	Resource and Pre-feasibility Assessment for Solar PV plant in Batete
	Resource evaluation study in Mbomo,	2019	PNUD Guinea Equatorial	Resource and Pre-feasibility Assessment for Solar PV plant in Mbomo

[157] https://social-assistance.africa.undp.org/sites/default/files/resources/Equatrial%20Guniea_Strategic%20plan%20horizon%202020_NY.pdf
[158] http://extwprlegs1.fao.org/docs/pdf/egq160264.pdf
[159] https://fvcguineaecuatorial.org/archivos/ProgramaPais.pdf
[160] http://www.se4allge.org/wp-content/uploads/2019/11/B-EVALUACION-DE-RECURSOS-ANOBON-MOD.pdf
[161] http://www.se4allge.org/wp-content/uploads/2019/11/B-EVALUACION-DE-RECURSOS-BATETE-MOD.pdf

	Photovoltaic plant project[162]			
	Resource evaluation study in Annobon, Solar hybrid system[163]	2019	PNUD Guinea Equatorial	Resource and Pre-feasibility Assessment for Solar Hybrid System Projects in Annobón
Efficient Cookstoves	IEA/WHO Clean Cooking Database, Equatorial Guinea[164]	2019	IEA/WHO	Clean Cooking Database from 2000 to 2018
Cross-Cutting	NA	NA	NA	NA

5.9 Gabon

Population	Electricity Access[165]
• Total Population [166] (2018): 2.12 million inhabitants Total Population (2015): 1.95 million inhabitants • Rural Population [167] (2018): 0.225 million inhabitants Rural Population (2015): 0.231 million inhabitants	• Population with Electricity (2018): 93.04% (96.67% in urban and 62.51% in rural) Population with Electricity (2015): 89.65% (95.75% in urban and 44.39% in rural) • Electricity consumption per capita (2014)[168]: 1167.85 kWh per capita per year

5.9.1 Laws and Regulations

Policies to promote Renewable Energy, Energy Efficiency and Energy Access

	Legislation	Implemented or in Discussion	Main content	Responsible Institution
Renewable Energy	The Energy Policy 2006			
Energy Efficiency	Decree # 0261/PR: On the Protection of the Environment of Gabon	Implemented	Energy efficiency mandates to be followed in construction of new buildings, and adherence to energy efficiency performance standards for existing buildings	Ministry of Energy and Hydraulic Resources
Energy Access	NA	NA	NA	NA

[162] http://www.se4allge.org/wp-content/uploads/2019/11/B-EVALUACION-DE-RECURSOS-MBOMO-MOD.pdf
[163] http://www.se4allge.org/wp-content/uploads/2019/11/B-EVALUACION-DE-RECURSOS-KOGO-MOD.pdf
[164] https://iea.blob.core.windows.net/assets/b6baec29-6a12-40d6-8333-b89519660299/WEO2019-Clean-Cooking-database.xlsx

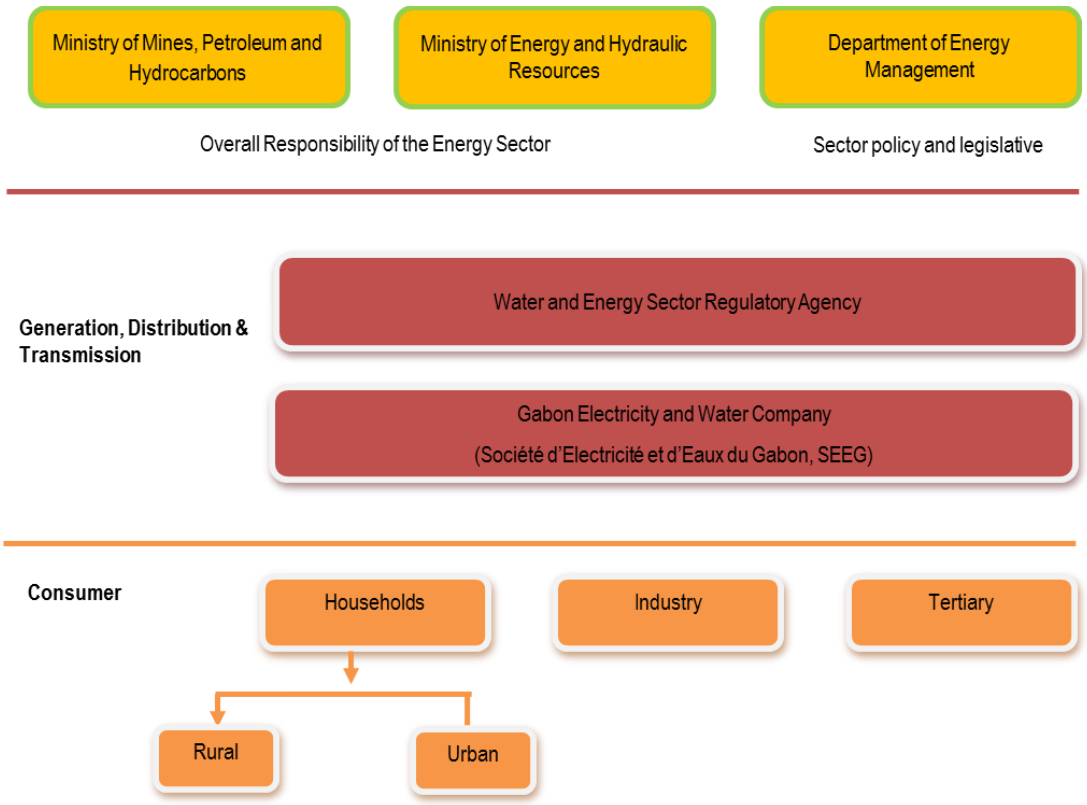
[165] World Bank Database. https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=GA
[166] World Bank Database. https://data.worldbank.org/indicator/SP.POP.TOTL?locations=GA
[167] https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=GA
[168] Electricity Power Consumption (kWh per capita)- Gabon. https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?locations=GA

