Assessment of the Conventional Energy Potential in Cameroon: The use of Wind, Small Hydro, and Solar Technologies as Alternatives Solutions

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Abstract- Energy supply in Cameroon remains below demand, although it has been growing steadily since 1980. Given that one of the growth targets of the Energy Sector Development Plan, which was 3GW of production by 2020, has not been met, it seemed appropriate to launch a study to gather information to estimate Cameroon's conventional energy potential and to highlight renewable sources such as solar, wind and small hydro. In total, about 100 articles and technical reports related to electrical energy were consulted. After eliminating duplicates and documents not directly related to the theme, the remaining documents were sorted according to eligibility criteria such as relevance to the conventional energy situation in Cameroon, focus on one of the targeted renewable sources, number of citations, and publication date. Following this screening, 32 references were finally selected and used as the basis for this study. It emerges that the hydroelectric and thermal productions of the country are respectively 1414.2 MW and 605.622 MW for a total of 2019.822 MW, the exploitable potential in renewable energies studied is estimated at 1339.038 MW which represents 66.29% of the current national energy potential. Similarly, it appears that the great north is favorable to the development of solar and wind energy representing about 88% of sources studied, or a minimum production value of 1180 MW, while the great south is favorable to the emergence of small hydroelectricity representing 12% of renewable sources, or a value of 158 MW.

Keywords conventional; wind; solar; hydro; renewable; power plant.

1. Introduction

Cameroon is a Central African state with an area of 475 442 km2. It is located between the 9th and 16th degrees of East longitude, and stretches from 1°40' to 13° North latitude, which gives it the privilege of combining almost all the climates of tropical Africa [1]. It is a group of ten regions, namely the Far North (EN), North (NO), Adamaoua (AD), Centre (CE), South (SU), East (ES), Littoral (LT), West (OU), North West (NW), and South West (SW).Cameroon's energy potential is essentially made up of hydroelectricity (64%), thermal energy (30%) and renewable energy (about 6%). However, Cameroon has a vast renewable energy potential that has not yet been exploited [2,3]. The galloping demography and the industrialization are at the origin of the new energy policy based on the research of green sources and the development of new technologies [4]. This policy is dictated by the authorities such as the Rio summit, the Kyoto protocol, the Paris conference which prescribe the reduction of greenhouse gases and the participation of renewable energy sources in the coverage of energy needs [5-9]. This is one of the reasons why the Central African Power Pool (CAPP) was created in a spirit of mutual assistance of member countries located in a region where the hydroelectric potential represents 57.7% of the African energy potential [6]. In Cameroon, although in perpetual growth, the global installed capacity remains far below the demand, despite the fact that the country is well endowed with hydroelectric, thermal and renewable sources [10]. Many studies have been conducted on the assessment of energy potential, but very few focus on the use of renewable energy as an alternative solution to the energy deficit. The work [11] presents this type of source as a viable energy option and recommends strong insertion in the educational system of the specialties dealing with these energies. Likewise, this concludes that solar energy is the best short-term solution to face the energy crisis in Pakistan. In addition to presenting them as a palliative source, [12] provides details on the knowledge of the most used in Algeria

The purpose of this work is to update the data on the electrical potential to highlight the capacity of renewable energy, despite the fact that the literature on their potential in Cameroon is limited and scattered [13]. For this reason, we have used a methodology of selection of works based on a set of criteria, the most important of which are the duration of the information conveyed and the closeness of its link with the energy potential of Cameroon. This article presents the substance of the energy potential in its conventional and renewable aspects in order to release after calculations of the results, proposals, even hypotheses and perspectives on the basis of the adopted methodology. A conclusion concludes the work.

2. Methods

This study is conducted using the bibliographic resource from books, documents and technical reports from local and international institutions. These books are mostly from the decade 2012-2022. Those published before and found in this work are there either by their consistency of content or simply because they fall within the regulatory or historical framework.

