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The Necessity of Sustainable and Affordable Energy Solutions for Industrial Companies in Cameroon

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Abstract: Since the years 2000, the Republic of Cameroon has been facing an unprecedented energy crisis. The energy demand had been growing while investments were still below acceptable level to provide energy to all consumers. Economic activities are negatively affected by the energy rationing and frequent power cuts. To cover their electricity needs, industrial companies have acquired diesel engines which not only pollute but add to production costs. Sustainable solutions were not investigated by industrial companies who prefer to pass on the additional production costs to consumers. Solar energy integration and energy valorization of solid wastes by industries are suggested. Cameroon has a huge undeveloped hydroelectric potential which require substantial investments. Excess losses observed on the electrical network should be reduced trough a renovation program. In the search of sustainable solutions for energy security, the role of the government is crucial.

Keywords: Cameroon; renewable energy; industry; electricity; oil

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1. Introduction

The Republic of Cameroon covers a total land area of 475,650 km^2 and is located at latitude 2-13 °N and longitude 8-16 °E with parts in western and central Africa. It shares borders with Nigeria, Chad, Central African Republic, Congo, Gabon, and Equatorial Guinea (Figure 1). The country is divided into ten regions, and each region has a capital city and is subdivided into divisions,

subdivisions and districts (Table 1). It thus has 58 divisions and 361 subdivisions. Cameroon is a democratic country which became impendent from Great Britain and France in 1960. The reunification of the country took place in 1972. The presidential regime is adopted and the president is elected for a 7 years term. A prime minister is appointed by the president. The parliament is formed after legislative elections, and has a mandate of 5 years. Just recently, a senate was put in place with part of its members appointed by the president and the remainder elected. As of September 2011, about 271 political parties where legally registered [1].

From 7 663 264 in 1976, the number of inhabitants is close to 20.1 million (2012 estimates) and is expected to reach 25 million by 2020 (Figure 2). The population is unequally distributed, with 17.7% in the centre, 17.8% in the Far North and 14.4% in the littoral region. The population is comprised of 40.6% male, 50.4% female and 64.24% is less than 24 years old [1; 2]. The literacy rate is to 71.20% (78.20% for male and 64.7% for female). It varies with locations, and is 89.9% in urban areas and 57.20% in rural areas [3]. The population growth rate was 2.7% in 2008 and has been declining since the 1980s, as can be viewed on Figure 3 and the trend is expected to continue. The rationale for this tendency could be found in the economic crisis.

Figure 1. The Map of Cameroon

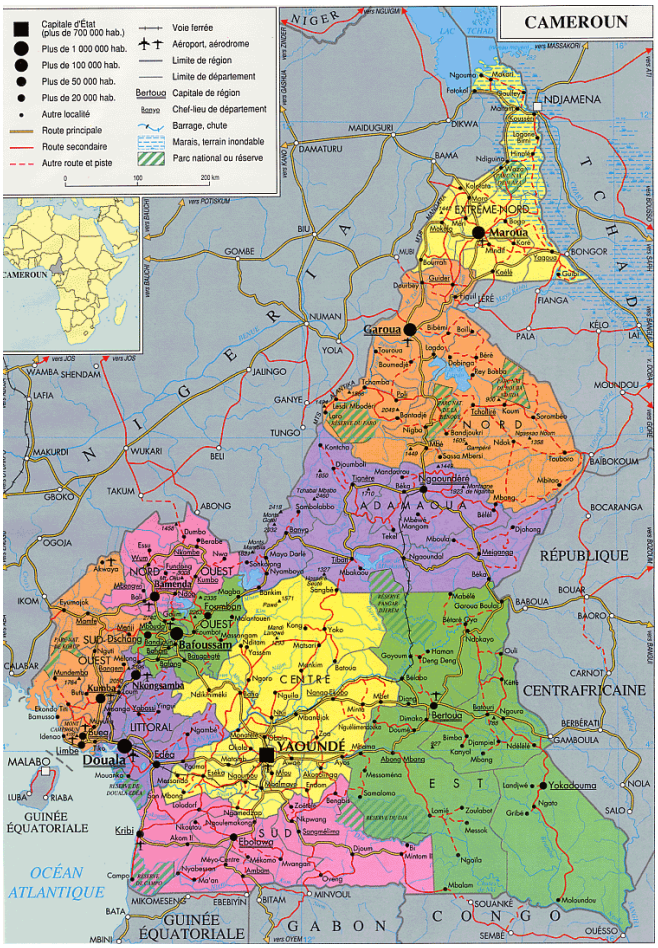


Table 1. The regions of Cameroon (Source: INS, 2011; Belgedj et al., 2007)

	Regions	Regional capital city	Number of divisions	Number of subdivisions	Population in 2007 (million)
1	Adamaoua	Ngaoundere	5	21	0.76
2	Centre	Yaoundé	10	70	2.6
3	East	Bertoua	4	33	0.82
4	Far North	Maroua	6	47	2.7
5	Littoral	Douala	4	35	2.2
6	North	Garoua	4	21	1.6
7	Northwest	Bamenda	7	34	1.7
8	South	Ebolowa	4	29	0.45
9	Southwest	Buea	6	31	1.3
10	West	Bafoussam	8	40	1.9

Figure 2. Population evolution and predictions in Cameroon (Source: INS, 2011)