Cross-Cutting Policies	Intended Nationally Determined Contributions (INDC, 2015)		Overall planning and preparation process to reduce at least 50% reduction in emission by 2025. Also includes mitigation actions and policies and adaptation targets	
	Industrialization Policy			
	Gabon Emergent policy			
	Law no. 005/2012		Establishment of the Gabonese Strategic Investment Fund	
	Law no. 007/2014, Protection of the Environment		Stresses on the importance of the sustainable use of the country's natural resources, including water. According to the Law, every project that can have a potential effect on the environment is required to submit an Environmental Impact Assessment to the ministry in charge of the environmental issues	

Note: NA – Not Available

5.9.2 Institutional Setup

The various ministries/agencies looking after the different components across the energy generation and distribution value chain for Gabon is given below:



Two ministries- the Ministry of Mines, Petroleum and Hydrocarbons, and the Ministry of Energy and Hydraulic Resources, are jointly responsible for the overall coordination of activities in the energy sector and for the strategies, planning and monitoring of the implementation of the different programmes. The ministries also play an important role in attracting private sector investment and coordinating support of development partners. They are responsible to ensure that the development of policies and strategies concerning national infrastructure are in line with regional integration and harmonisation policies.

There is a Department of Energy Management under the Director General's Office of Energy in Gabon, which operates under the Ministry of Energy and Hydraulic Resources.

Water and Energy Sector Regulatory Agency 2010 is the energy regulator in Gabon. The state-owned vertically integrated, Gabon Electricity and Water Company (Société d'Electricité et d'Eaux du Gabon, SEEG) is the sole generator, transmitter, and distributor of electric energy. On a regional level, the country is a member of the Central Africa Power Pool.

5.9.3 Renewable Energy Market Benchmark and Potentials

RE Target: 70% by 2020 and 80% by 2025[169]

- Gabon's INDC commits 80% share of hydropower by 2025 (equivalent to a 48% reduction in emissions in electricity sector by 2025)
- The Government of Gabon is also planning to develop a solar electrification of remote villages plan with an aim to improve access to energy in rural areas without use of fossil fuels.

Installed capacity (MW) [170]	Generation (GWh) [171]

[169] Table R6 Renewable Power Targets for Share of Electricity Generation, 2018, and Progress, End-2017 (Page 194) https://www.ren21.net/wp-content/uploads/2019/05/gsr_2019_full_report_en.pdf
[170] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Gabon_Africa_RE_SP.pdf
[171] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Gabon_Africa_RE_SP.pdf

• RE Installed capacity (2018): 333 • Non-RE installed capacity (2018): 296	• RE generation (2017): 1595 • Non-RE generation (2017): 1690

RE Potential Identified (MW)

Hydro (Large/ Medium / Small)	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal
8,000[172]	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**

Note: NA – Not Available

5.9.4 Energy Efficiency Market Benchmark and Potentials

- Gabon's INDC has identified two types of measures for controlling GHG emissions related to electricity production and consumption as

  - Enhanced energy efficiency of the economy;

  - Development of low-carbon means of production.

- A historical analysis over the period 2000-2010 shows that the energy efficiency of the economy Gabonese improved on average by 3.8% per year (INDC Gabon 2015).
- Gabon wishes to continue this momentum and continue to improve energy efficiency on this base, with an environmental target of 4,000 GWh consumed by 2025
- Gabon has mandated energy efficiency norms to be followed in construction of new buildings, and adherence to energy efficiency performance standards for existing buildings (Chapter 2, Energy Efficiency and Adaptation to Climate Change, Decree # 0261/PR: On the Protection of the Environment of Gabon).

5.9.5 Energy Access

- Gabon has developed an ambitious hydroelectricity development plan, with as an objective to ensure by 2025 a supply of electricity based on 80% on hydroelectricity and 20% on gas.
- According to REN21's Renewables 2018 Global Status Report, more than 14% population did not have the access to clean cooking at the end of 2017[173].