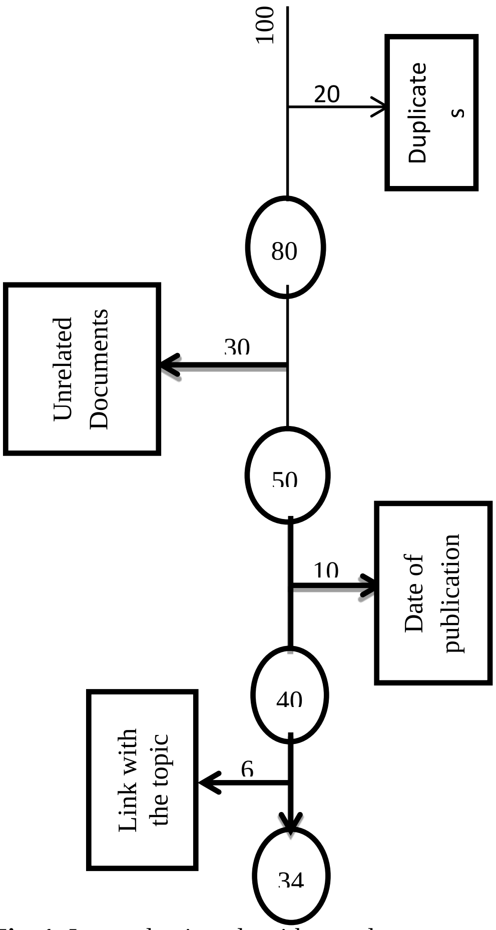

Fig. 1. Item selection algorithm and reports.

The purpose of this study is to estimate the conventional energy potential of Cameroon and to highlight solar, wind and small hydro sources. A total of about 100 articles and technical reports related to electric power were consulted. After eliminating duplicates and unrelated documents, about 50 of the remaining materials were screened for eligibility criteria, namely link to Cameroon's conventional energy situation, development focused on one of the targeted renewable sources, number of citations and date of publication. After this sorting, 32 references were selected as the basis for this analysis. The summary table of these works allows us to have a good visibility on each of them.

Table 1. Selected references

Source	Year	Document type	Citation*
[1]	2016	Document	/
[3]	2022	Article	
[4]	2017	Document	07
[5]	1997	Conference	84
[6]	2018	Document	/
[7]	2021	Review article	25
[9]	2020	Article	04
[10]	2019	Document	/
[13]	2020	Document	/
[14]	2011	Article	15
[15]	2018	Article	01
[16]	2019	Article	01
[17]	2015	Article	20
[18]	2020	Article	03
[19]	2019	Book	01
[22]	2020	Book	01
[23]	2020	Article	23
[24]	2021	Article	04
[25]	2013	Report	135
[26]	2021	Article	06
[27]	2012	Article	90
[28]	1999	Article	16
[29]	2017	Document	/
[30]	2007	Document	/
[31]	2017	Document	/
[33]	2014	Article	12
[34]	2016	Article	04
[35]	2014	Article	19
[36]	1980	Document	55
[37]	2013	Review article	150
[38]	2014	Report	/
[39]	2016	Report	16

The table above presents the articles and documents whose relevance is essentially linked to the theme and the work criteria.

3. Results and discussions

At the end of the various readings of articles and technical reports, it emerges that the potential of conventional energy remains below the demand. Therefore the renewable energies more adapted to the improvement of the quantitative and qualitative supply are favorable. the most exploitable among these energies, namely the wind, the solar, and the small hydro associated with the conventional one, constitute the field that was explored.

3.1. Conventional Energy Potential of Cameroon

This potential includes hydroelectric and thermal potential.

3.1.1. The hydroelectric potential of Cameroon

Hydroelectric facilities are classified according to their capacity based on the new electricity law in force in Cameroon. Table 2 presents the different energy levels.

Table 2. Classification of hydroelectric facilities [14].

Large hydroelectricity	Small hydro (renewable energy source: RES)		
	Mini-hydro	Micro-hydro	Pico-hydro
Capacity ≥10MW	10MW > capacity ≥ 1MW	1MW > capacity ≥ 0.01MW	Capacity < 0.01MW

Cameroon has an average of 23 GW of large-scale hydropower potential on about 30 sites, mainly concentrated in the southern part of the country. Most of these sites are located in the Sanaga watershed, the country's main river basin, which alone contains up to 65% of the national potential, with 9 generating sites [15]. The hydroelectric plants in operation are listed in Table 3. There are also 4 reservoir dams whose purpose is to regulate the flow of the river on which it is built during low water periods. These reservoir dams are Bamendjin, Mape, Mbakaou and Lom-Pangar [7,16]

Table 3. Hydroelectric plants in operation [7,8].