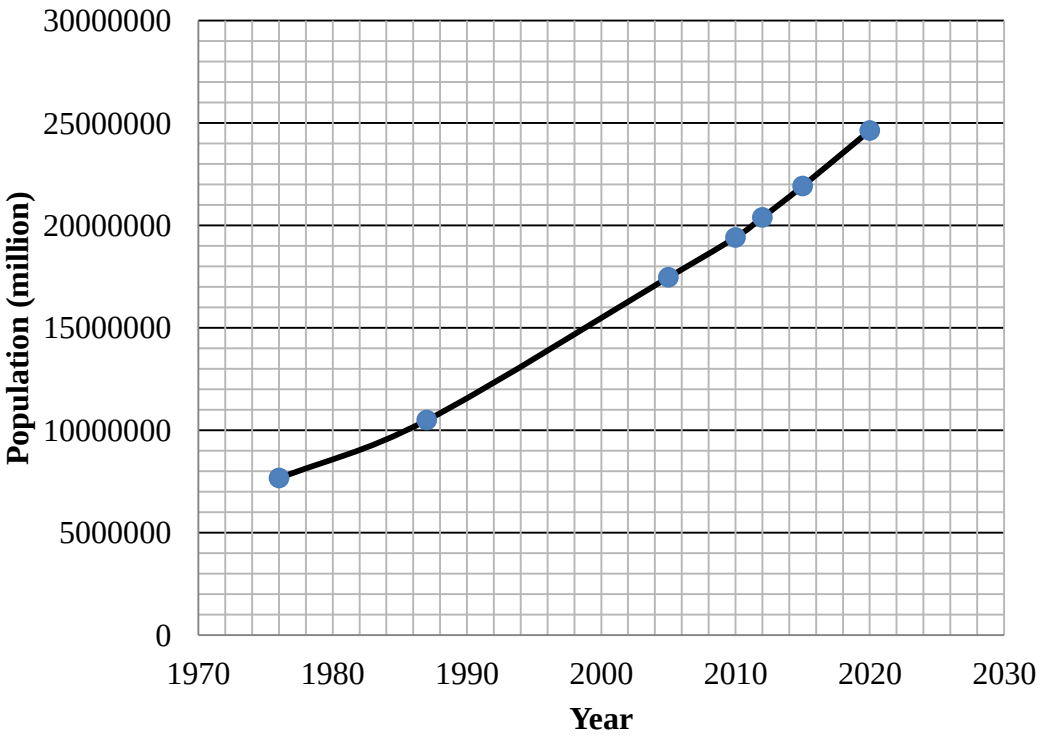
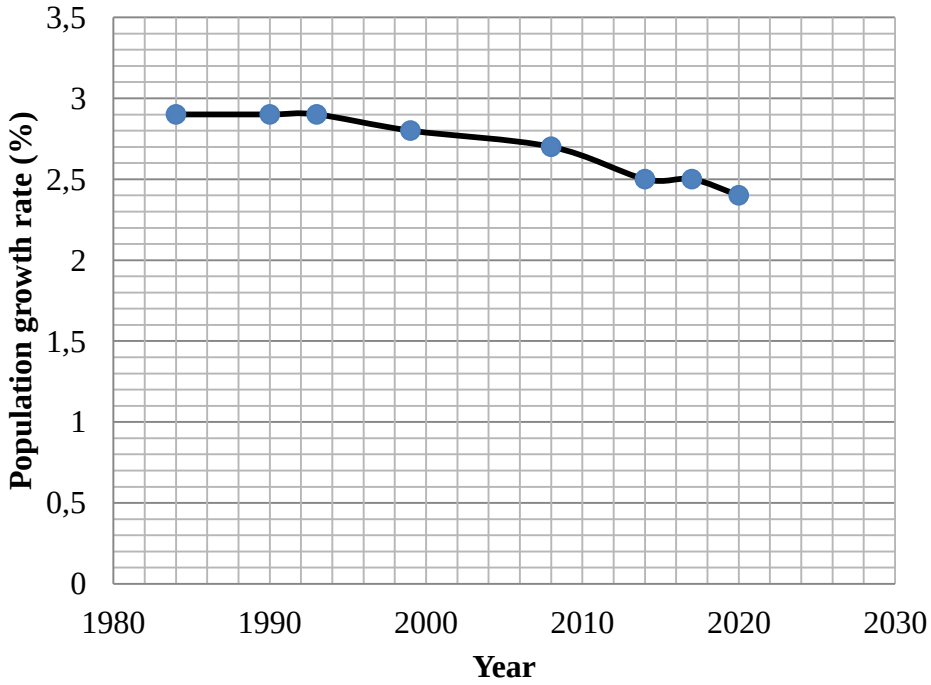


Figure 3. Population growth rate over the years (Source: INS, 2011)



There is evidence that energy is an important key driver of the economic growth. Energy is needed for productive activities in the form of electricity (for pumps, electrical motors, etc) and thermal energy (thermal loads). Thus, electricity generating infrastructures – nuclear plants, coal power plants, wind farms, solar parks, hydropower plants, etc are vulnerable and strategic points. The availability and supply of energy resources converted into useful forms – oil, sun, coal, uranium, etc are critical components of country's policy and as such should be assessed, exploited and managed in a sustainable manner. The present paper is divided into three parts. Fist, the electricity and oil products production and consumption in Cameroon is analyzed. Secondly, the industrial sector is presented and assessed. The paper finally closes with few recommendations.

2. Energy production and consumption

2.1 Electricity production and consumption

In 2001, after a privatization process the government of Cameroon sold its wholly-owned power company SONEL to AES Corporation. AES-SONEL became a private monopoly whose activities include generation, transmission and distribution of electrical energy in Cameroon. AES-SONEL acquired 51% of SONEL shares for a concession period of 20 years, the state and the employees the remainder. As part of the acquisition deal, AES-SONEL would invest in infrastructure renewal, expansion, and improved service levels during the concession period [4]. An electricity sector regulatory agency (ARSEL) was created after the liberalization of the electricity sector. Electricity development corporation (EDC), a state owned company aiming at

investing in the electricity sector was also created. A Rural electrification agency (AER) was put in place by the government to provide electricity to isolated or non grid connected populations in 1998.