5.9.6 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	Emerging Gabon Strategic Plan (Plan Strategique Gabon Emergent, PSGE)			Increase the country's capacity to 1,200 MW by 2020. Goal is to increase the share of renewable energy in the country's energy mix from 40% in 2010 to 80% in 2020. This goal is to be achieved predominantly through the development of hydropower

[172] Page 84, https://www.unido.org/sites/default/files/files/2020-02/Africa%20Regions.pdf

[173] Table R 22 Population Without Access to Clean Cooking, 2017, Page 226. https://www.ren21.net/wp-content/uploads/2019/05/gsr_2019_full_report_en.pdf

	Gabonese Strategic Investment Fund			Aim is to assist the development of new industries capable of generating enough revenue to replace decreasing revenues from the fossil fuels sector
	Solar Electrification Plan			Solar electrification plan for isolated villages will improve access to energy in rural areas without the use of fossil fuels
	Lion Works Fund	2004 - ongoing	Lion Works Capital	USD 750 million private equity funds focussed on RE development
	African Development Fund	1974 - ongoing	African Development Bank (AfDB)	Long-term loans and grants up to USD 1.4 million in development of RE
	Sustainable Energy Fund for Africa	2012 - ongoing	AfDB	Grants USD 1 million to stimulate renewable energy investments in Gabon
Energy Efficiency	State Energy and Water Saving Program		Ministry of Energy	
Energy Access – Mini-grids	NA	NA	NA	NA
Clean Cooking	NA	NA	NA	NA
Cross-Cutting	NA	NA	NA	NA

5.10 Rwanda

Population	Electricity Access[174]
• Total Population [175] (2018): 12.30 million inhabitants Total Population (2015): 11.37 million inhabitants • Rural Population [176] (2018): 10.18 million inhabitants Rural Population (2015): 9.43 million inhabitants	• Population with Electricity (2018): 34.72% (89.06% urban and 23.42% rural) • Population with Electricity (2015): 22.8% (72.90% urban and 12.54% rural) • Electricity consumption per capita: N/A

[174] World Bank Database. https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=RW
[175] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=RW
[176] https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=RW

5.10.1 Laws and Regulations

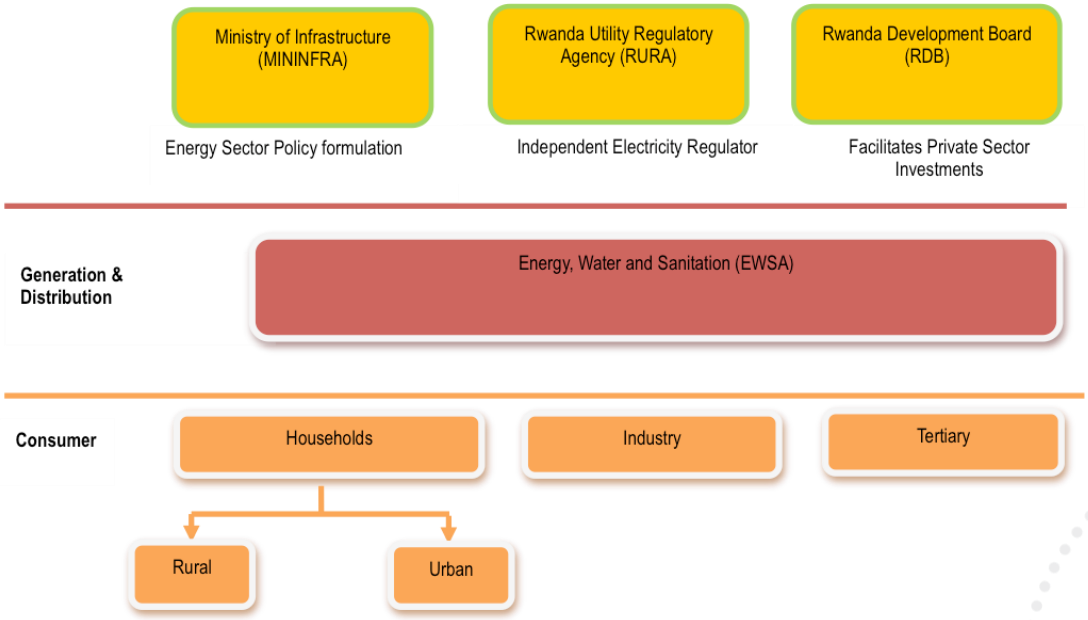
Policies to promote Renewable Energy, Energy Efficiency and Energy Access

