Local Hydroelectric Power as Seedbeds for Supplementing Electricity Supply in the North West Region of Cameroon

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Abstract: **Access to electricity in most developing countries in Sub-Saharan Africa (SSA) is a herculean task. However, the emergence of Local hydroelectric power (LHEP) is becoming popular and being embraced by a wide range of communities as a pre-solution to their energy issues. Although widely acknowledged as coming to the rescue of electricity disfavoured communities, this paper considers such initiatives as going far beyond mere energy supply schemes but standing out as seedbeds for supplementing electricity supply. This perception is challenged with evidences on the role and influence of this category of renewable energy schemes in energy supply. Then a demonstration is made of how local electricity systems are unavoidable recourse to by numerous households in classical energy redundant areas. It is, therefore argued that decentralized electricity systems serve as seedbeds for supplementing energy supply and sustaining it in marginalised energy supply communities, makes it a seedbed to electricity supply. Further academic attention is required to render such initiatives less risky and efficient by upgrading their performance with the required technological know-how and equipment.**

Keywords: **Community energy, seedbeds, conventional electricity, North West Region, Cameroon.**

I. INTRODUCTION

Electricity generation in Sub-Saharan Africa (SSA) is characterised by acute shortages and high levels of unreliability. In most of the countries in the region, electricity generation capacities are less than 1000 MW, against huge demand for domestic, service, and industrial applications. The entire installed electricity generation capacity for all 48 countries of SSA excluding the Republic of South Africa is just around 30 giga watts (GW), which is stated to be almost equal to that of Argentina [1]. Growing demands in energy, especially, electrical energy and government's incapacity to satisfy local energy needs led to community energy projects in disfavoured energy communities. Considering access to energy as a "fundamental right", local dwellers feel discriminated upon and marginalised looking at the current energy distribution pattern and at the enormous energy potential harboured by their communities and country at large. Despite the efforts mobilised by these communities to tackle the issue through community energy projects the efforts are often not measured up as potent enough to lay the grounds for resolving the general energy deficiency.

That notwithstanding, Geographers interested in community energy [2] consider it as a manifestation of "new ways and new geographies of producing, living, and working with energy" while others have considered the drive towards community energy as being motivated by the transition to low carbon economies [3]. The term community energy has been used to refer to what is done or owned collectively in different contexts including: civic energy [4]; [5] citizen energy [6]; grassroots energy ([7], [8], [9]) local energy ([10], [11], [12], [13]) and 'collective and politically-motivated energy' [14].

What so ever the motives behind such appellations, the argument is based on the fact that the outcome of local HEP (LHEP) in most communities has been out of concerns to redress the deplorable energy conditions most communities find themselves in. Community energy as a concept will particularly draw the attention of any keen Geographer through its influence modes on energy production and distribution and the ways through which spatial identities impact processes and the manner in which energy projects are negotiated ([15], [16], [17]). Differences in how projects are controlled, owned and financed translate into differences in civic actors' roles, and the degrees of risk, return, and responsibility for communities of community energy [18]. These differences explains governments lukewarm attitude in developing countries as regards financial and technological support to local energy projects and as such serves as premise for little or no aid and in very rare circumstances governments come in when their political interests are at stake to woo the population and obtain their votes [19].

The deplorable energy situation in developing countries in sub Saharan Africa and the plausible efforts mobilised by communities through LHEP plants in these areas lit the light to reflect on how such initiatives could shoulder electricity supply in these countries. In this light, various energy schemes and users of LHEP in these communities identified, demonstrating how they supplement electricity supply. *The questions raised here are: can local HEP initiatives be considered as seedbeds for supplementing electricity supply? If yes, how do such energy initiatives supplement electricity supply?*

II. RESEARCH METHODOLOGY

a. Location of study area

The study area lies between latitudes 5°40' and 7°00' north of the equator and longitudes 9°45' and 11°10'east of the Greenwich meridian (figure 1).