Hydro in Cameroon is the main source of electricity, and the potential is high and is said to be the second largest potential in sub-Sahara Africa after that of the Democratic Republic of Congo (DRC). The technical potential of the country was estimated at 23 GW. Main hydroelectric power plants supplying the country are: Edéa (263 MW), Songloulou (388 MW), and Lagdo (72 MW). A certain number of sites suitable have been identified but still not yet exploited. Small hydropower plants exist in some specific places, and the potential is found in western and eastern regions. As seen on Table 2, the electrical capacity from thermal power plants has increased over the years as a response to the increasing energy demand. In 2010, the thermal capacity was 284.1 MW, representing 28.19% of a total electrical capacity of 1007.1 MW [1].

Table 2. Evolution of the electrical capacity of AES-SONEL (Source: INS, 2011; Nkue & Njomo, 2009)

Year	Hydro capacity (MW)	Thermal capacity (MW)	Total (MW)
2000	719	118	837
2001	719	131	850
2002	719	156	875
2003	719	114	833
2004	719	101,5	820,5
2005	719	209,2	928,2
2006	719	205,90	924,9
2007	719	202,50	921,5
2008	719	217,90	936,9
2009	719	303,00	1022
2010	723	284,10	1007,1

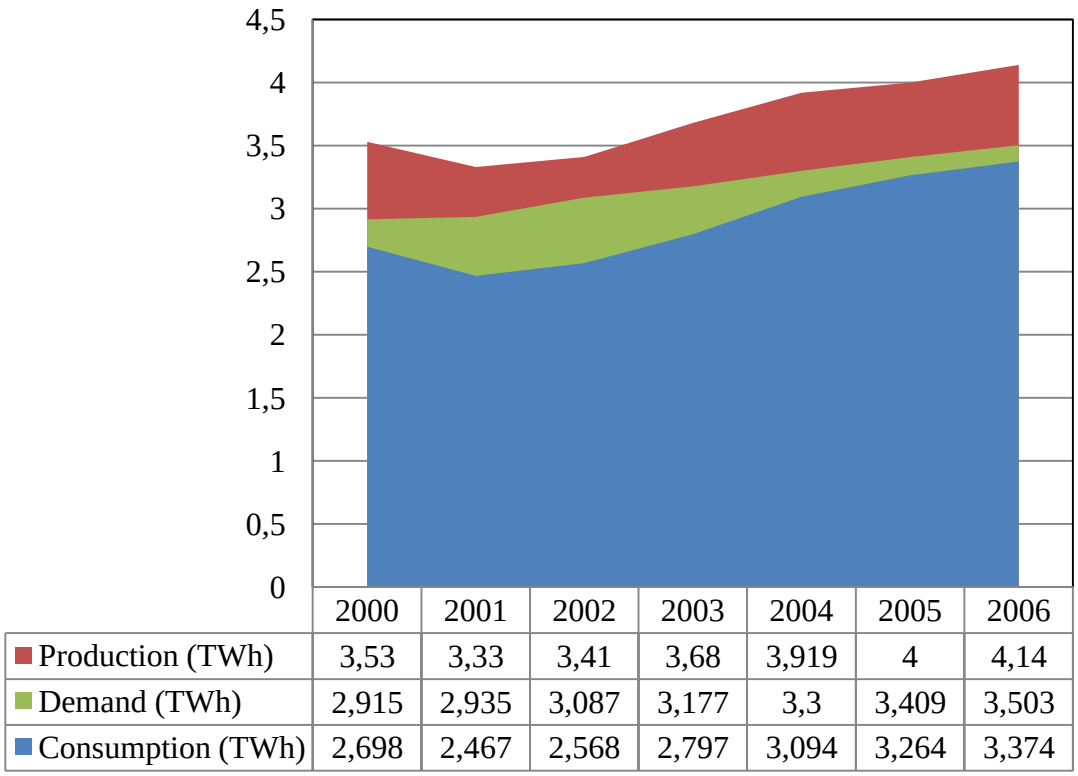
The electricity generation has been increasing over the years as seen on Table 3. According to IRENA (The International Renewable Energy Agency) it was close to 6 TWh in 2012 [5]. Significant losses are witnessed on the electrical network, between 18-26%.

The energy demand has been increasing – see Figure 4 [6], but the production didn't meet the demand because of significant losses observed on the network. The losses on transportation lines are due to ageing effects on materials and components (transformers, cables). Thus, substantial parts of the distribution lines should undergo renovation. As of 2009, the distribution line was 28405 km long [1]. Figure 4 clearly shows that if half of the losses are recovered, the energy demand could be met.

Table 3. Electricity production and losses (Source: INS, 2011; Tamo Tatsiete et al., 2010, Nkue & Njomo, 2009)

Year	Production (TWh)	Losses (%)
2000	3,53	23,57
2001	3,33	25,92
2002	3,41	24,69
2003	3,68	23,99
2004	3,19	21,05
2005	4	18,40
2006	4,14	18,50
2007	4,256	21,08
2008	4,502	21,66
2009	4,496	25,22
2010	4,821	25,72

Figure 4. Electrical Network Energy Balance (Nkue & Njomo, 2009)



	2000	2001	2002	2003	2004	2005	2006
Production (TWh)	3,53	3,33	3,41	3,68	3,919	4	4,14
Demand (TWh)	2,915	2,935	3,087	3,177	3,3	3,409	3,503
Consumption (TWh)	2,698	2,467	2,568	2,797	3,094	3,264	3,374