	Legislation	Implemented or in Discussion	Main content	Responsible Institution
Renewable Energy	Energy Sector Strategic Plan (2018)	Implemented	Overview and status of energy sector including targets for renewable energy (52% by 2024), energy access (100% by 2024) and 15% reduction in transmission & distribution losses, achievements in energy sector, and challenges. Also outlines priority strategies and actions	Ministry of Infrastructure (MININFRA)
	Rwanda Energy Policy (2015)	Implemented	Governing laws and regulations, strategic directions, and guiding principles, and implementation of actions	Ministry of Infrastructure (MININFRA)
	Renewable Energy and Energy Efficiency Law (2018)	In discussion	Governs renewable energy sources in Rwanda with the aim of promoting further development, utilisation and sustainability	Ministry of Infrastructure (MININFRA)
	Solar Water Heating regulations (2015)	Implemented	Licensing and regulatory framework for the design, installations, operation, repair, maintenance, and upgrade of Solar Water Heating Systems in Rwanda	Rwanda Utilities Regulatory Authority (RURA)
	Rwanda Electricity Law (2011)	Implemented	Requirements and procedures for granting license for electricity production and transmission from all inexhaustible natural power source including solar, wind, water, geothermal, biomass, etc	Ministry of Infrastructure (MININFRA)
Energy Efficiency	Renewable Energy and Energy Efficiency Law (2018)	In discussion	Governs energy efficiency in Rwanda with the aim of promoting further development, utilisation, and sustainability	Ministry of Infrastructure (MININFRA)
	Energy Efficiency Strategy (2018)	In discussion	Outlines initiatives to improve efficiency across generation, transmission and distribution and end-user consumption	Ministry of Infrastructure (MININFRA)
	Guidelines Promoting Energy Efficiency Measures (2013)	Implemented	Guidelines aimed at guiding electricity consumers on how to promote energy efficiency use. Outlines measures including energy saving tips that will help in the efficient use of electricity mainly applicable to businesses/industry, institutional	Rwanda Utilities Regulatory Agency (RURA)

			premises, and residential consumers	
Energy Access	Rural Electrification Strategy (2016)	Implemented	Targets for rural electrification, proposed strategic programmes, implementation plan, detailing roles and responsibilities of government and private sector	Ministry of Infrastructure (MININFRA)
Cross-Cutting Policies	Intended Nationally Determined Contribution (INDC, 2015)	Implemented	Adaptation vision and goals	Ministry of Natural Resources (MINRENA)
	National Gender Policy (2010)	Implemented	Programmes, opportunities, constraints, and institutional framework for implementation	Ministry of Gender and Family Promotion (MIGEPROF)
	National Strategy on Green Growth and Climate Resilience (2011)	Implemented	Guiding principles, strategic objectives, programmes for action, enablers, and roadmap for implementation	Ministry of Natural Resources (MINRENA)

5.10.2 Institutional Setup

The various ministries/agencies looking after the different components across the energy generation and distribution value chain for Rwanda is given below:



The Ministry of Infrastructure (MININFRA) is responsible for the overall coordination of activities in the energy sector and for the strategies, planning and monitoring of the implementation of the different programmes. The ministry also plays an important role in attracting private sector investment and coordinating support of development partners. It is also responsible to ensure that the development of policies and strategies concerning national infrastructure are in line with regional integration and harmonisation policies with the EAC.

Rwanda Utilities Regulatory Authority (RURA) is responsible for ensuring that electricity tariffs reflect recurrent costs as well as for the approval and registration of all energy activities and like MININFRA

facilitates and encourages private sector participation in investments in public utilities. Also, it is also responsible for publishing and updating the REFIT tariffs as well as for the licencing of utility service providers.

The Rwanda Development Board (RDB) is responsible for facilitating private sector investment into the energy sector.

Energy, Water and Sanitation (EWSA) distributes power and water in Rwanda. It is responsible for proper management of electricity infrastructure, gas, petroleum products, water and sanitation and coordination of all activities related with programmes aimed at development and exploitation of energy sources.

5.10.3 Renewable Energy Market Benchmark and Potentials

RE Target: 52% generation from RE sources[177] by 2024

Installed capacity (MW)[178]	Generation (GWh)[179]
• RE Installed capacity (2018): 137 • Non-RE installed capacity (2018): 118	• RE generation (2017): 399 • Non-RE generation (2017): 375

RE Potential Identified (TWh)[180]

Hydro (Large/ Medium / Small)	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal
<400 MW	**66.8 TWh**	**NA**	**NA**	**140-180 MW**	**NA**	**47.3 MW**

Note: NA – Not Available

5.10.4 Energy Efficiency Market Benchmark and Potentials

EE target: Reduce losses in transmission and distribution from 22% to 15% by 2024

- According to the Energy Sector Strategic Plan (2018/19 - 2023/24) report, MINIFRA is planning an Energy Efficiency Strategy which will lay out initiatives aimed to improve efficiency across the entire electricity value chain, ranging from generation, through transmission and distribution to end-user consumption.
- The Government have several programmes under discussion including efficient and resilient transport programme, adoption of energy efficient standards and building codes, among others.
- Although MININFRA, Rwanda Energy Group (REG) and the Rwanda Standards Board (RSB) will lead the design, implementation and monitoring of the Energy Efficiency Strategy[181] and its initiatives, there is a market for private sector institutions to get involved at the local level to implement the end-user efficiency programs such as awareness campaigns targeted at energy conservation, standards and labelling on appliances, etc. as well as to ensure sustainability of Government led initiatives.