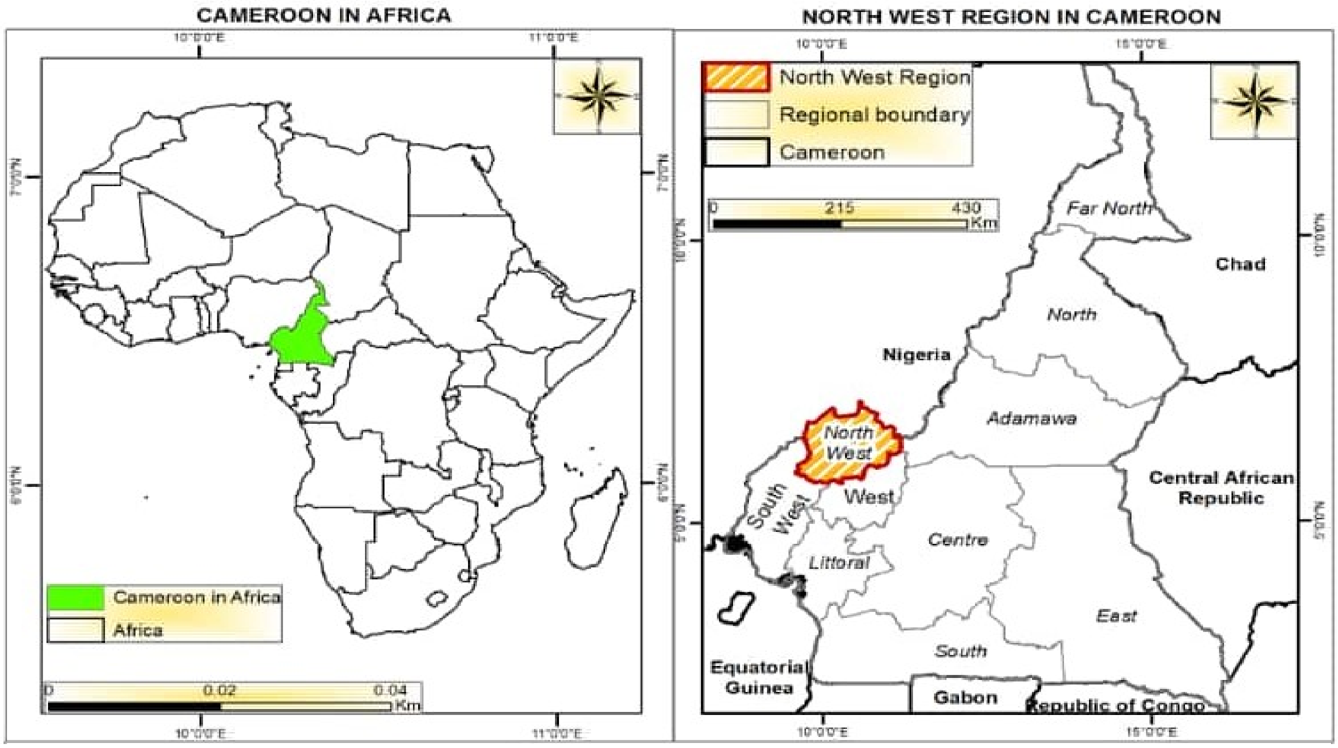

Figure 1: location of the North West Region (NWR) in Africa and Cameroon.
Source: Atlas of Cameroon, 2016.

The Region is characterised by accidental relief of massifs and mountains. It features several dormant volcanoes, including Mount Oku (3100m). A cool temperate-like climate, influenced mainly by mountainous terrain and rugged topography. Average rainfall is about 2400mm, average temperature 23°C, ranging between 15° and 32°C. These are characteristic features that favour Small Scale HEP (SSHEP).

b. Methods and techniques

Amongst the seven Divisions of the NWR of Cameroon, LHEP production is practiced in Bui Division.

Table 1: Surveyed households in referenced localities

Number	Locality	Total number of households	Surveyed households
1	Bamdzeng	84	14
2	Kingomen	390	18
3	Djottin	1468	39
4	Shiy	279	29
	TOTAl	2222	100

Source; *BUCREP, 2005; Heifer Project International; & SHUMAS, 2016*

Information and statistics on SSHEP was obtained from the Kumbo Development and Orientation Centre (KUDOC) a local NGO as well as SHUMAS (Strategic Humanitarian Services) and SNV (Netherlands Development Organisation) equally served as resource centres for SSHEP activities in the study area. Random sampling technique was used to draw samples of households with SSHEP connections. Quantitative and qualitative data was collected through questionnaires, interviews and observations. Four reference localities in the study area that is Kingomen, Bamdzeng, Djottin and Shiy (table 1) were considered owing to their implication in the production and supply of SSHEP. A sample of 100 user households of SSHEP was drawn from the reference localities and to these households, structured questionnaires were administered. Supplementary information was obtained from reviewed literature.

A GPS receiver was used to locate SSHEP plants, users and distribution networks in the Region. A digital camera was used to take photographs in the field. The schemes as well as other important features observed were illustrated using photos.

III. RESULTS AND DISCUSSION

a. Small Scale HEP potential.

