Hydropower Solutions

HYPOSO

Hydropower solutions for developing and emerging countries

Framework analysis and research needs in Cameroon (part of HYPOSO D3.2)

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Cameroon

1 Key facts

Population	about 24 million	2017 census
Area	475,000 km^2	
Access to electricity	63.57	2017
Installed hydro capacity	947 MW	2017
Hydro capacity under construction	80.7 MW	2019
Share of generation from hydropower	73 %	2017
Hydro generation	5,090 GWh	2017
Economically feasible hydro potential	105 TWh/year	
Small hydropower potential	630 MW	2016
Small hydropower installed capacity	>15 MW	2020

The Republic of Cameroon is a sub-Saharan African country, *located* at the Gulf of Guinea in Central and West Africa.

1.1 Climate

Cameroon is sometimes described as "Africa in miniature" because it exhibits all the major climates and vegetation of the continent. The country can be classified into four zones differentiated by geography, climate and vegetation: the Sudano-Sahelian, the savanna, the coastal, and the tropical forest This climate varies with terrain, from tropical along the coast to semiarid and hot in the north near Chad. Exceedingly hot and humid, the coastal belt includes some of the wettest places on earth. For example, Debundscha, at the base of Mount Cameroon, has an average annual rainfall above10,000 millimetres (Molua & Lambi, 2006).

1.2 Topography

There are four geographical regions. The western lowlands (rising from sea level to 600 m) extend along the Gulf of Guinea coast and average about 100 km in width. The north-western highlands consist of forested volcanic mountains reaching over 2,440 m in height. The central plateau region extends eastward from the western lowlands and northwest highlands to the border with the Central African Republic and northward to the Bénoué River. It includes the Adamawa Plateau, at elevations of 900 to 1,500 m. This is a transitional area where forest gives way to savanna. The northern region is essentially a vast savanna plain that slopes down to the Chad Basin.

1.3 Water resources

Average annual precipitation is 1,600 mm. It is highest in the coastal and mountainous regions. The country's two rainfall regimes (unimodal and bimodal) show a gradual reduction in amount from the coastal region in the south to the Chad plain in the north.

The main catchment basins are: the Atlantic basin, the Congo basin, the Niger basin, and the basin of Lake Chad tributaries. The Sanaga River, flowing into the Atlantic Ocean and with discharge reaching 2,000 m^3/s is the country's longest river (920 km). Its catchment basin covers approximately 140,000 km^2 or 30 % of the country's territory.

A representative indicator of the hydroelectric potential of a country is the density of hydropower potential called also specific potential and defined as the technical hydropower potential (or sometime gross theoretical) per area unit (square kilometre) of the country. For Cameroon it is estimated to be 0.24 GWh/year per square kilometre. To compare, for Austria and Norway this specific indicator is around 0.66 and Brazil - 0.15 GWh/(year·km^2).

2 Power sector overview

MINEE (*Ministere de l'Eau et de l'Energie*) and the Electricity Development Corporation (EDC) are responsible for the energy sector in Cameroon. The utility company ENEO, which replaced AES-SONEL, is in charge of the generation and distribution of electricity. The National Company for Electricity Transmission Network (SONATREL) is the TSO (voltage above 30 kV). ENEO, Kribi Development Corporation (KPDC), Dibanba Development Corporation (DPDC) and the Emergency Thermal Programme (PTU) supply all electricity to the national grid (H&D, 2019).

The Rural Electrification Agency (AER) is in charge of promoting rural electrification and managing the Rural Energy Fund.

The Electricity Sector Regulation Agency (ARSEL) approves electricity tariffs and determines electrical standards. The Agency also monitors the sector's activity and financial equilibrium, examines concession licence applications, authorizes electricity generation and distribution in rural areas, protects consumers, promotes competition and facilitates private sector involvement. The Electricity Development Corporation (EDC) is a state-owned company that is in charge of the development of the electricity sector including all hydropower projects.