5.10.5 Energy Access

Energy Access Target: 100% of access to energy by 2024182 (Grid access 52%; Off grid access 48%); Household access to electricity: 100%; Productive user access to electricity: 100%)

[177] Ministry of Infrastructure, Republic of Rwanda, Energy Sector Strategic Plan. September 2018.
[178] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Rwanda_Africa_RE_SP.pdf
[179] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Rwanda_Africa_RE_SP.pdf
[180] Ministry of Infrastructure, Rwanda Energy Sector Strategic Plan 2018/19- 2023/24, Retrieved: September 2018
[181] Energy Sector Strategic Plan (ESSP), 2018
[182] Energy Sector Strategic Plan (ESSP), 2018

- It is expected that 48% of all households will have their electricity needs met by off-grid solutions by 2024. Further, 100% of productive users will be connected, up from the current level of 72% (as per Energy Sector Strategic Plan, 2018).
- Productive users utilise energy for activities that enhance income and welfare and include health and education facilities, public infrastructure, and industry.
- Majority of the population in Rwanda resides in the rural areas (83% of total population). Rural Electrification Strategy (RES) published by MININFRA sets out a clear development plan for the rural areas.
- In order to ensure that each rural household is able to access the most appropriate form of electricity (based on their income levels and usage patterns), the Rural Electrification Strategy (2016) sets out four discrete programmes based on the consumer and technology, as below
    I. Mechanism to allow low-income households to access modern energy services through a basic solar system as a necessity.
    II. Establishing a risk-mitigation facility targeting the private sector such that solar products will be made available on financial terms that the population can afford.
    III. Mini grids will be developed by the private sector with Government playing a key role in identifying sites and establishing a framework through which these can become financially viable investments.
    IV. Government will continue to roll out the electricity network via Energy Access Roll-out Program (EARP), focusing on connecting high consumption users and driving economic growth.
- Expansion of the grid will continue through the Energy Access Roll-out Program (EARP). The private sector will continue to play a leading role in expanding energy access.
- According to the Rwanda Energy Policy (2015), in order to increase efficiency and create market opportunities for local business, where it is deemed appropriate, government owned power plants (including mini grids) shall be considered for lease to the private sector for operation and management.

Modern cooking targets[183] for Rwanda are listed below:

- Improved cookstoves (% of total population):30% (66% population still use traditional cookstoves)
- Efficient charcoal production (%): 28.7%

5.10.6 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	Scaling up Renewable Energy Program (SREP) Investment Plan	2015 – 2024	MININFRA, REG	The funds are to be used, in part, to address financial bottlenecks for SHS distributors, thereby stimulating the provision of off-grid solar systems in un-electrified locales
	Lighting Africa (Rwanda)	2014 - 2018	World Bank Group, MININFRA	Promote quality-verified off-grid solar products and provide basic electricity needs (lighting and mobile phone charging) in off-grid areas. Further to support Government programs to overcome financial challenges, as well as others that focus on

[183] Energy Sector Strategic Plan (ESSP), 2018

				consumer awareness, quality assurance, and product affordability
	Sustainable Energy for All (SEforAll)	2011 - ongoing	United Nations, MININFRA	Achieving off-grid energy access and increasing the share of renewable energy. Presents plan to deliver energy efficiency and renewable energy (biomass, off-grid and power generation from renewable energies)
	Vision 2020	2000 - 2020	Ministry of Finance and Economic Planning (MINECOFIN)	Increase energy production and diversify into alternative energy sources, thereby promoting economic growth making Rwanda a middle-income country by 2020
	Vision 2050	2020 - 2050	Ministry of Finance and Economic Planning (MINECOFIN)	Objectives include expanding affordable, reliable access to electricity to citizens and industrial users, ensuring sustainability in biomass supply and securing supplies of petroleum
Energy Efficiency	EELA Project	2019 – on-going	EACREEE	Introduction of EE standards for lighting and appliances
Energy Access – Mini-grids	Rural Electrification Strategy (RES)	2016 - ongoing	MININFRA, REG	Sets out four programmes[184] which deliver off-grid solutions (SHS and mini-grids), to achieve the 48% target for off grid access (through RE sources)
	Energy Access Roll-out Programme (2009)[185]	2009 - ongoing	Rwanda Energy Group (REG)	Target to increase rate of electrification from baseline rate of 6% to 100% by 2024. Rural Electrification Strategy (2016) remains a key driver for EARP in rural areas
Efficient Cookstoves	Biomass Energy Strategy	2018 - 2024	MININFRA	Halve the number of households using traditional cooking technologies to achieve a sustainable balance between supply and demand of biomass through promotion of most energy efficient technologies
Cross-Cutting	National Strategy for Transformation-1	2017 - 2024	Ministry of Finance and Economic Planning (MINECOFIN)	Sets sectoral targets to be achieved by 2024. These link sectoral achievements and progress to national development