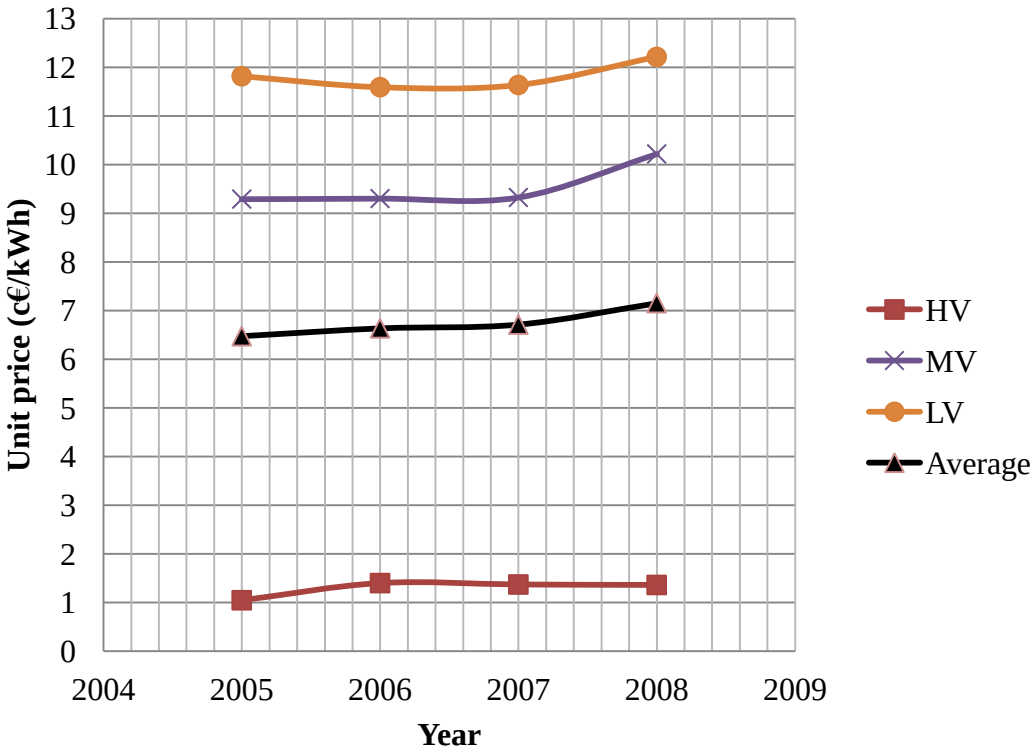
Different retail prices exist in the electricity sector: HV (high voltage), MV (medium voltage) and LV (low voltage). Customers are grouped into three categories: LV, MV and special customers. Special and medium voltage customers (industrial companies) represent 0.23% of

consumers but consume 65.13% of total electrical energy consumed in the country – see Table 4 [1]. SMEs and households, 99.77% of consumers use the remainder (34.87%). The average price of electricity has been increasing over the years - see Figure 5. The cost of the kWh depends on the category of customer. Special customers pay close to c€1.2/kWh, MV customers pay c€7/kWh and LV customers, c€12.2/kWh in 2008. It is obvious that households pay higher price for electricity – about 10 times that of special customers.

Table 4. Distribution of energy consumption by customer's category as of 2007 (Source: INS, 2011)

Type of customers	Electrical energy (kWh)	Share (%)	Number of customers	Percentage (%)
Low Voltage	1 171 414	34.87	570 787	99.76
Medium Voltage	780 159	23.22	1 312	0.23
Special Customers	1 408 140	41.91	5	0.00087
TOTAL	3 359 713	100	572 104	100

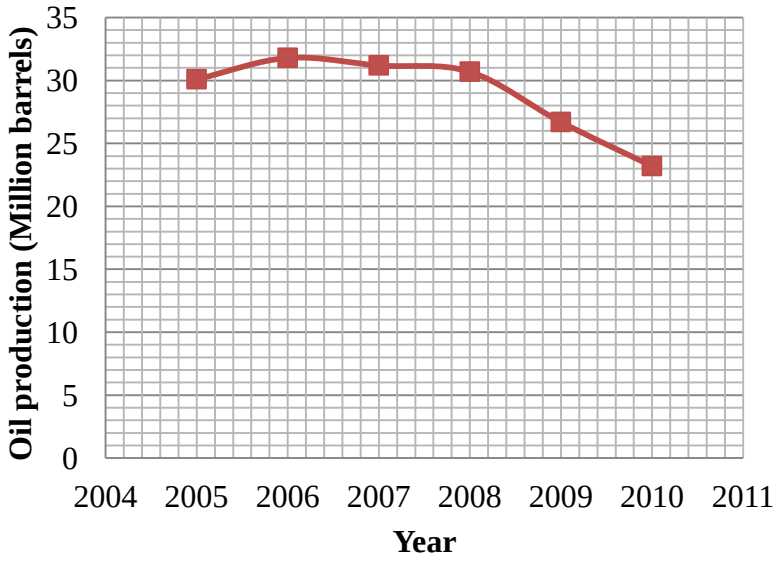
Figure 5. Electricity price in Cameroon (Source: INS, 2011)



2.2 Oil production and consumption

Cameroon is and oil and gas producer since 1976. A certain number of stakeholders are found in the oil sector [2]: consumers (industries, transportations, households), the ministry in charge is the ministry of energy and water (MINEE), companies (Pecten, Total, etc.), SONARA (Société Nationale de Raffineries) SNH (Société Nationale des Hydrocarbures), SCDP (Société Camerounaise des Dépôts Pétroliers), and CSPH (Caisse de Stabilisation des Prix des Hydrocarbures) is in charge of the stabilization of the prices of oil and gas and is under the umbrella of the ministry of trade and commerce.
The national production has been declining over the years since 1986, and the trend continues – see Figure 6[1; 7]. The sole oil refinery is SONARA, a state owned company. The oil produced in the country is not appropriate for the company as its process design system is not suitable for the heavy oil produced in the country. It is designed for light oil while the one produced in the country is heavier. Thus, 85% of the oil refined is imported from Nigeria – see Table 5[1]. The natural gas produced is entirely burned onsite, of which 60% only is used for thermal processes and the rest wasted. The company is not capable of producing enough LPG for the growing internal market entirely made up of households [2; 6; 8]. Thus, the import of LPG has grown between 2002 and 2007 by 142% [2].