No	Region	River	plant	Capacity (MW)
01	LT	Sanaga	Songloulou	384
02	LT	Sanaga	Edéa	276.4
03	SU	Ntem	Memve'ele	211
04	SU	Dja	Mekin	15
05	NO	Bénoué	Lagdo	72
06	ES	Sanaga	Lom Pangar	30
07	CE	Sanaga	Nachtigal	420
08	SW	Uvé	Ngassona*	3
09	AD	Ndjerem	Mbakaou*	2,8
Total			**9**	**1414,2 MW**

* Mini plants considered as RES.

The Cameroonian government, in addition to its own imperatives in terms of electrical energy for its population, also intends to export electricity to neighboring countries. These imperatives are set out in the Growth and Employment Strategy Paper (GESP) [17]. With this in mind, the country is currently building hydroelectric and thermal power plants to improve access to electricity and reach at least 4 GW of power generation capacity by 2035, as envisaged in the Power Sector Development Plan (PDSE). Overall, there are 18 large-scale hydroelectric projects for a total of 9 GW. Some of these are listed in Table 4

Table 4. Some planned hydroelectric power plants [16,17].

Project	Region	Capacity (MW)	Observation
Chollet	SU	600	
Noun-Wouri	OU	1028	
Mungo	SW	60	
Nachtigal	CE	420	In progress
Grand Eweng	LT	1200	
Song Mbengue	LT	1140	
Kikot	LT	1000	
Warak	AD	75	
Njock	CE	170	
Ngodi	LT	1140	
Song Dong	LT	280	
Nyamzom	CE	375	
Ekom-Nkam	LT	10.84	
Atoufi		10.27	
Manyu	NW	10.84	

In addition to the above sites that have been studied in depth, a hundred other sites with a capacity of more than 10 MW each have been identified in Cameroon. See Document Annex 1.

3.1.2. The Thermal Potential of Cameroon

Thermal energy is the solution adopted by the Cameroonian government in the short term to reduce the country's energy deficit. Thus, the emergency thermal program (ETP) initiated in 2009 adds 101.24 MW of additional energy to the RIS by 4 power plants, whose 88 groups reinforce the usual power plants of the national electricity network. In addition, in order to satisfy the population, the government has liberalized the electricity market and a few independent operators (IO) have been active in thermal generation since 2009. These include the Dibamba Power Development Corporation (DPDC), the Kribi Power Development Company (KPDC), and AGGREKO, which are located in Dibamba, Kribi, and Maroua, respectively, for a total of 312 MW, bringing the national thermal production to 567.64 MW, as shown in Table 5 [18,19].

Table 5. Thermal power plants connected to the grid [18,19].

Nº	Region	Plants	Fuel	Units	Capacity (MW)	Observation
1	SW	Limbé	HFO	5	85	
2	LT	Logbaba	LFO	2	12	

3	LT	Bassa	LFO	3	9	
4	CE	Oyomabang	HFO	3	18	
5	OU	Bafoussam	LFO	3	6	
6	EN	Kousséri	LFO	3	4.4	
7	NO	Djamboutou	HFO	20	20	
8	CE	Mbalmayo	LFO	9	13.2	ETP
9	SU	Ebolowa	LFO	9	13.2	ETP
10	NW	Bamenda	LFO	18	25.4	ETP
11	CE	Ahala	LFO	52	49.44	ETP
12	LT	Dibamba	HFO	//	86	IO
13	EN	Maroua	HFO	//	10	IO
14	LT	Kribi	Gaz	//	216	IO
Total		**14**	//	**127**	**567.64**	

However, throughout the national territory, there are many power plants operating in isolation for the electrification of the locality where they are located and its surroundings.

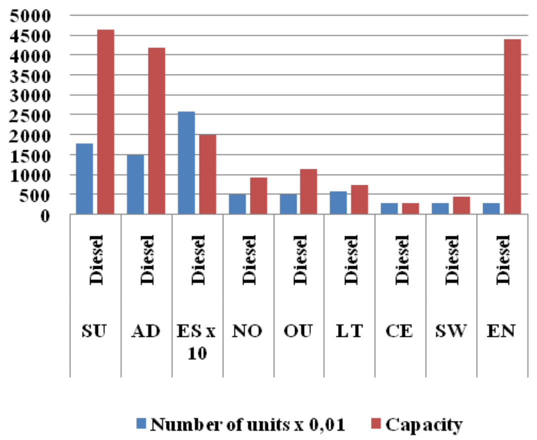

Fig. 2. Capacities of off-grid power thermal plants.