[184] Four programmes are : (i) mechanism to allow low-income households to access modern energy services through a basic solar system as a basic necessity; (ii) risk-mitigation facility targeting the private sector such that solar products will be made available on financial terms that the population can afford; (iii) Mini-grids developed by the private sector with Government framework; (iv) Continued electricity network via EARP

[185] Lenz Luziane et al (2015), Does Large Scale Infrastructure Investment Alleviate Poverty? Impacts of Rwanda's Electricity Access Roll-Out Program. In *Ruhr Economic papers*. Retrieved from: https://www.econstor.eu/bitstream/10419/110333/1/825622085.pdf

5.11 São Tomé and Príncipe

Population	Electricity Access[186]
• Total Population [187] (2018): 0.21 million inhabitants Total Population (2015): 0.19 million inhabitants • Rural Population [188] (2018): 0.057 million inhabitants Rural Population (2015): 0.059 million inhabitants	• Population with Electricity (2018): 71.00% (76.70% in urban and 55.74% in rural) Population with Electricity (2015): 66.17% (73.06% in urban and 49.94% in rural) • Electricity consumption per capita: N/A

5.11.1 Laws and Regulations

Policies to promote Renewable Energy, Energy Efficiency and Energy Access

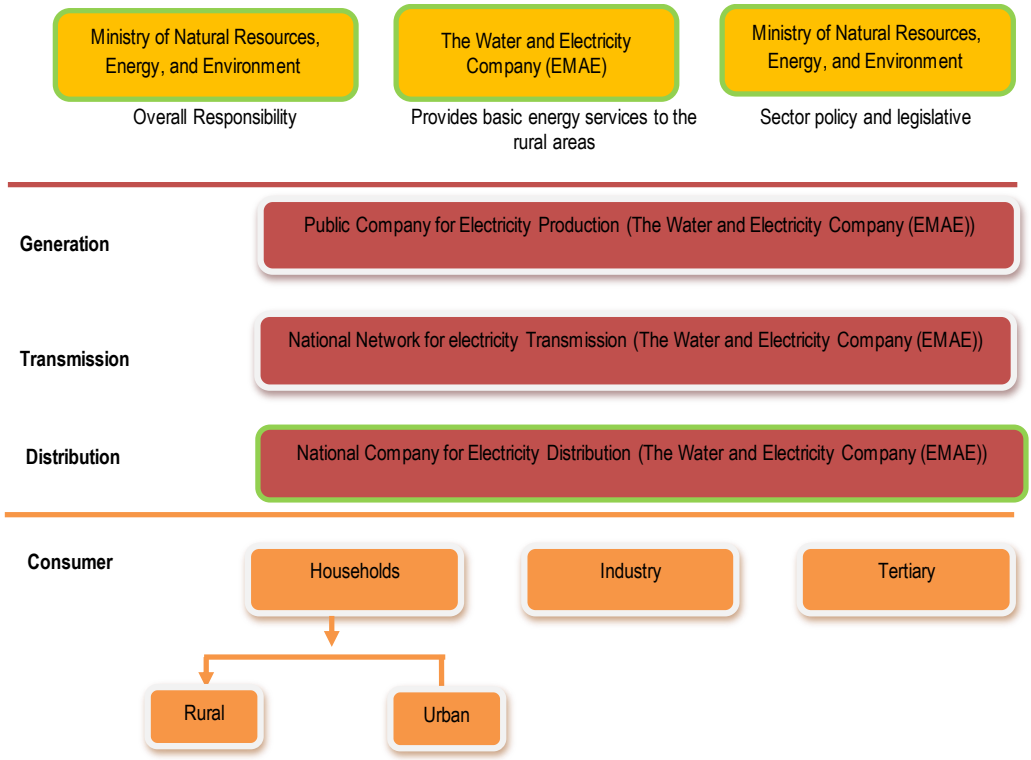
	Legislation	Implemented or in Discussion	Main content	Responsible Institution
Renewable Energy	Legal Regime of the National Electric Sector Organization[189]	Implemented	This Law Decree establishes the bases for the organization and functioning of the National Electric Sector, hereinafter referred to as SEN, defining the entities and the model of the electricity market, as well as the general principles of the exercise of production, transportation, distribution and commercialization activities. of electricity.	Ministry of Justice, Administration, Public Ministry and Parliamentary Affairs
	Transformation Agenda 2030 "*São Tomé e Príncipe 2030: o País que queremos construir*" ("STP 2030: the country we want to build (2015)	Implemented	Strategic axes are: 1) consolidate the rule of law and deepen democracy, 2) sustainable development, 3) promote human development, 4) promote values and favour the acknowledgement and maintenance of a virtuous process towards the success of development policies.	DGNER
	Grandes Opções do Plano 2020 -2023 (Big Options of the Plan)		The 2020-2023 Plan's Grand Options are approved, integrating the policy measures and investments that allow them to materialize. Energy is one of	