A development plan for the electricity sector, known as PDSE 2030 (*Plan de Developpement du Secteur de l'Electricite Horizon 2030*) was established in 2006 and updated in 2014 to meet the 2035 energy target. This Electricity Sector Development Plan presents estimates of the rate of energy consumption within the country up to 2035. Cameroon also intends (since cop21 in France) to increase the share of renewable energy in energy mix from 1 % to 25 % by 2035. It recommends development of hydropower plants, interconnection between the south grid and the north grid, and also interconnection with neighbouring countries. Along it, the government points out that hydropower sources are vulnerable to drought, thus threatening the country's energy security. Therefore, there is a need to diversify Cameroon's energy mix to ensure energy security.

The total installed capacity of all powerplants (as of 2017) is 1,529 MW, of which 816 MW is hydro. Total production in 2017 was 6,973 GWh (latest available data), of which 5,090 GWh was contributed by hydro (73 per cent) (H&D, 2019). About 26 % of national electricity production is based on the use of imported fuels (Figure 1).

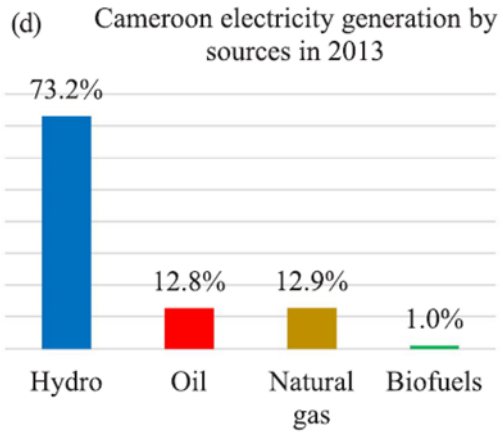

Figure 1: Cameroon - electricity generation by source in 2013 (Muh et al, 2018)

3 Renewable electricity policy

In spite of the well-established power sector framework, there is still a lack of adequate regulation and institutional setting for the off-grid and on-grid, renewable energy and energy efficiency sectors. The government is currently working on a specifically dedicated text for renewable energies and another on energy efficiency. In order to meet up with all the aforementioned challenges, Cameroon possesses a significant amount of resources to enhance the supply of electrical power.

While many developing countries already have specific renewable energy policies, some form of national policy targets or support scheme for renewable energy, Cameroon is still putting in place specific renewable energy targets and promotion policy. In 2005, the government of Cameroon developed the National Energy Plan for Reducing Poverty (Egute et al, 2017). It has key strategic areas which include capacity building of stakeholders in management, planning, operation and maintenance of energy systems; rural energy; productive uses of energy and promotion of private sector investment in rural electrification. In addition, the country is finalizing a very large electrification program including interconnection of the south and north grids. This will lead to a high increase of the demand.

4 Hydropower potential and sector

The country has the fourth largest hydropower potential in Africa behind the Democratic Republic of Congo, Madagascar, and Ethiopia (Kenfack and Hamandjoda, 2012). But harnessing of hydropower resource started relatively recently, some 70 years ago (Figure 2).

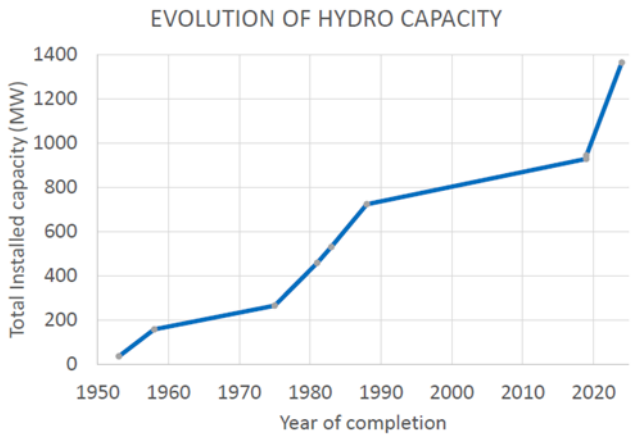

Figure 2: Cameroon - Evolution of hydropower capacity (Kenfack, 2019)

Preliminary sites locations are shown in Figure 3.