These plants have a total capacity of 37,982 MW and are illustrated in the figure below [19]. This brings the national thermal production to 605,622 MW.

3.2. Potential of Renewable Energy Sources

-The world is facing a big problem in the production of electricity due to the energy crisis, caused by the shortage of fossil fuels and the increase in global energy demand. Thus, most countries consider renewable energy resources as an effective solution to the global energy crisis[20, 21].

Cameroon has a vast potential for renewable energy resources, with an impressive potential for small hydroelectricity. In order to guarantee access to affordable electricity for all, the government is committed to electrifying remote localities using solar energy and/or mini hydroelectric power plants; connecting all communes to the electricity network; increasing the density of service and the quality of service of the distribution network; and continuing rural electrification programs through the extension of interconnected distribution networks [22]. So far, these energy needs are only met by 4.8% of hydroelectricity. Wind and solar energy remain almost entirely untapped, while coincidentally, these potentials are at their maximum during the dry season when low water levels have a considerable influence on hydroelectric production [23].

3.2.1. Small Hydroelectricity

In the race to increase electricity production and promote green energy, small hydro has an important role to play. To this end, several micro-hydro projects are to be developed in Cameroon in the particular context of rural electrification. The realization of classified infrastructures in the very short term will lead to a substantial increase in small hydropower to about 9 MW [13]. In the medium and long term, all the projects listed make a gigantic contribution, amounting to 970 MW [23]. Some of these projects are listed in the table below.

Table 6. Micro-hydro projects [19, 22, 23].

Project	Capacity (kW)	Project	Capacity (kW)
Ngambé-Tikar	530	Lom tributaries	9130
Ndokayo	4530	Colomines	7000
Rumpi	2900	Ntiou aval	2280
Olamzé	400	Ntiou amont	1140
Baré-Bakem	110	Moloundou	8560
Koutaba	150	Boden	6800
Fotetsa	120	Gogazi	4000
Ngassona	2900	Gambari	5000
Yoke.	2000	Zokoumambale	9000
Abi Falls	2000	Oudou	9700
Aswenjway	2000	Nkam à bexem	9700
Firso	1000	Djialingo	5000
Menka	1000	Mayo Nolti	6800
Mirzam 1	4000	Benade	7990
Mirzam 2	3000	Edjong	9000
Malale	750	Nsanakang	8560
Foumban	128	Dschang	260
Bekili	1000	Batie	1600
Bambélé	9000	Mari	5000
15 micro-hydro sites producing 3900 KW [24].			
Before 2013 : 303 KW [1].			
Total sites identified: **158.241 MW**			

Moreover, this source of energy is expected to attract more interest in the coming years, as the country will benefit from the support of the Hydro Power Solutions (HYPOSO) framework, which aims to increase the share of renewable energy through sustainable hydropower solutions and rural electrification in five countries, including Cameroon [24].

3.2.2. Solar Energy Sources

Solar radiation carries waves that generate two types of energy: photovoltaic solar energy, which is the result of the transformation of this radiation into electricity, and solar thermal energy, which converts it into heat. In [25,26], it is demonstrated that solar thermal energy can be exploited in Cameroon with the CSP (Concentrating Solar Power) technology. The conversion considered in this review is the solar photovoltaic conversion. According to [14,27], the whole country has a significant solar energy potential. In general, the solar energy intensity is higher in the far north regions with estimates between 4 and 5.8 kWh/day/m^2 and 4.9 kWh/day/m^2 in the rest of the country [28]. The Ministry of Energy estimates the amount of solar energy received at 2,327 TWh/day in Cameroon where the values of irradiation and estimated solar energy powers by region are recorded in the figure below [19, 29-31].

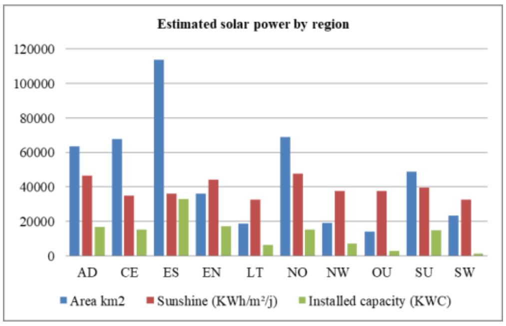

Fig. 3. Solar energy irradiation and installed power.