[186] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=ST
[187] https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ST
[188] https://data.worldbank.org/indicator/SP.RUR.TOTL?locations=ST
[189] http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/laws/8131.pdf

			the sectors targeted by the plan.	
	Least Cost Power Development Plan for 2018-2035)	Implemented	The plan, with an emphasis on the production of electricity from RE, aims to establish the essential guidelines for the different chains in the sector (production, transport and distribution), as well as defining which investments are necessary.	AFAP
	National Renewable Energy Action Plan	In development	RE action plan to guide STP in the achievement of its 2030 vision	DGNER
Energy Efficiency	National Energy Efficiency Action Plan	In development	EE action plan to guide STP in the achievement of its 2030 vision	DGNER
Energy Access	Least Cost Power Development Plan for 2018-2035)	Implemented	This plan also includes off-grid electrification involving mini-grids and SHS.	AFAP
	SEforALL Action Agenda	To be developed	It is projected that within the GEF/UNIDO project in implementation in STP, the SEforALL AA were energy access targets (beyond RE and EE will be set)	NA

5.11.2 Institutional Setup

The various ministries/agencies looking after the different components across the energy generation and distribution value chain for Sao Tome and Principe is given below:



The Ministry of Natural Resources, Energy, and Environment is in charge of the energy sector. There is no dedicated energy regulator, although the General Regulation Authority (Autoridade Geral de Regulação, AGER) that was created to regulate the infrastructure sector is expected to assume responsibility for regulating the energy sector. The Empresa de Água e Electricidade (EMAE) the Water and Electricity Company is state-owned monopoly that manages water and electricity supply. [190]

5.11.3 Renewable Energy Market Benchmark and Potentials

RE target: 50% of the production from RE

The Democratic Republic of São Tomé e Príncipe is a small volcanic archipelago in the Gulf of Guinea. The country is one of Africa's smallest nations with a total area of approximately 1,100 km2 and a population of 199,9101, of which 65.1 percent live in urban areas. A young nation that became independent in 1975 has also a young population, with 62.9% of people below 24 years. Promoting inclusive social and economic development, while conserving the natural resources and preparing to the adverse effects of the climate change are key priorities of the country's development agenda. São Tomé e Príncipe prepared its National Adaptation Program of Actions (NAPA) and Nationally Determined Contributions (NDCs), and has recently developed, with the support of the World Bank, a comprehensive multisector investment plan to identify and prioritize its climate actions.

São Tomé e Príncipe is committed to reducing its national emissions by 24% compared to the 2030 business-as-usual (BAU) scenario. Mitigation actions focus on increasing the share of renewable energies in the national electricity system to 47% of which 34% of hydro and 13% solar energy. To achieve this goal, the country estimates that USD 59 Million investment will be necessary. [191]

Installed capacity (MW) [192]	Generation (GWh) [193]

[190] https://wedocs.unep.org/bitstream/handle/20.500.11822/20518/Energy_profile_SaoTome.pdf?sequence=1&isAllowed=y
[191] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Sao%20Tome%20and%20Principe_Africa_RE_SP.pdf
[192] https://www.irena.org/IRENADocuments/Statistical_Profiles/Africa/Sao%20Tome%20and%20Principe_Africa_RE_SP.pdf
[193] https://www.unido.org/sites/default/files/files/2020-02/Africa%20Regions.pdf

• RE Installed capacity (2018): 3 • Non-RE Installed capacity (2018): 45	• RE generation (2017): 6 • Non-RE generation (2017): 96

RE Potential Identified (MW)

Hydro (Large/ Medium / Small)	Solar PV	Solar CSP	Wind	Biogas	Biomass	Geothermal
31[194]	NA	NA	NA	NA	NA	NA

Note: NA – Not Available

5.11.4 Energy Efficiency Market Benchmark and Potentials

EE target: No reference data found.

5.11.5 Energy Access

Energy Access Target: No targets defined

Modern cooking target: No targets defined

5.11.6 Plans, Programmes, Funds & Projects

	Plan / Programme / Fund / Project	Implementation Period	Executing Agency	Objective / Target
Renewable Energy	National Adaptation Programmes action on Climate Change [195]	2006	World Bank	An analysis was made in respects of climate as well as the geographical, economic and financial situation. The studies, "Inventory of gases with greenhouse effect" and "National Strategy of Adaptation on Climate Change".
	National Development Plan 2017-2021	2017		Designed to operationalise the Transformation Agenda STP 2030 and the Sustainable Development Goals (SDGs)
	São Tomé and Príncipe intended nationally determined contribution[196]	2015	UNEP	The aim of the document is to identify the mitigation to national reduce emissions and the actions to be taken by the Sao Tome and Principe authorities.
	NDC Country Outlook São Tomé and Príncipe [197]	2015	NDC Partnership	The NDC document states the actions towards reducing climate change impacts in a vulnerable country like Sao Tome and