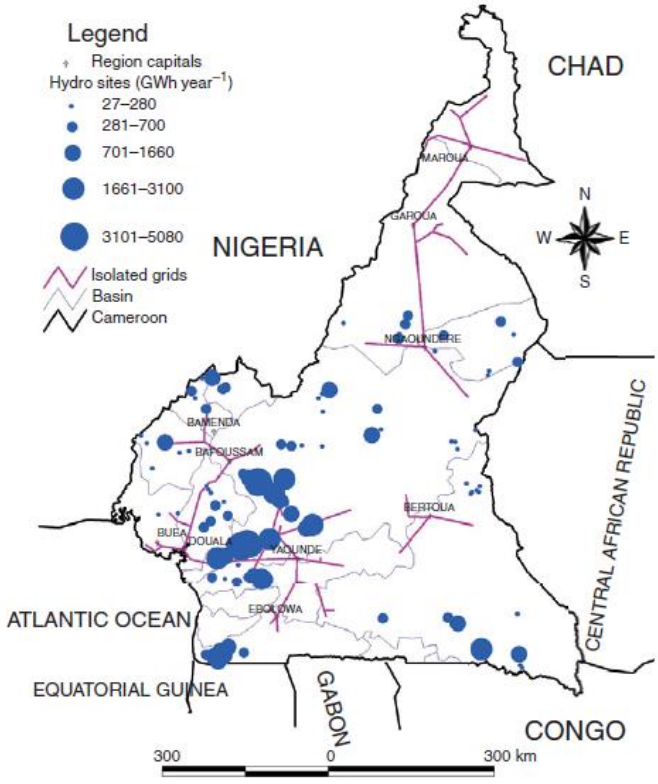

Figure 3: Location of hydropower sites in Cameroon (Kenfack and Hamandjoda, 2012)

The gross theoretical hydro potential of Cameroon is 294 TWh/year. Of this, 115 TWh/year is considered technically feasible, and 105 TWh/year economically feasible (Figure 4, average annual generation is 2017 estimate). Only about 4 per cent of the technically feasible capacity has been developed. There was 816 MW of hydro capacity in operation (in 2017). The total installed capacity of all power plants (as of 2017) is 1529 MW, of which 816 MW is hydro. Total production in 2017 was 6,973 GWh (latest available data), of which 5,090 GWh (73 %) was contributed by hydro (H&D, 2019).

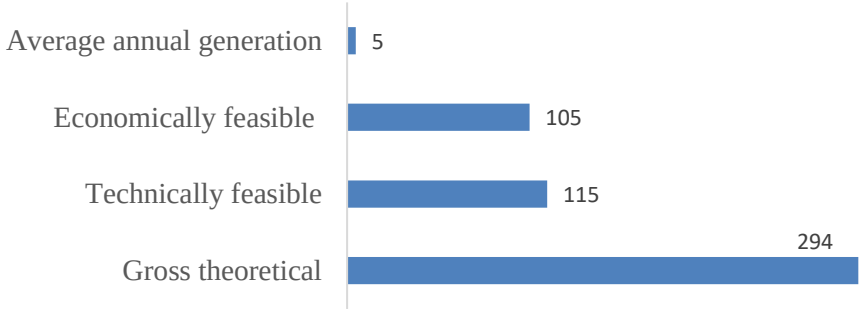

Figure 4: Hydropower potential in TWh/year in Cameroon (H&D, 2019)

As of 2019, only 8 hydropower plants are operational or under construction, out of which three are small schemes in the country (Figure 5).