Figure 6. Oil production in Cameroon (Source: INS, 2011)



In industries, fuel oil and diesel are used for process heat and electricity generation, respectively while the transportation sector uses diesel and super [1; 9-11]. The transportations are dominated by buses, individual cars and motorcycles imported from Europe and China. The introduction of motorcycles and second hand vehicles has led to increased pollution and subsequent consequences on health. Table 6 is an evidence of the growing oil products consumption in the country [1]. The demand would be well above the figures displayed. Figure 7 shows the variation of the prices between 2000 and 2010. The prices have been increasing over the years with a peak

reached in 2008. Such increase cannot be without negative effects on the economic activities and the purchasing power of the populations.

Table 5. Quantity of oil refined by SONARA

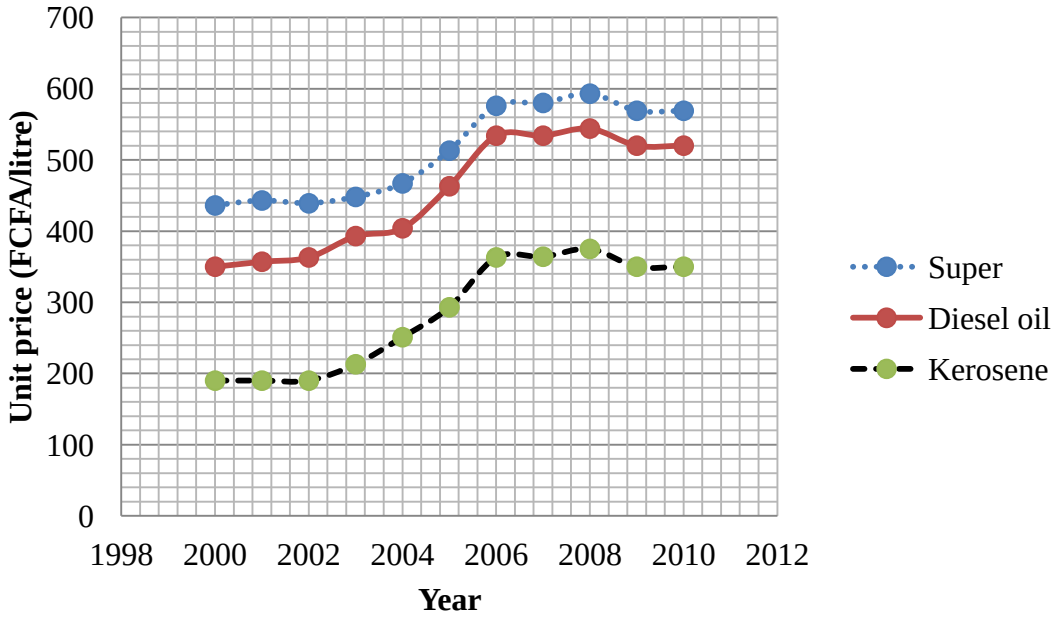
	SNH (Metric tones)	Importations (Metric tones)	Total (Metric tones)	Percentage of imports (%)
2005	124	1731	1855	93,31
2006	249	1608	1857	86,59
2007	325	1760	2085	84,41
2008	409	1663	2072	80,26
2009	346	1420	1766	80,40
Average	**290,6**	**1636,4**	**1927**	**84,99**

Table 6. Oil products consumption in Cameroon (source: INS, 2011)

Products	Annual consumption (tones)				
	2005	2006	2007	2008	2009
Super	383870	369211	380062	408780	415824
Kerosene	102201	210912	201433	207433	199905
Diesel oil	255327	491530	500157	526008	523143
Fuel oil	61401	59422	54273	62995	82972
LPG	41990	33593	49065	51894	56933

Figure 7. Unit price evolution of oil products in Cameroon (Source: INS, 2011)

*1 € = 655.99FCFA (February 2014)



3. The Cameroon's industrial sector

Industrial companies operate into three or more main sectors depending on the industrial level of the country. However, primary, secondary and tertiary (and quaternary) sectors are clearly distinguished. The primary sector includes the production of raw materials and basic food. Activities concerned are: agriculture, mining, forestry, farming, grazing, hunting and gathering, fishing, and quarrying. The secondary sector manufactures finished goods and activities associated with this segment of the economy are: metal working and smelting, automobile production, textile production, chemical and engineering industries, aerospace manufacturing, energy utilities, engineering, breweries and bottlers, construction and shipbuilding. The tertiary sector is the service industry. The activities within this sector are: retail and wholesale sales, transportation and distribution, entertainment, restaurants, clerical services, media, tourism, insurance, banking, healthcare and law. Two others sectors of the economy are: the quaternary and the quinary sectors. The quaternary sector is comprised of all intellectual activities (culture, education, information technology, etc). The last sector is not well defined and usually considered a branch of the quaternary sector.