The very first grid-connected solar photovoltaic plant is located in Guider in the North Cameroon Region. It has a capacity of 10 MW and is already injecting 2.3 MW into the grid since March 2022. However, it is not the first of its kind in the country. Already in 2013, the power installed by solar across the ten regions was 1.3 MW [10]. Closer to home, we can mention: The solar power plant in Djoum allowing to produce 186 kilowatt-peak is commissioned on January 25, 2018. It has a capacity expandable to 372 kWp and is coupled to a diesel thermal power plant of 1,115 kW existing since the 1970 to which it serves as a backup. This plant is the first of the solar program of the operator Eneo in Cameroon [2]. The Lomié hybrid solar park has a capacity of 125 kilowatts peak (kWp). It was commissioned on July 27, 2020 in the Eastern region. It is the second hybrid solar-thermal power plant of its kind, after the one in Djoum [3].

Work on the Maroua and Ngaoundéré solar power plants, which have been in the pipeline since 2018, should begin in 2021 under the supervision of Eneo. These plants and the one in Guider will help balance the energy supply in the north. As part of its strategy to promote renewable energy in Cameroon, at least five other photovoltaic power plant projects are scheduled for investment by Eneo. These are the Lagdo, Garoua, Ngaoundal, Bertoua and Yokadouma solar power plants. However, the solar source is usually the subject of isolated production and in most cases small independent producers. It is with this in mind that in November 2015 the government announced the solar electrification project for 166 localities in the ten regions. This project in reality being only the first part of the project "Electrification of 1000 localities across Cameroon by solar photovoltaic system" From this angle, the solar power plant of Ngang inaugurated in 2016, that of Nsem inaugurated in 2018, ... are of a series of 350 of which 59 others are completed. They are intended for the electrification of households, services and public administrations. This series, which we call Independent Solar Power Plants (CSI), will result in 12 MW produced in remote localities [32-35]. Based on the above, the following summary table can be drawn up in relation to solar.

Table 7. Potential contribution to networks by solar identified.

Plants	Capacity (MW)	Observations*
Maroua	15	Scatec Solar
Garoua	30	Enerray Solar
Guider	10	Scatec Solar
Lagdo	20	
Bertoua	5	
Ngaoundéré	20	GDS Orion Solar
Before 2013	1,3	10 regions
Djoum	0,372	
Lomié	0,125	
Ngaoundal	//	
Yokadouma	//	
Projet 1000	12	CSI
Total	**113.797**	

* The private structures that are partners of Eneo for the production are mentioned.

The figure 4 provides information on the production possibilities by region with possible energy exports to the interconnected grid [14].

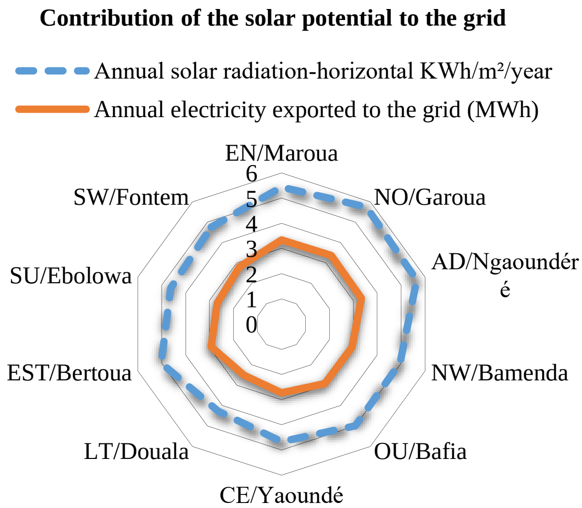

Fig. 4. Minimum potential contribution to networks by solar energy and by region.

The regions whose sunshine values are between 5 and 6 KWh/m²/year are the sunniest; these are the North, Adamaoua, the Extreme North, and the East. Conversely, those below 5KWh/m²/year are the least sunny

