CHAPTER 29: THE STATE OF ELECTRICITY PRODUCTION AND DISTRIBUTION IN CAMEROON

Durando NDONGSOK & Oliver C. RUPPEL

1 Introduction

Access to energy and the human development index (HDI) of the United Nation's Development Programme (UNDP) are connected, because access to energy gives access to information, to health, to human security, to wealth etc. fueling human development in general. The more energy per capita a country consumes, the more developed it is. All the 17 Sustainable Development Goals (SDGs) of the United Nations are connected to or influenced by access to energy. Goal 7 is all about 'affordable and clean energy', while Goals 4 and 12 explicitly talk about energy. For other Goals,

> although not explicitly mentioned in targets or indicators of many development goals, energy services and technologies contribute to their achievement by facilitating and enabling relevant development processes.[1]

The more energy one consumes, the less one pays. A study of the US based social investor Acumen shows that cost of energy reduce drastically from (i) the use of 3 stones-stoves for cooking and kerosene lanterns for lighting that costs are extremely high to (ii) the combined use of improved cooking stoves and solar lanterns that cost $2/kWh, (iii) the home systems like solar that cost $0.6/kWh, (iv) mini-grid and off-grid systems that can cost $0.2/kWh and finally (v) the combination grid connection and the use of LPG can cost as low as $0.1/kWh to end user.

According to the 2015 International Energy Agency report on energy and climate change, energy participates to around 70% of global greenhouse gas emissions.[2] Clean energy may save the world from climate change catastrophes, by helping to keep the temperature variation on earth surface below 2 degrees by the end of this century.

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1 See https://energypedia.info/wiki/Energy_and_the_Sustainable_Development_Goals, accessed 18 February 2018.

2 IEA (2015).

Table 1: Facts and figures on energy in Cameroon

Some Relevant Facts	
Energy consumption per capita per year (2010)	0.30 toe
Total installed electricity capacity (2016)	1 600 MW
Electricity consumption per capita per year (2016)	281 kWh
Part of renewable energy in the electricity mix (2015)	<1%
Electrification rate (2016)	54% (national) 88% (urban) 17% (rural)

Electricity, though not always the form of energy the most used, is actually the most 'seen' and powers our daily activities from the household level to industries. After a brief presentation of the energy mix of Cameroon, this subchapter will put more focus on making (clean) electricity available and affordable to the majority of Cameroonians.

2 The energy mix of Cameroon

The main energy source used in Cameroon is still biomass. For cooking and heating purposes, the majority of Cameroonians still rely on biomass, which is abundant and to certain extents renewable and affordable. Electricity and gas are still very lowly used, mostly because of non-availability and non-accessibility, especially in the rural areas. According to a report on the energetic situation of Cameroon (SEC) in 2011, the energy consumption mix was 73% biomass, 20% oil and gas products and 7% electricity totalling around 6,000 ktoe (Kilo tons of oil equivalent) for the whole country and converted to about 0.3 toe (tons of oil equivalent) per capita.[3] A quick comparison with the world average per capita consumption of about 2toe shows that access to energy in Cameroon is still extremely low.

3 Access to electricity and the electricity mix of Cameroon

Like energy as a whole, access to electricity in Cameroon is at the lowest compared with other countries of the world. World Bank's data indicate that the world's yearly average electricity access is above 3,000 kWh per capita, compared to Cameroon's 281 kWh per capita.[4] According to the 2016 World Energy Outlook, only 54% of the Cameroonian population has access to electricity, with an average of 88% in urban

3 MINEE (2011).
4 See https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC, accessed 6 February 2018.

areas versus only 17% in rural areas.[5] There is still a lot to be done in order to connect all Cameroonians to good and affordable electricity sources.

The electricity mix of Cameroon is dominated by hydraulic power. As much as 57% of the electricity produced is from hydro and the rest from thermal sources based on fuel (heavy and light) and very recently from gas with the installation of the Kribi Power Development Corporation (KPDC) that is injecting 216 MW electricity from gas into the grid since 2013.[6] There is, however, a high volume of own electricity generation using diesel generators. Many companies and individuals produce their own electricity, because of the non-availability. Considering that, the electricity mix becomes 45% from hydro, 18% thermal, and as much as 35.5% own production onshore and 1.5% offshore totaling around 1,600 MW of electricity capacity installed.[7] The own production is usually relatively expensive, and any alternative will contribute companies and individuals to reduce their production costs and eventually create more wealth for the society.