In Cameroon, 0.4% operates in the primary sector, 13.1% in the secondary and 86.5% in the tertiary [1]. There are about 12 154 companies officially registered in the secondary sector. The distributions per region and by type of activity are as given in Tables 7 and 8. Most companies are located in the centre (28.37%) and littoral regions (33.4%). Table 9 shows that 22.8% of the labor force works in the secondary and 67.8% in the sector of services.

Table 7. Spatial distribution of companies of the secondary sector (Source: INS, 2011)

	Regions	Number of companies	Percentage per region (%)
1	Adamaoua	224	1,84
2	Centre	3448	28,37
3	East	105	0,86
4	Extreme north	194	1,60
5	Littoral	4064	33,44
6	North	439	3,61
7	North west	1083	8,91
8	South	220	1,81
9	South West	1040	8,56
10	West	1337	11,00
	Total	12154	100

Table 8: Distribution of industrial companies in the secondary sector in Cameroon (Source: INS, 2011)

	Types	Number of companies	Percentage per type (%)
1	Extraction	30	0.2
2	Food	736	6.1
3	Drinks and tobacco	31	0.3
4	Textile, rubber and plastics	6500	53.5
5	Timber, wood and paper	2777	22.8
6	Petrochemical	71	0.6
7	Metallurgy and smelting works	1108	9.1
8	Energy (Oil, gas, electricity) and water	195	1.6
9	Engineering and construction	706	5.8
	Total	12154	100

Table 9: Number of jobs in Cameroon (Source: INS, 2011)

Sector	Number of jobs	Percentage (%)
Primary	33905	8.8
Secondary	87889	22.8
Tertiary	261927	67.8
Not declared	2542	0.7
TOTAL	386263	100

Figure 8: GDP growth and contribution of the secondary sector (Source: INS, 2011)

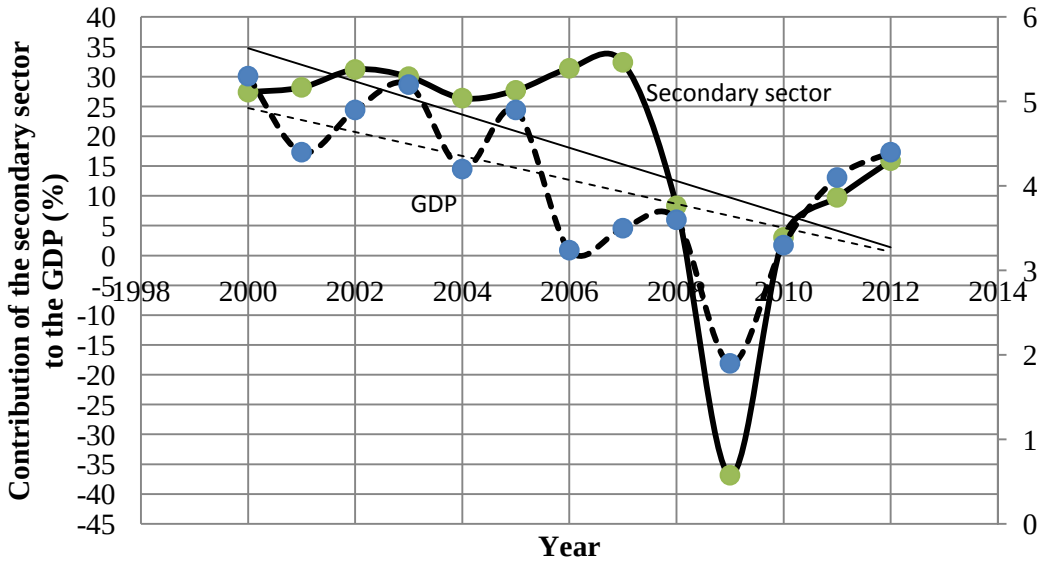


Figure 8 is an evidence of the weight of the secondary sector on the economic growth. It shows a correlation between GDP growth rate and the contribution of the secondary sector. The figure shows that during the period 2000-2012, the GDP growth has varied between 1.9 - 5.3% [1; 9; 12]. In 2009, the growth was the lowest and the contribution of the secondary sector was even negative -36.84%. This was due to the decrease in oil production, thus proving how important is the oil production for the country. It not only provides direct revenues for the country but also energy (fuel/thermal and diesel/electricity) for the industry and more persistently fuel for electricity generation. It is worthwhile to recall that about 30% of AES-SONEL electrical capacity is of thermal origin. According to Tamo Tatsiete et al. [9], AES-SONEL consumed 90 Million tons of oil fuel in 2007.

4. Discussion and recommendations

4.1 Sustainable management of the electrical network

In section 2, it has been shown that the losses are responsible of the electricity deficit and that reducing the losses down to 10% could help meet the electricity demand in the country. This means replacing old transmission lines and transformers by new equipments. Some authors found that most hydroelectric plants operate with efficiency below 55% [9-11]. This could be solved by adopting energy plants upgrade.

4.2 Oil policy

Oil in Cameroon is a critical issue. It not provides revenues to the Country, but sustains the economic activities. Therefore, it becomes now very important for the government to develop a new oil policy. Close to 85% of oil refined in the country is imported from one country, Nigeria. The declining in national oil production should bring onboard new suppliers. The disputed area of Bakassi is rich of oil, and efforts should be done to exploit this crucial wealth.