3.2.3. Wind Energy Sources

The wind source cannot be exploited uniformly because of the very noticeable difference in wind speed levels from one region to another. Meteorological data indicate that winds are strongest in the far northern region and decrease in strength as you go down. Commercial wind farms are generally located in areas where the average wind speed is well above 4 m/s at a height of 10 m above the ground. Previous work shows that the three northern regions have the best wind speeds between 3 and 5m/s. The other regions have average wind speeds between 1.2 and 2.4 m/s. For this reason, they are very fruitful for the installation of conventional wind turbines with horizontal axis, and can be connected to the national electrical grid. In other regions, the exploitation of the wind requires the use of Savonius type wind turbines with an input speed of 1m/s [13,33]. Studies done on isolated sites have given results that confirm what has just been said. For example, a study carried out at Mount Tinguelin in Garoua in the North region, characterizes it as a sure source of wind energy potential and evaluates its annual energy production at 22322 MWh from Enercon type wind turbines [37]. Work carried out in Bamenda in the North-West and Bafoussam in the West of the country indicates that the Savonius wind turbine would match their potential and provide sufficient energy for rural electrification and water pumping in agriculture. Similarly, the wind potential data noted that a 42 MW wind farm could be built in the Bamboutos Mountains [23,38,39]. The following table shows the potential contribution of wind power to the grid, particularly in the three northern regions, considering an average of 2,283 wind turbines in Adamaoua, the middle ground between the quantities used in the far north and the north.

Table 8. The minimum potential contribution of wind power to grids [37,38].

Region	Height of the mast (m)	Wind velocity (m/s)	Capacity produced per year		Type Wind turbine
			wind power (MWh)	Power plant (GWh)	
EN	64	4.7	1732	3490	Enercon E-82
NO	64	4.4	1368	3490	
AD	64	4.0	876	2000	
Other	variable	$V \leq 4$	//	//	Savonius

These values were found by the parameters characterizing the wind potential such as: the most frequent wind speed (V_{Fmax}); the velocity containing the maximum energy in a wind regime (V_{Emax}); the energy density of the wind (E_D); the total energy available in the wind spectra during a given period (E_S); the energy available to the wind turbine during a given period (E_{AG}); and the annual percentage of time during which the wind has an exploitable value. The figures below provide information on these different variables.

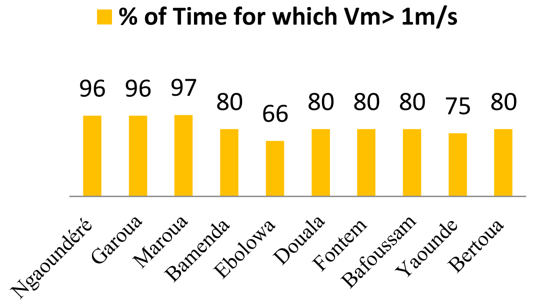

Figure 5. Annual percentage of time that wind has an exploitable value by region.

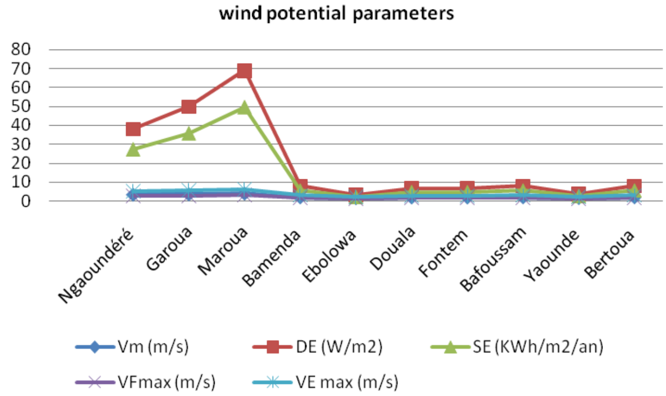

Fig. 6. Parameters characterizing the wind potential.

The values in Table 8 allow us to mention the following as the wind component contribution, just taking into account the contribution of the Bamboutos Mountains site for the South and East interconnected networks. Thus, we can minimally consider the following values: RIN: 1025 MW, RIS and RIE: 42 MW, for a total of 1067 MW.

3.3. Evolution of Conventional Energies

It is simply the sum of the hydroelectric and thermal productions of the country that is to say respectively 1414.2 MW and 605.622 MW for a total of 2019.822 MW. Even if the fixed objectives are not generally achieved, it is worth noting that the annual production is in perpetual growth. The figures below are an illustration [4,6].

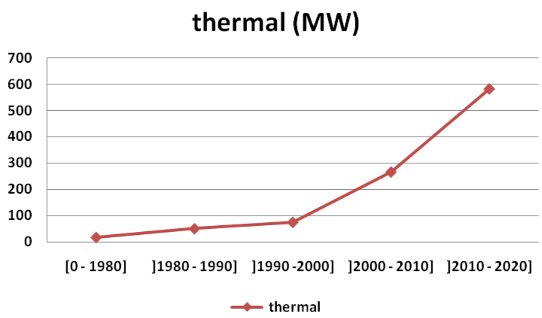

Fig. 7. evolution of the thermal production.