4 The untapped electricity potential of Cameroon

Cameroon is blessed with enormous and varied resources for electricity production. The hydraulic potential is estimated at 20,000 MW[8] – of which only about 5% is exploited – the second largest in Africa after the Democratic Republic of the Congo. This hydraulic potential is sovereign, as all the rivers that can be used are within the frontiers of Cameroon and not shared with any neighbouring country. The gas potential is also enormous and can produce 5,000 MW electricity for more than 150,000 years. To date, only one gas power plant is installed and producing 216 MW electricity connected to the grid in Kribi. The average solar radiation ranges from around 4.5 kWh/m^2/day in the southern part of the country to around 5.7 kWh/m2/day in the northern part of Cameroon, with the highest values in the far north region.[9] In comparison, Germany which has just an average 1.7 kWh/m^2/day has more than 40,000 MW solar energy capacity installed. That is to say, the solar potential is really enormous in Cameroon.

The wind potential of Cameroon is relatively low. Proven resources can produce in total around 400 MW in the Mount Bamboutos in the western region of Cameroon. But, what is more important is that Cameroon does also have an enormous po-

5 IEA (2016).
6 MINEE (2015).
7 (ibid.).
8 (ibid.).
9 (ibid.).

tential to develop off-grid solutions, which can help achieve electrification with clean and affordable sources within a short period of time. This can occur by producing directly in off-grid areas instead of spending a lot of money – and time – to take the electricity grid everywhere. A recent study called 'Invest'Elect' financed by the European Union and conducted by the National Electricity Regulation Agency (ARSEL) indicated an interesting electricity off-grid potential of 262 micro hydro sites and 25 small biomass sites, totalling 284 MW. Solar that has also a good potential is not included, but there are many solar off-grid and home systems projects ongoing. The most known are the ongoing HUAWEI financed projects of 166 micro solar plants in rural communities of Cameroon totalling 11.2 MW.[10]

5 Institutional set up to facilitate access to electricity

Cameroon has put in place many institutions, enough to make electricity production, transmission and distribution very fluid if they work efficiently. At the head of these institutions is the Ministry of Water Resources and Energy (MINEE).

Table 2: Relevant Institutions

Abbreviation	Name	Role/responsibility
MINEE	Ministry of Water Resources and Energy	Elaborates and monitors the implementation of a national energetic policy under the control of the Presidency of the Republic of Cameroon; defines electricity tariffs. The Direction of Electricity manages the electricity sector. The newly created Direction of Renewable Energy and Energy Efficiency ensures the promotion of RE and EE.
ARSEL	Electricity Sector Regulation Agency	Regulates operators and electricity operations. Defines electricity tariffs.
EDC	Electricity Development Corporation	Develops state-owned hydroelectricity projects.
AER	Rural Electrification Agency	Promotes rural electrification by elaborating and monitoring State projects while supervising private operators in the rural sector.
SONATREL	National Electricity Transmission Company	Manages the electricity transmission network for the State.
ENEO	Electricity of Cameroon	The main private electricity producer. ENEO had the monopoly for electricity production until 1000 MW, which has been reached already.

10 See http://e.huawei.com/za/case-studies/global/2017/201707101504, accessed 6 February 2018.

For the moment, SONATREL, created only in 2015 with a Director appointed in October 2016, has not really started its operations. The production, transportation and distribution are still done by the privately-owned operator ENEO, but when SONATREL will become fully functional, ENEO will be an independent power producer (IPP) like any other producer. IPPs are still struggling to get authorisation through power purchase agreements (PPAs) to start producing electricity and injecting into the grid, though ENEO has already surpassed the 1,000 MW installed capacity by which its production monopoly automatically ended, as stipulated in its contract with the government of Cameroon. To date, only two IPPs, the Kribi Power Development Company (KPDC, 216 MW gas-fired plant) and the Dibamba Power Development Company (DPDC, 88 MW oil-fired plant) have PPAs with ENEO (and the PPAs will normally be transferred to SONATREL). The arrival of SONATREL will certainly facilitate the signature of PPAs with more IPPs since SONATREL will be more impartial than ENEO, which understandably cannot facilitate access to the grid to other IPPs, considered as competitors.

6 Country orientation towards electricity access

In the document Cameroon Vision 2035, the target of Cameroon is to « double energy production by 2035 and increase energy consumption per unit GDP from 27.7% to 45% ».[11] Besides this guiding document, Cameroon developed already in 2007 the Poverty Reduction Energy Plan (PANERP), whereby energy is seen as the main driver for development. Then, an Electricity Sector Development Plan (PDSE) was developed in 2010 and updated in 2014. The PDSE indicates electricity production scenarios with the lowest at about 4,000 MW by 2035 and highest at 6,000 MW. Jumping from around 1,500 MW installed capacity today to any of those scenarios in 2035 requires accelerating the thinking in electricity production.