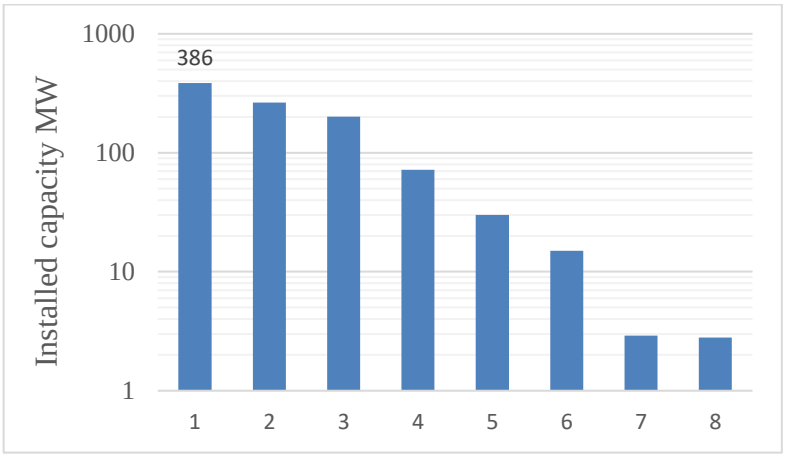

Figure 5: Operational hydropower plants sorted by installed capacity in Cameroon

There are five hydropower plants in operation with individual capacities greater than 10 MW (Lagdo, 72 MW; Edea, 276 MW; Songloulou, 384 MW; Memve'ele (80 MW - to be uprated to 211 MW) and, Mekin, completed and under commissioning, 15 MW). All hydropower capacity is owned and operated by ENEO-Cameroon, independent power producers Dibamba Power Development Corporation, Kribi Power Development Company and now the state with Mekin and Memve'ele.

The upper capacity limit of SHP in Cameroon is 10 MW. The complete assessment of small hydropower potential is yet to be done. It is believed that Cameroon has the second largest small hydro potential in middle Africa - behind Angola. The country is still looking for funds to make an in-depth assessment of the small hydro potential. A very preliminary list of locations of sites for potential micro to small hydropower plants is freely accessible (ONUDI, 2019).

As of 2017, the installed capacity of SHP was at least 1 MW, however, comprehensive and accurate data on total installed capacity are not currently available (Table 1). The small hydropower potential is estimated to be at 970 MW (WSHPDR, 2019). Other sources provide SHP power generation potential estimated at 1.115 TWh, concentrated mainly in the Western

and Eastern regions (Nematchoua et al. 2015). Recently, erection of the first private installation - the 1.4 MW Mbakaou Carriere SHP was initiated.

Table 1: Cameroon - Small hydro (<10MW) characteristics according to WSHPDR

Reference	Potential, MW	Installed capacity, MW	Number of operating SHPs	Comments
WSHPDR, 2019	970	1.0	1	2017 data

The 2.9 MW Gassona Falls (ERD Rumpi project) is under construction and it is reported that the total of 15 MW of small hydro capacity is at the planning stage in the Southern and South-western regions, which could produce more than 105 GWh/year. About 20 small schemes have been identified for the next 10 years (H&D, 2019).

5 SHP policy and market analysis

Despite the fact that hydropower sector is still not well developed in Cameroon, a large number of stakeholders (some 60) are involved in one or another way in the sector (HYPOSO D3.1, 2019). This clearly shows that Cameroon is experiencing economic growth accompanied by increasing energy demand and inadequate supply and therefore hydropower market is rapidly expanding. Seven of these stakeholders represent EU companies (including UK), 12 - China and 1 - USA. Research and training entities account for 5.

5.1 SHP policy

It is obvious, that small hydropower is integrated within the whole energy and hydropower sector. Notwithstanding this, mostly small hydro policy is to be highlighted herewith. Key legal documents making up the legal framework to which hydropower must comply are listed in Table 2.