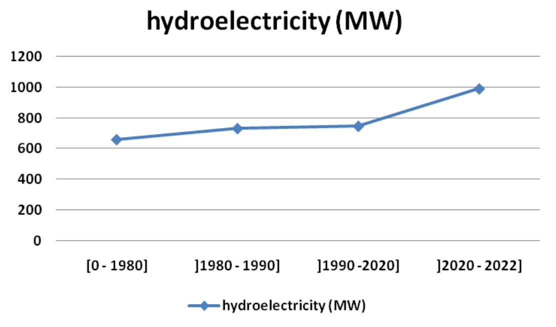

Fig. 8. evolution of the hydroelectricity production.

The figures above show the evolution of thermal and hydroelectric sources between 1980 and, 2022 in Cameroon.

3.4. The Renewable Energy Potential Studied

According to the studies conducted above, the current situation of renewable energies in Cameroon is summarized in the table below.

Table 9. Current national renewable energy production.

Nature	Capacity (MW)	Percentage (%)
Wind	1067	79,68
Solar	113.797	08,49
Small hydro.	158.241	11,81
Total	**1339,038**	**100**

It emerges that the current wind energy potential is estimated at the minimum value of 1067 MW, which represents 52.82% of current national production. That of solar energy is 113.797 MW representing 05.63% of the national production. As for the small hydro, its percentage is 07.83% for a value of 158.241 MW. In general, the current potential in renewable energy represents the 66.29% of the current national energy potential.

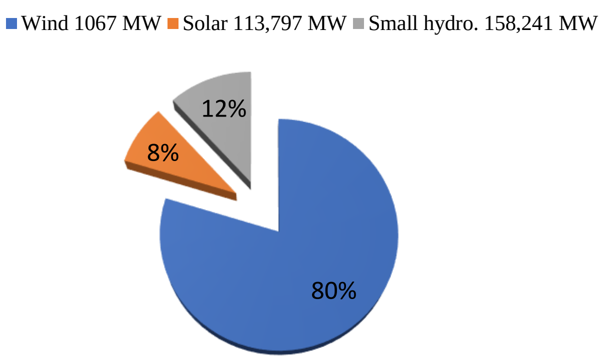

Fig. 9. Percentage of energy intake of the RES studied.

As shown in Figure 9, wind power production is much higher than other sources. The implementation of this resource alone would make it possible to reach the objectives of 3000 MW of production by 2025, and by associating it with solar and small hydro sources, we will be very close to the objective of 4 GW of national production by 2035 as planned by the electricity sector development program. In addition to conventional energies, the most important current network, the RIS, thanks to the Sanaga basin, will be followed or even equaled by the RIN. To further fill the energy gap, in addition to the implementation of the results of this work, we suggest the exploration of other forms of renewable energy such as biomass, offshore wind, geothermal, cogeneration, ... Also, in the current context where the loads are multiple through the cohabitation of industries, services, and households, a look at multi-source systems will be a definite advantage. Finally, a policy of popularization of the important content of Cameroon in RES in order to attract maximum private investors is to be considered.

4. Conclusion

The objective of this study was to review the literature, the data on the electrical potential, and the current state of development of this sector in Cameroon. The current conventional energy potential is estimated at 2019,822 MW and is insufficient to power households and industries. Renewable energies, notably small hydro, solar, and wind power, are abundant in the country but are not sufficiently exploited to date. They could produce at least 1339 MW which is more than half of what conventional sources currently produce. Coincidentally, it is during the dry season, when low water levels reduce current production, that these sources will be at their most productive. This research was based on approximately 100 articles and technical reports, of which 30 were selected based on criteria such as proximity to Cameroon's energy potential assessment and year of publication. Similarly, it appeared that the far north is favorable to the development of solar and wind energy representing about 88% of the sources studied, i.e., a minimum production value of 1180 MW, while the far south is favorable to the emergence of small hydroelectricity representing 12% of the RES, i.e., a value of 158 MW. These energies can therefore be used as offsets to conventional power generation. Their development could fill the gap between the high demand and the still insufficient energy supply in Cameroon. Indeed, the energy supply estimated at 3000 MW in 2020 is not yet reached in this year 2022 or the production is about 2019 MW. In perspective, it is suggested to increase the production of the mentioned energies, to practice more and more the hybridization of the power plants according to the geographical zones, to open the sector of the energy production of Cameroon to private investors to accelerate the exploitation of the studied renewable energy sources and those which are unexplored such as the biomass, the geothermal energy, to quote only those.