The Rural Electrification Master Plan was developed in 2008 and guides the actions of the Rural Electrification Agency. Cameroon recognised through the development of this master plan that it is impossible to have all parts of the country connected to one electricity grid until 2035 and therefore promotes the development of off-grid solutions. Also, this master plan emphasises the importance of the use of renewable energies to reach rural electrification. As indicated by the Minister of Water Resources and Energy in March 2017 and reported in the online magazine 'Business in Cameroon', the objective set in the plan is to have 10,000 towns connected to the electricity grid by 2035. To achieve this, 50,000 connections to the power grid per

11 Republic of Cameroon (2009).

year are planned over a period of 20 years, totalling one million connections.[12] The government calls this master plan participative in a sense that the private sector is invited to actively participate in achieving it.

Regarding renewable energies, Cameroon, in its (Intended) Nationally Determined Contribution (NDC) to reduce greenhouse gas as part of the COP21 (leading to the Paris Agreement) decided to have 25% renewable energy in the electricity mix by 2035[13], from less than 1% today.

7 Existing legal framework

The legal framework supporting the development of energy in Cameroon is rather light. Although various relevant legal texts exist, the main and most important ones are still missing. Tariffs are not yet clearly defined and rules for signing PPAs are also not clear. Also, with the importance that renewable energies are gaining worldwide, there is no renewable energy law in Cameroon so far. A renewable energy law was proposed by the Ministry of Water Resources and Energy since 2013 but it has never been signed by the President.

For the moment, one law supporting the renewable energies is the finance law of 2012 giving a value-added tax levy for importers of solar and wind-related equipment. Also, the private investment law of 2013 (Law No. 2013/004 of 18 April 2013[14]) gives more advantages to investors in RE, ranging from duty levies on the importation of equipment to tax holidays of up to 10 years.

While waiting for tariffs definition and clear and fair rules for signing PPAs (the latter will most likely be one of the first agendas of SONATREL), independent producers of electricity for own use do not need any specific agreement if the total capacity is less than 1 MW. They can even sell the surplus electricity to an industry in their neighbourhood, at a price negotiated by the two parties.

12 See http://www.businessincameroon.com/electricity/0704-7039-the-cameroonian-government-has-a-rural-electrification-plan-for-10-000-towns-by-2035, accessed 6 February 2018.

13 See http://www4.unfccc.int/ndcregistry/PublishedDocuments/Cameroon%20First/CPDN%20CMR%20Final.pdf, accessed 6 February 2018.

14 See https://www.prc.cm/fr/actualites/actes/lois/170-loi-n-2013-004-du-18-avril-2013-fixant-les-incitations-a-l-investissement-prive-en-republique-du-cameroun, accessed 6 February 2018.

8 Making energy available and affordable to the majority of Cameroonians

Several actions need to be implemented to transform the enormous electricity potential of Cameroon into clean, available and affordable electricity for households and industries. Those actions include:

- The institutional set up needs to be improved. Although existing institutions seem to be equipped with clearly defined roles, there is a need for acceleration of transfer of transmission competences from ENEO to SONATREL. Until there is a clear breakdown of roles between producers, transporter(s) and distributors, there will always be confusion infringing the development of the sector.
- The legal framework needs to be improved. One needs to start by making work what exists already. Yet, a law on renewable energy would definitely spur the sector.
- A clear definition of tariffs is needed.
- Apply demand side management through EE measures. ARSEL with funding from the EU developed National Energy Efficiency Plan, which has indicated for example that good actions can lead to up to 30% efficiency in electricity consumption per year by 2025. This is converted into 2,250 GWh electricity saved per year, or avoiding the construction of a 450 MW electricity plant.[15] Loosing so much capacity when the demand is met by 50% only is too much.
- Train local banks to enter this new business. For the moment, apart from the Rural Electrification Fund – that has not yet financed any project – put in place to finance rural electrification project and managed by the AER, there is no other funding possibility in the market. The National Investment Company put back in 2008 a renewable energy fund to finance clean projects, but it died off because there was no project and probably no understanding on how to transform this idea into reality. It is important to put local financing vehicles in place and/or build the capacity of local banks to develop new business lines in financing (renewable) energy. After a feasibility study to finance renewable energies and energy efficiency projects in Cameroon through local banks, the French cooperation has launched a call to recruit consultants that will manage a fund dedicated to that purpose. The African Development Bank conducted a similar study in 2016, but there is no clear sign in the market of putting in place a financing vehicle dedicated only to Cameroon.