Table 2: Cameroon - Key legal documents regulating RES and hydropower

Name of legal document (not older than 5 last years but those still in force)	Type of activities addressed	Summary and impact on development of hydropower (small or large)
Law N ° 2011/022 of 14 December 2011 governing the electricity sector, which replaces Law n ° 98/022 of 24 December 1998;	Electricity sector	Texts related to the sector
Decree No. 2012/2806 / PM of 24 September 2012 implementing certain provisions of Law No. 2011/022 of 14 December 2011 governing the electricity sector in Cameroon	Electricity sector	

Decree No. 2001/021 / PM of 29 January 2001 fixing the rate, the methods for calculating, recovering and distributing the royalty on the activities of the electricity sector	Electricity sector	Tariffs
Decree No. 2000/464 PM of 30 June 2000 governing the activities of the electricity sector	Electricity sector	Texts governing the sector
the order n ° 0193 / A / MINEE of April 28th, 2014 concerning the composition of the files of the application for concession, license, authorization and declaration, as well as the expenses relating thereto which replace the decree n ° 061 / CAB / MINMEE of January 30, 2001	Electricity sector	Files for titles
Law N° 96/12 of 5th August 1996 Relating to Environmental Management in Cameroon	Environmental protection	EIA
"Decree N° 2001/718/PM of 3 September 2001 The organization and functioning of the Interministerial Committee on the Environment"	Environmental protection	EIA
"Decree N° 2005/0577/PM of 23 February 2005 Defining the conditions for undertaking EIA"	Environmental protection	EIA
"Ministerial Order N° 0069/MINEP of 08 March 2005 - Defining the categories of operations subject to EIA"	Environmental protection	EIA
"Rule n° 0070/MINEP of 22nd April 2005 fixing the different categories of operations submitted to the realization of an EIA (article 19 of the law)"	Environmental protection	EIA
Law No. 98/005 dated 14 April 1998 – relating to water (the “Water Act”);	Environmental protection	
"Decree No. 2001/164/PM dated 8 May 2001 – “Decree on Utilisation of Water”, which sets the conditions of utilisation of water for business or industrial purposes"	Water management	Water use
"Decree No. 2001/165/PM of 8 May 2001 decree on the “Protection of Water”, which sets the conditions of the protection of surface and groundwater against pollution"	Water management	Water protection

Learning conditions for granting water rights and authorisations to use hydropower (concessions or permissions) is the first step for potential investors. Type of permits needed & average time for a small hydro scheme are as follows:

Production License (6 months procedure) + Approval of Environmental Terms (around 8 months) + Power Purchase Agreement (3 months) + Declaration of public interest (up to 1 year) = around 3 years' time to take all the licenses. Several actions can be initiated simultaneously. The duration of permits (concession) can be granted up to 35 years.

For comparison, to develop large hydro scheme all procedures require more or less the same time.

5.2 Industrial and economic overview

Less than 28 % of rural areas and only 63.57 % of the population of Cameroon have access to electricity grid. Irrespectively of the above, Cameroon has a huge hydropower potential which could be harnessed. Mini grids, powered by pico- and micro- hydropower plants, are a relatively new rural electrification strategy in Cameroon. Several of such mini grids have been developed in the mountain regions of the country (Ministry of Energy, 2018).

There are many sites suitable for small hydropower facilities, however so far, they have not been developed. Only few companies are involved in the small hydropower sector (*EdF*, *IED-Invest, Synohydro*). Hydropower equipment manufacturing industry does not exist at all. But this situation is going to change very soon (see "Future prospects).

Average investment cost for small (low head <20 m) and medium to large hydro (>50 MW) schemes is 2,689 and 3,482 (€/kW), respectively. Average cost per kWh electricity produced is 8.3 and 6 eurocents, respectively.

No feed-in tariff system to support renewable electricity deployment has been introduced. But cost of service to ensure cost effectiveness of projects exists. ARSEL is responsible to assure the operator to obtain average profits in normal conditions of activity.

Investment support for large hydro is available, needed to be arranged with the government.