4.3 Governance and investments

Entrepreneurs in Cameroon find corruption as the major threat to business according to a NIS (national Institute of Statistics) report [1]. Despite new laws opening the electricity sector to private investments, local investors are not whiling to invest in energy business because of the lack of thrust and other uncertainties and risks surrounding business in Cameroon. While oil revenues have been declining, it is high time for the government to develop strategic plans to attract foreign investments. Few projects have been announced in the country and would require huge investments in the electricity sector: Limbe oil yard (20 MW), Kribi deep sea port, ALUCAM factory extension (400 MW), Iron and steel complex, etc. Neighboring countries: Nigeria, Chad and Central African Republic have expressed their interest of purchasing electricity from Cameroon. The country in order to cover its electricity needs should increase its capacity to 3 GW by 2020 [12]. The potential for 100% clean electricity is really huge and potential sites have been identified – see Table 10, but the investments have not followed till

now [13]. By exploiting this hydroelectric potential, Cameroon will become a net electrical energy exporter. Therefore, it is the task of the government to ensure that environment is safe for business, and develop partnership and international/national collaborations to unlock this potential.

Table 10. Potential sites or Projects in the electricity sector (Global village, 2012; Tatsiete et al, 2010)

Projects	Location	Capacity (MW)	Status
Thermal power station	kribi	150	Under const.
Hydroelectric power station	Natchigal	280-330	
Hydroelectric power station	Lom-pangar	170	Under const.
Hydroelectric power station	Memvélé	120-200	
Upgrade of Hydroelectric power stations	Edéa & Songloulou	30	
Hydroelectric power station	Song Mbengué	950	
Hydroelectric power station	Kikot	350-550	
Hydroelectric power station	Njock	270	
Hydroelectric power station	Ngodi	475	
Hydroelectric power station	Song dong	250-300	
Hydroelectric power station	Nyanzom	375	
Hydroelectric power station	Bayomen	470	
Hydroelectric power station	Mouila Mogué	350	
Hydroelectric power station	Baganté	90	
Hydroelectric power station	Warak	50	
Hydroelectric power station	Gbazoumbé	12	
Hydroelectric power station	Ndokayo	-	
Hydroelectric power station	Cholet	400	
Hydroelectric power station	Grand Eweng	386	
Hydroelectric power station	Petit Eweng	230	
Hydroelectric power station	Noun-Wouri	1200	
Hydroelectric power station	Mandourou	67	
Hydroelectric power station	Mbinjal	66	
Hydroelectric power station	Lancrenon	34	
Hydroelectric power station	Vogzom	33	
Hydroelectric power station	Munaya	200	
Hydroelectric power station	Kpaf	300	
Hydroelectric power station	Mentchum	15-35	

4.4 *Energy efficiency*

Energy efficiency and demand-side management practices have never been encouraged in the country – neither in buildings nor in industries and transports. Energy audits should be encouraged to reduce excess energy consumption and replace equipments with poor performance. Factories consume 65% of the electricity produced in the country and energy intensive industries – cement and metal, should adopt sustainable practices. In literature very works exist on households energy issues.

4.5 Renewable energy integration in factories

In the context of energy shortage, industrial companies have acquired diesel generators to produce their own electricity [9-10]. The cost of electricity generated by the industries is about 5 to 6 times that generated by AES-SONEL. This leads to the increase of the production costs which is later pass on to the consumers. Without the increase in wages, the purchasing power of households is just reduced. In a country where the minimum wage is less than €50, the inflation is very sensitive. The industrial companies instead of using expansive and polluting diesel engines should search for new solutions. One these solutions would be the integration of renewable energy technologies in factories to generate electricity or to assist processes. Solar energy is available in the country and can be used – solar photovoltaic panels can be integrated on roofs or adequately installed where land is available. Solar thermal panels could produce heat for processes or coupled to absorption/adsorption cooling systems. Table 11 lists processes and required temperatures. Temperatures are in the range 60-300 °C. Some of the processes could be supplied with heat from medium temperature solar thermal collectors [14]. In Table 12, a large number of solar thermal collectors that could be used are given. Some examples of integration of solar thermal energy in factories are found in Germany and Austria. Successful projects where in food and drinks industries.

In 2000, 66 timber factories where recorded in Cameroon and they produced about 2.22 million cubic meter of manufactured wood. Third of these factories where without dryer and the remainder were integrated structures with production lines for furniture. The material recovery efficiency was 32% for simple factories and 50% for integrated factories [15]. This implies that huge amount of biomass material is wasted in timber factories. These residues could serve in households and part used for electricity generation. Appropriate strategies should be developed by the government to encourage timber factories to maximize the recovery efficiency by installing cogeneration systems which would produce heat and electricity for the factory and the excess electricity produced sold to the AES-SONEL.

Table 11. Industries and temperature required for processes.

Industry	Process	Temperature (°C)
Food industry	Sterilization	60-120
	Pasteurization	60-80
	Cooking	90-100
	Bleaching	60-90
	Washing	60-90
Chemical	Soaps	200-260
	Synthetic rubber	150-200
	Processing heat	120-180
	Pre-heating water	60-90
Plastics	Preparation	120-140
	Distillation	140-150
	Separation	200-220
	Extension	140-160
Textile	Bleaching, dyeing	60-90
	Drying, degreasing	100-130
	Fixing	160-180
	Pressing	80-100

Table 12. Solar thermal collectors and characteristics

Type	T [°C]	Concentration ratio	Tracking
Air collector	0-50	1	-
Pool collector	0-50	1	-
Reflector collector	50-90	-	-
Solar pond	70 – 90	1	-
Solar chimney	20 – 80	1	-
Flat plate collector	30 – 100	1	-
Advanced Flat Plate collector	80-150	1	-
CHAPS collector	80-150	8-80	One-axis
Evacuated tube collector	90 – 200	1	-
Compound Parabolic CPC	70-240	1-5	-
Fresnel reflector technology	100 – 400	8 – 80	One-axis
Parabolic trough	70 – 400	8 – 80	One-axis
Heliostat	500 – 800	600 – 1000	Two-axis
Dish concentrators	500 - 1200	800 - 8000	Two-axis

4.6 Renewable energy potential assessment

Most part of the country is covered by forest, and this gives small room for wind energy. The country shows wind speed below 4 m/s at 100 m height, which is not economical. Some specific areas such as the North have wind speed in the range 5-7 m/s and the littoral region could have potential for offshore and onshore wind energy. Very few works exist on the wind potential in the country and no official map is available. In literature, figure found are derived from satellite measurements carried out by foreign organization such as NASA (National Aeronautics and Space Administration), NREL (National Renewable Energy Laboratory) or DLR (German Space Agency) and some private companies.