15 EUEI (2014).

- The use of climate finance is also possible to finance renewable energies, but that, in turn, requires a more substantive understanding of the subject matter. For example, there is the Green Climate Fund (GFC), which is supposed to have more than USD 10 billion available to finance climate resilient projects in developing countries. Cameroon has not yet even attracted the 1 million USD available for readiness, while Senegal has already secured funding for 3 projects out of the 58 financed worldwide as of October 2017. The GCF, through readily available money, needs projects to go through some stringing steps that need certain preparation and a solar institution framework which Cameroon does not yet have. The African Development Bank is financing a lot in energy production in African countries through programmes like the Sustainable Energy Fund for Africa. Cameroon has attracted funding through this vehicle for the financing of a 72 MW solar plant in Mbalmayo, Center Region, but more could be attracted.

9 Investment

Many challenges and opportunities in unlocking Cameroon's potential are related to investment. While the level of investment in renewable energy is still marginal, the gains made so far are still a long way off providing electricity to all. To unlock its potential, Cameroon has to contend with some of the challenges undermining the growth of the sector. Like many other African countries, Cameroon must attract more investment in new energy solutions. This, in turn, will require political support, competence and courage in making foreign investment as attractive as it needs to be. A favourable investment climate is essential. Various factors, however, lead to an unfavourable investment climate. These *inter alia* include poor governance, institutional failures, macroeconomic policy imperfections and inadequate infrastructure, as well as corruption, bureaucratic red tape, weak legal systems and a lack of transparency in government departments. Key risks for private-sector investors are often linked to political and/or regulatory instabilities, insecurity of property rights, lack of knowledge of (or contradictory application of) legal systems, currency risks and the instability and uncertainty of the regulatory and policy environment, including, for example, the longevity of incentive programmes. In this light, the most appropriate approach for achieving the aforementioned is adherence to and promotion of the rule of law while creating incentive structures for investors to act sustainably, to meet the requirements of corporate social (and environmental) responsibility and to respect national social development goals, empowerment policies, labour standards and hu-

man rights. There is most probably no other way to attract local and foreign investors into the 'juicy' business of energy.[16]

10 Cameroon as energy exporter to neighbouring countries

Despite the huge potential, Cameroon is still struggling to meet the fast-increasing demand of electricity that will power its path to become an emerging economy by 2035 as envisioned by the country.

But then, Cameroon is surrounded by countries like Nigeria that do not have the same energy potential and have a huge population. Cameroon could export energy and make good revenue from it.

Also, Cameroon is part of the Central African Power Pool (CAPP), a pool of the Economic Community of Central African States (ECCAS) working to implement a common energy policy and monitor studies and construction of infrastructures while organising the transfer of electricity and related services throughout these states where the total electrification has not yet reached 20%. CAPP was created in 2003 and is headquartered in the Republic of Congo. Once fully interconnected and operational, Cameroon can through CAPP commercialise electricity exports to the other nine ECCAS countries of the pool.

11 The time for standalone solar systems

The ideal situation is to have the whole population connected to a national grid. Cameroon has the potential to give enough electricity to the increasingly growing population and sell for good revenue electricity to neighbouring countries. There is an acceleration in putting in place institutional and legal frameworks which could make this possible. There are international financial windows that the country could benefit from. But, in any ideal circumstance favourable to Cameroon, electricity will still take decades to connect every single household to the grid. In the meantime, kerosene lanterns will continue to be used whilst off-grid populations continue to struggle to get their mobile phone (re-)charged, which is a barrier to sustainable development. A study conducted by SNV Cameroon in 2013 and confirmed by several studies in other countries show that a rural household spends around USD 100 per year for lighting and phone recharging.[17] Moreover, kerosene lamps, for instance, are

16 Ruppel (2016a & b).
17 SNV Cameroon (2012).

not only associated with indoor air pollution and risk of fires but also associated with the reduction of greenhouse gas emissions.

The problem with standalone solar systems is the acquisition cost. The government of Cameroon can effect different financial incentives to importers of such systems given that the imported systems meet for instance Lighting Global Quality Standards – the best quality available in the market supported by the World Bank – and eventually subsidise the price to end-users instead of subsidising the kerosene as it is currently the case. Countries like Kenya, Ghana, and Nigeria etc. have applied different mechanisms and millions of standalone solar systems are already distributed there. Cameroon should do the same whilst continuing the work to give access to grid electricity everywhere.

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