6 Educational framework

There are nine state-run universities in Cameroon: Buea, Bamenda, Douala, Yaounde I & II, Dschang, Maroua and Ngaoundere and Ebolowa. Cameroon's tertiary education is made up of thriving private universities such as the Bamenda University of Science and Technology (BUST), International University, Bamenda and the Fotso Victor University in the Western province.

However, there is no narrowly specialised hydropower or hydropower engineering study program in the country education system. Hydropower is usually part of renewable or energy studies or even civil, power or mechanical engineering. At least 4 universities are offering undergraduate degrees. Only one is providing the master studies (Table 3).

Table 3: List of universities offering energy and hydropower engineering subjects

No	University	Hydropower study and different program	Hydropower as part of renewable or energy studies	Topics included syllabus	Basic knowledge courses
1.	University of Yaounde I (Polytechnic)	Master of energy	yes, but less than 15 hours	general knowledge	Renewable energy
2.	University of Maroua (Polytechnic)	Bachelor program	yes	ongoing	Comprehensive renewable knowledge
3.	University of the Mountains	Pico and micro hydro	yes, but pico and micro	general knowledge	Renewable energy
4.	University of Dschang	Pico and micro hydro activities	yes, but pico and micro	general knowledge	Renewable energy
5.	University of Douala	no	no	general knowledge	Renewable energy

There are a number of NGOs, international organisations and associations promoting hydropower in the country (Table 4).

Table 4: Organisations established in Cameroon and acting in hydropower sector

No	Organisation	Contact person	Educational level in the organisation
1.	Friedrich Ebert foundation	Nina Netzer	Dialogue facility
2.	UNIDO	Francis Nzukou	Hydro promotion program under completion
3.	GIZ	Projects office	n/a
4.	France Development agency		n/a
5.	State Secretariat for Economic Affairs SECO (Switzerland)		n/a
6.	ICOLD	Adrien Towa	n/a

Main gaps to bridge the knowledge for small hydro in universities are as follows (Table 5).

Table 5: Cameroon - Identified needs for improving knowledge level at universities

No	Level	Identified needs
1.	University of Yaounde I (Polytechnic)	Master program in small hydro and equipment of hydro lab
2.	University of Maroua (Polytechnic)	Creation of hydro lab and curricula
3.	University of the Mountains	Establishing the curricula for micro hydro
4.	University of Dschang	Establishing the curricula for micro hydro
5.	University of Bamenda	Establishing the curricula for micro hydro, create a lab

The survey conducted in Cameroon revealed the following research topics to be undertaken in the future, but not limited to:

- Small hydro laboratory exists in University of Yaoundé I (Polytechnic) designated for bachelor, master and PhD students, but needs equipment upgrade and a small hydro curriculum;
- First hydropower engineers have been trained at University of Maroua. The curriculum needs revising and updating, furthermore, operational hydro plants are too distanced from the university more than 600 km (for placement students to vocational practice);
- The same is valid for master programs;
- Didactic micro hydropower equipment is available at University of the Mountains in Bangangté, but needs putting in place hydropower course;
- SHP pilot projects should be promoted for students training.

7 Research situation and needs

7.1 R&D projects

In this project, the definition of R&D goes beyond its pure concept. Taking into account the practical issues and particular situation in the research field of the target countries, there the term of Innovation (R&I) was added. Although the concept of R&D is not always the same as R&I and vice versa, here we assume their interchangeability.

Only one R&D project conducted by University of Yaoundé has been reported related to establishment of small hydro laboratory. A couple of applied projects dealing with micro hydro power plants were completed at National Advanced School of Engineering, University of Yaoundé (Kengne Signe et al, 2017, 2019).

The search of the publications (mainly papers in peer reviewed journals in English) in ScienceDirect database (a website which provides subscription-based access to a large database of scientific and medical research) revealed that hydropower research is progressing in this country.