Geothermal energy is probably available in the western part of Cameroon. Hot springs are found in some regions with good probability for Adamaoua and Southwest regions but the potential is not yet studied.

In 2009, total primary energy supply amounted to 289.6 PJ according to IRENA [5]. Biomass represented 64%, fossil fuels 31% and hydro 5%. Biomass is well used in the country. It is the cheapest form of energy and the popular among the population. It is mainly used for cooking in the form of firewood. Other types of biomass such as agricultural residues, sawdust and other organic residues from food industries are available for energy generation but the potential is unknown and should be assessed.

Cameroon in its western part presents coast of several kilometers, and find itself well positioned in the gulf of guinea already rich in oil. The temperature of the surface seawater could be attractive for OTEC (Ocean thermal energy conversion) systems, but yet the temperature difference within that part of the Atlantic Ocean needs to be assessed. Energy from the ocean can be also harnessed using tidal, wave, and osmotic conversion technologies. This energy source has not yet been evaluated and no study is available.

For thorough assessment of the energy potential of the country, a clear policy should be adopted integrating various government bodies and favoring research and collaboration between all stakeholders of the energy sector (industrial companies, policy makers, decision makers, universities, consumers). The creation of a national energy laboratory whose role would be to carry out in-depth analysis and investigations and to advise the government would be an important step towards sustainability in the energy sector in Cameroon.

5. Conclusion

Cameroon since the years 2000 is facing an energy crisis – declining oil production and deficit in electricity generation. The electricity deficit is partly explained by the excess losses observed on the electrical network due to poor maintenance. Despite the liberalization of the energy sector, the country was unable to attract enough investments to cover its energy needs. Thus, the

industrial sector has suffered from the energy shortage and the only solution was the purchase of the diesel engines to produce their own electricity. The consequence is that the consumption of diesel oil has skyrocketed in the country and additional costs of electricity generation by independent producers have been passed on to the consumers whose purchasing power has been reduced. The country has a huge energy potential which unfortunately is unexploited – Hydro could produce enough electricity for the country and provide additional revenues. If the country is to sustain its economic growth, substantial investments should be made in order to bring its electricity generation capacity to at least 3 GW in the upcoming years. Industrial companies should investigate sustainable solutions such as the integration of solar energy technologies in processes or waste recovery to generate onsite electricity. The role of the government would be very important to put in place a sustainable policy and develop strategies to attract investments.

References and Notes

1. Institut National de la Statistique (INS). Annuaire statistique du Cameroun: recueil des séries d'informations statistiques sur les activités économiques, sociales, politiques et culturelles du pays jusqu'en 2010 – édition **2011**.
2. Belgedj, M.; Merklein, H.A.; Nkoto-Angoula, J. Cameroonian LP Gas sector study, World Bank's Oil & Gas Policy Division **2007**, Volume I, Report 70657.
3. Institut National de la Statistique (INS). Deuxième enquête sur l'emploi et le secteur informel au Cameroun (EESI2): phase 1 - Nov. **2011**.
4. Vesey, A.M. Managing government policy in Cameroon: corporate meets track I diplomacy, *Reflections from practice*, March **2011**.
5. Renewable energy country profile: Cameroon, IRENA, **2012**.
6. Nkue V.; Njomo D. Analyse du système énergétique camerounais dans une perspective de développement soutenable, *Revue de l'Energie* **2009**, 588.
7. Djiofack C.Z.; Omgba L.D. Oil depletion and development in Cameroon: A critical appraisal of the permanent income hypothesis, *Energy Policy* **2011**, 39, 7202–7216.
8. Mom Njong, A.; Tabi Atemkeng, J. An analysis of domestic cooking energy choices in Cameroon, *European Journal of Social Sciences* **2011**, 20, 336-347.
9. Tamo Tatsiete, T.; Kemajou, A.; Diboma, B.S. Electricity self-generation costs for industrial companies in Cameroon. *Energies* **2010**, 3, 1353-1368.
10. Diboma, B.S.; Tamo Tatietse, T. Power interruption costs to industries in Cameroon, *Energy Policy* **2013**, 62, 582-592.
11. Tamba, J.G. ; Njomo, D. ; Limanond, T. ; Ntsafack, B. Causality analysis of diesel consumption and economic growth in Cameroon, *Energy Policy* **2012**, 45, 567-575.
12. International Monetary Fund (IMF). Cameroun : Consultations de 2013 au titre de l'article IV, Rapport du FMI N° 13/279, Aout **2013**.
13. Gobal Village Cameroon. Etat des lieux du cadre réglementaire du secteur des énergies renouvelables au Cameroun, **2012**.

14. Tchanche B.F.; Essam Sh. Mohamed; Papadakis G. Solar energy: a solution for energy poverty in Africa?, in Proc. of ISES Solar World Congress, 11-14 Oct. **2009**, Johannesburg, South Africa.
15. Agence d'Electrification Rurale (AER). Cogénération et électrification rurale: les opportunités pour les scieries au basin du Congo, (presentation) Douala, May **2013**.