Acknowledgments

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ACCOMPANYING DOCUMENT

List of sites discovered in Cameroon with production capacities greater than 10 MW

N°	Sites	Capacities (MW)	Watercourses	N°	Sites	Capacities (MW)	Watercourses
01	Atoufi	62	Mentchum	48	Makaï	146	Nyong
02	Mapo downstream	37	Djerem	49	Mak Mo	17	Manyu
03	Bagangté upstream	183	Noun	50	Makouk	22	Nkam
04	Bagangté downstream	146	Noun	51	Mamfé	181	Manyu
05	Bajo	19	Munaya Sud	52	Mandourou	86	Faro
06	Bakari Bata	34	Mbere-ngou	53	Mantoum	87	Mbam
07	Bangué	43	Boumba	54	Mayo Darlé in Koné	19	Mbam
08	Banja	74	Katsina	55	Mayo Djinga	12	Mbam
09	Batari	25	Katsina	56	Mayo Taram in Nyagoum	40	Mbam
10	Bayomen	472	Mbam	57	Mba downstream	15	Lom
11	Bekem	24	Nkam	58	Mbam upstream	148	Mbam
12	Bénadé	22	Mentchum	59	Mbengué Tiko	23	Kadey
13	Bilomo	189	Mbam	60	Mbinja	94	Faro
14	Bodi	115	Nyong	61	Moloundou upstream	19	Boumba
15	Bongola à Bitandé	159	Ntem	62	Moloundou downstream	28	Boumba
16	Bongola upstream	176	Ntem	63	Mouila – Mogué	370	Nyong
17	Buba's fall	20	Moungo	64	Mounkounda	56	Wouri
18	Nki's fall	387	Dja	65	Mpoumé	124	Nyong
19	Oudou's fall	16	Oudou	66	Nachtigal upstream	196	Sanaga
20	Mba's fall	52	Lom	67	Nachtigal downstream	167	Sanaga
21	Waran's fall	69	Vina nord	68	Nden	59	Vina nord
22	Dehané	100	Nyong	69	Ndokban	20	Makombe
23	Djam, Tari	11	Mayo nolti	70	Ngaï	11	Vina nord
24	Djohong	34	Mbere-ngou	71	Ngodi	509	Sanaga
25	Edéa upstream	439	Sanaga	72	Ngoïla	156	Dja
26	Ekom	18	Nkam	73	Njock	157	Nyong
27	Eweng (major project)	885	Sanaga	74	Nloatchok	154	Mbam
28	Eweng (small project)	307	Sanaga	75	Nsanakany	18	Manyu
29	Fo	56	Faro	76	Ntem in Akom	50	Ntem
30	Gbabiri	56	Mbere –ngou	77	Ntem in Ma'an	78	Ntem
31	Gorge du Ntem	556	Ntem	78	Ntem in Memvélé	200	Ntem
32	Big Edéa	426	Sanaga	79	Ntem at the elbow	278	Ntem
33	BigNachtigal	450	Sanaga	80	Nyazom	335	Mbam
34	Kelempeck	44	Nyong	81	Akwens'bridge	44	Munya sud
35	Kellé	20	Nyong	82	Mezams'rapids	107	Dja
36	Kékékumo	85	Mentchum	83	Song Dong	278	Sanaga
37	Kikot upstream	287	Sanaga	84	Song Loulou RD	259	Sanaga
38	Kikot downstream	574	Sanaga	85	Song Mbong	94	Nyong
39	Kim in Boubala	19	Mbam	86	Songmbengue	939	Sanaga
40	Kim in Mankom	44	Mbam	87	Tinto-Mbu	44	Manyu
41	Kim in Mendoudou	57	Mbam	88	Tombassala	128	Nkam
42	Kumbi	65	Katsina	89	Vozom	32	Vina nord
43	Kwaf	150	Katsina	90	Von	32	Faro
44	Lancrenon	31	Mbere-ngou	91	Wouri in Yabassi	115	Wouri
45	Litala	148	Sanaga	92	Yenga	176	Boumba
46	Lablé	130	Mbam	93	Zoulabot	67	Dja
47	Lom Pangar	52	Sanaga				