At least a dozen papers directly or indirectly related to hydropower issues were published during last 8 years in the scientific journals of Renewable Energy, Renewable and Sustainable Energy Reviews, Energy Procedia, Energy Policy, Environmental Science & Policy. Papers and other publication written by Cameroonian researchers and directly referred to hydropower are present in the bibliography list.

7.2 Research needs

The most needed, small hydro oriented research directions are well recognised and already reflected in the abovementioned bibliography. The following needs may be considered essential from the point of view of human life quality and natural environment protection:

- further recognition of the hydropower potential of the country;
- development of technologies suited for electrification of remote areas;
- better understanding of hydropower multi-aspect environmental impact.

Some more detailed research topics are listed below:

a. hydrology studies aimed at development of ever more detailed hydrological characteristics of rivers and other water courses, including the climate change impact on the country water balance;
b. identification of the most suitable small hydro development sites so as to prepare the basis for developing the national small hydro master plans;
c. analysing technical and economic feasibility of applying some innovative technologies (e.g. hydrokinetic turbines) in remote areas of the country;
d. hybrid installations with hydropower components for isolated grids in remote areas, including dedicated smart grid software;
e. optimised management of multipurpose river cascades;
f. environmental studies aimed at determining the current status at selected water courses so as to streamline future environmental decisions;
g. environment friendly hydropower technologies.

8 Environment

The Ministry of Environment and Nature Protection is responsible for environmental protection in the country. A Law on the Environment was enacted in 2005 by the Government, concerning the assessment of all types of project and operational units.

The Ministry of Water and Energy (MINEE) is responsible for water resources. Water for industrial and domestic consumption is supplied by *La Camerounaise des Eaux* (CDE).

Cameroon Water Utilities Corporation (*Camwater*) manages the infrastructure used for water supply.

In Cameroon, all land belongs to the state. The Cameroon legislation makes provision for 33 % of the national territory to be classified as protected areas. The Ministry of Forestry and Wildlife is responsible for the management of its protected areas. Mapping of protected areas evolution in Cameroon is given in Tchindjang et al. (2005).

9 Barriers to SHP development

The progress in renewable energy in Cameroon is hindered by several issues: inadequate policies, regulations and institutions; information, awareness and technical capabilities; and financial constraints due to the high initial capital investments associated with the implementation of renewable. Insignificant financial resources are devoted to the development of renewable energy in Cameroon despite its vast potentials (Muh et al, 2018).

The main challenges to consider for developing small hydropower projects in Cameroon are, but not limited to (WSHPDR, 2019):

- The Government is favouring large hydropower schemes - expected to export electrical energy to the neighbouring countries;
- Renewable energy development framework, rules and conditions have not been established yet;
- Low energy prices are not very attractive for private investments;
- Scarce information hydrological, climate and other statistical data, especially for rural areas, are available;
- Private investments are not well favoured, it is hard to establish a private company in hydropower sector;
- Acceptance and development of an economically viable and competitive private hydropower project price is a true challenge
- Hydropower projects encounter low social acceptance and heavy bureaucracy obstacles in their initial stage
- Some rural communities hardly accept hydropower projects due to local tradition linked with ancestral uses of water

From the point of view of potential investor in small hydro the following barriers are to be expected:

- No support for start-up companies in private sector, means no money for equity;
- Only local commercial banks available instead of investment banks;
- XAF (Central African CFA Franc) financing mechanism is very expensive (very high interest rate);
- Lack of guaranty from the governments or local banks;
- Risk of devaluation for XAF mechanism (not controlled locally);

- Difficulties in money transfer issues (not easy);
- No support for funding project maturation process;
- No data bank for projects to be developed ;
- Lack of accurate data on the potential, leading to poor reliability of financial models.

10 Future prospects

10.1 Large Hydro

The substantial hydropower potential presents many investment opportunities for the future. Cameroon shares borders with all CEMAC countries, has the highest gross national product and the greatest hydro potential. Given this large hydro potential, the development of hydro plants could make the country a net electricity exporter in the future. Four neighbouring countries, Chad, Nigeria, Gabon and Equatorial Guinea, have already expressed interest, and there are plans to build transmission lines between the four countries as soon as more hydro plants are developed (H&D, 2019).