[194] ALER, Status das ER e EE em STP (Draft), 2018
[195] https://www.thegef.org/sites/default/files/project_documents/NAPA%2520final%2520report_0.pdf
[196] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Sao%20Tome%20and%20Principe%20First/STP_INDC%20_Ingles_30.09.pdf
[197] https://ndcpartnership.org/sites/all/themes/ndcp_v2/docs/country-engagement/countries/NCDP_Outlook_STP_v1a.pdf

				Principe, which is a SIDS. The measures proposed in the NDC include targets for the use of hydropower and solar PV.
	National adaptation programmes of action on climate change (PANA)[198]	2006	World Bank	The NAPA identifies the immediate needs and priorities for adaptation to climate change. A deep analysis of the country was made, in respects of climate as well as the geographical, economic and financial situation. The studies, "Inventory of gases with greenhouse effect, GEE. 1999" and "National Strategy of Adaptation on Climate Change" allowed us to obtain information on the problem of emissions of gases with greenhouse effects and climate change in Sao Tome and Principe, as well as to delineate policies and measures to adopt in a framework for sustainable development.
Energy Efficiency	Sao Tome and Principe savings policy assessment	2020-2030	U4E	Country Energy Efficiency savings database. This includes energy, cost and CO_2 estimates for lighting, refrigeration, air conditioning and electric motors.
Energy Access – Mini-grids	NA	NA	NA	NA
Efficient Cookstoves	IEA/WHO Clean Cooking Database, Sao Tome and Principe[199]	2019	IEA/WHO	Clean Cooking Database from 2000 to 2018
	Clean Cooking Alliance Data[200]	2020	Clean Cooking Alliance	Generic country level data for polluting, open fires or inefficient fuels for cooking.
Cross-Cutting	Strategic Program to Promote Renewable Energy and Energy Efficiency Investments in the Electricity Sector of Sao Tome and Principe[201]	2019	Ministry of Infrastructure, Natural Resources and Environment (MINRE), Agência Fiduciária de Administração de Projeto (AFAP), ECOWAS Centre for Renewable Energy and	The country promotion of investments in renewable energy and energy efficiency solutions with high GHG emission reduction and local value creation potential in the electricity sector

[198] https://www.thegef.org/sites/default/files/project_documents/NAPA%2520final%2520report_0.pdf
[199] https://iea.blob.core.windows.net/assets/b6baec29-6a12-40d6-8333-b89519660299/WEO2019-Clean-Cooking-database.xlsx
[200] ://www.cleancookingalliance.org/country-profiles/33-sao-tome-principe.html
[201] https://www.thegef.org/project/strategic-program-promote-renewable-energy-and-energy-efficiency-investments-electricity

			Energy Efficiency (ECREEE)	
	ECCAS and CEMAC White Paper[202]	2014-2030	CEEAC-CEMAC	The White Paper is based on a common vision of ECCAS and CEMAC in order to ensure by 2030 universal access to modern energy services for populations, with a view to the emergence of Central Africa and a sustainable human development. This vision is supported by three guiding principles: good governance, regional, national and local; energy security and the development of renewable energy, in particular the development of hydro power; equity, inclusive development, and poverty reduction.
	Promotion of environmentally sustainable and climate-resilient grid/isolated grid-based hydroelectric electricity through an integrated approach in Sao Tome and Principe. [203]	2016	UNDP	The document introduces an integrated energy and ecosystems-based approach to grid/isolated-grid-based mini/small hydro-electricity generation in Sao Tome and Principe by leveraging $20.7 million in multilateral and private sector financing over a five-year implementation period.
	Emissions Reduction Profile Sao Tome and Principe[204]	2012	ACP-MEA & UNFCCC	The document assesses the country overall abatement potential including energy efficiency measures (lighting), hydro power implementation and efficient cookstoves reaching an emission reduction potential of 111,630 tonnes CO_2.

5.12 RISE Country Profiles

Note that as well as the desk-based research and feedback form the Needs Assessment questionnaire to develop the Country Profiles above, we have also found the 'Regulatory Indicators for Sustainable Energy' country profiles useful in reviewing the status of markets in Central Africa. These profiles, which are developed as part of the World Bank's ESMAP department, are available for all the relevant countries apart from Equatorial Guinea, Gabon and Sao Tome e Principe. At the following link:

https://rise.esmap.org/countries

[202] https://www.se4all-africa.org/fileadmin/uploads/se4all/Documents/News___Partners_Docs/ECCAS_CEMAC_livre_blanc_energie_2014.pdf

[203] https://info.undp.org/docs/pdc/Documents/STP/PIMS%204602%20STP%20MFA%20ProDoc.pdf

[204] http://www.acp-cd4cdm.org/media/366234/emissions-reduction-profile-sao_tome_principe.pdf