However, the negative effect of climate change should be underlined. So far persistent power outages used to take place throughout the country, especially in the dry seasons when water levels in reservoirs are low (Muh et al., 2018).

The Lom Pangar dam is already under operation at the Lom river and the 30 MW plant is under construction at the toe of the dam. Construction of Bini a Warak HPP (75 MW) is underway in the Adamoua region. The Lom Pangar dam will increase the year-round production capacity of the two hydropower plants on the Sanaga river, Edea and Song Loulou, with the interconnection of the Northern and Southern grid The dam will also enable development of a cascade of hydro plants to be built downstream.

Private developer *Joule Africa* plans to implement the 485 MW Kpep scheme. This will be the first stage of a cascade development, which could eventually have a total capacity of 850 MW. The project is scheduled for completion within three years.

Another private developer, *Platinum Power*, is expected to construct the Makay complex (400 MW) on the Nyong river.

Meanwhile, financial closure has been reached, and all final agreements signed, for the 420 MW Nachtigal scheme. The plant is now under construction. A consortium of French, Belgian and Moroccan contractors were awarded the construction contract in 2018. Final binding agreements for the scheme were signed between the EdF, the IFC, and the Government of Cameroon. In January Mott MacDonald was appointed as the lenders' technical advisor, and also early this year the World Bank Group's Multilateral Investment Guarantee Agency (MIGA) issued guarantees worth € 164.5 million to the investors, and it was announced that construction would begin shortly.

A project development agreement is ongoing for the 398 MW Songdong scheme.

EDC invited recently (2019) expressions of interest to carry out a study for the optimal development of the hydropower potential of the Sanaga river basin. The selected consultant will review and update the Sanaga water resources inventory, taking into account existing developments, and outline studies for each hydropower site. Studies are also ongoing for the development of Grand Eweng project (up to 1,800 MW).

The 600 MW Chollet scheme is planned to be developed with the Republic of Congo. It will be built on the river Dja, on the border of the two countries. Both governments are committed to implementation of this scheme, on which agreement was reached in late 2014.

10.2 Small hydro

About 20 small schemes have been identified for the next 10 years. There are a number of plants (20 kW to 3 MW) abandoned due to grid extension and political instability (civil war in some regions). A very preliminary list of locations of sites for potential micro to small hydro plants is freely accessible (ONUDI).

The Cameroonian government is struggling to cope with a low electricity access rate in the country. The lack of private investment is the root cause for the low electricity access rates in rural areas in Cameroon. Therefore, it has drafted policies favouring participation of private investors in the sector that started working.

Tens of memorandums of understanding (MoU) from a few MW to hundreds of MW in hydro capacity are being concluded. The companies are coming from almost all over of the world.

Companies with memorandum of understanding (MoU) for projects above 5 MW are listed below:

- Asian Pacific; Hydrochina Corporation; Grenor Cameroon SA;
- A2Z Maintenance & Engineering Services Limited & Eurofina S.A.; Club Millenium; African Energy Company; Hydromine Inc; TBEA; Kedjom Power Project (KPP); TBEA
- Xinjiang Beixin Construction and Engineering; CWE; Sino Hydro; Joule Africa; Ximcor; SUHN; China National Electric Equipment Corporation; APICA; Alpha Technology

MoU for Small hydro (shares 1 to 2) are:

- Green Watt; Bamusso City Council; Fabien M. Assigana & Associates International Consulting; Fokoué City Council; Berkeley Energy; Adeid; Solarhydrowatt; Bill; Hydromekin; Alpha Technology; Kedjom Power Project; Minee/Aer/UNIDO; AER / Plan VER; AER / Erd Rumpi; AER / Projet Fed.

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