Reference [20] held that the potential of generating electricity and mechanical power from small scale hydro systems is qualitatively stated to be enormous in many countries in SSA due to its geographical features: presence of perennial rivers and mountainous locations especially in central, eastern, and some southern parts of Africa. Cameroon and more precisely its North Western flanks happen to be endowed with great potential for SSHEP justifying the presence of these plants in the area. In fact, SSHEP plants have been developed by communities with the technology and financial resources at their disposal for the betterment of their living condition. This is the case in Kingomen, Shiy, Bamdzeng and Djottin localities where SSHEP schemes are present and functional. SSHEP sources are the most readily exploitable energy sources in Cameroon. The first SSHEP scheme in Cameroon was put in place in Dchang in 1944. LHEP is the electrical power generated from water masses in motion in a water course. It can be used to extract water for irrigation systems. It uses the mechanical energy contained in water for tractions and above all electricity generation. Micro HEP potentials in Cameroon stand at $19.7X10^{3}$MW with an average of $11.5X10^{6}$MWh/yr [21]. More precisely, micro HEP schemes are considered to be schemes that produce electricity of less than 10MW while the Cameroonian law considers as RE, schemes that produce electricity of less than 5MW. In the western part of Cameroon precisely the NWR where the presence of hilly relief favours the development of this energy type, SSHEP schemes have been located around Bafoussam, Bamboutos, Foumban, Jakiri, Kumbo and Djottin. Feasibility studies indicate that the total potential of SSHEP possessed by Cameroon stands at 127.65MW [22].

The NWR is endowed with enormous small and large-scale HEP potentials. This potential that is first determined by natural heritage (all-year-round river), and slope gradient confirms the possibility of an area to produce SSHEP. As concerns large scale HEP potential, the Menchum falls top the list with an HEP potential that can supply the whole of West Africa; 15-35GW [21]. However, SSHEP potentials (all Year Rivers) are dotted here and there all over the Region but only a few have been exploited to the benefit of communities like Kingomen, Djottin, Bamdzeng and Shiy.

Today, 35% of ENEO's (Energy of Cameroon) one million connections are in rural areas. The concessionaire originally with its obligation of 500000 new connections focused on urban and peri-urban areas, neglecting rural areas [23]. It should be pointed out here that this was done through extension lines ignoring the capacity and HEP potential rural areas harbour in terms of LHEP. This increases the burden on the national electricity corporation as the quantity of electricity produced (1450MW) is far less than electricity demand (3000MW); [21]. This state of affairs creates a general disequilibrium in electricity supply as even the newly connected households especially in rural areas go for weeks without power supply. Added to this, the Government of Cameroon and donors finance grid extension projects and then transfer them to ENEO, thereby extending ENEO's service perimeter instead of investing in LHEP. This has transformed the country into a reach but underexploited HEP potential. Meanwhile, SSHEP potentials as in the North West Region serving as seedbeds to supplement such endeavours are not enhanced by government through its institutions.

Again, [24] argued that technically, it is possible to divert small portion of the flow from big rivers for power generation; meaning that even large-scale hydropower sites could as well be potential sites for SSHEP development. Thus, in general, Cameroon has significant SSHEP potential which if harnessed can improve access and supply of electricity to rural off-grid communities. With a rich hydrographic network, rivers can thus be diverted to increase the SSHEP potential they harbour. It is in this light that very small rivers having high HEP potentials like River Ndzer in Kingomen village are used for SSHEP without any fluctuations in its volume. Rivers in the NWR of Cameroon (NWRC) where feasibility studies have been conducted thus fulfil the criteria for SSHEP generation, serving as seedbeds for supplementing electricity supply in the Region though energy access equally contributes in this drive.

b. Access to energy and accessibility.

Field evidence revealed that indigenes of localities where SSHEP plants are located were increasingly using SSHEP as noticed in the localities of Kingomen, Bamdzeng, Djottin and Shiy of the NWRC. However, a recent report from the UN Secretary General's Advisory Group on Energy and Climate Change [25] stresses the importance of universal access to modern energy sources by 2030 as key part of enhancing Sustainable Development (SD). It also suggests a new understanding of the term 'access', and identifies the specific contributions of RE to SD that go beyond the effects of increased energy access based on grid expansion. This approach defines energy access as "access to clean, reliable and affordable energy services for cooking and heating, lighting, communications and productive uses" and illustrates the incremental process involved in moving from servicing basic human needs to creating a self-sustaining process of SD [25].

Access to modern energy services, whether from renewable or non-renewable sources, is closely related with measures of development, particularly for those countries at the early stages of development. Indeed, the link between adequate energy services and achievement of the Millennium Development Goals (MDGs) was defined explicitly in the Johannesburg Plan of Implementation that emerged from the World Summit on Sustainable Development in 2002 [26]. As emphasized by a number of studies, providing access to modern energy (such as electricity or natural gas) for the poorest members of society is crucial for the achievement of any single of the eight MDGs ([27], [28], [29], [26]). The advent of SSHEP production in the NWRC is thus a perfect example of an initiative that fulfils the requirements of MDGs to encourage local communities in the drive towards resolving their energy difficulties.

However, in 2010, 20% of the world population, mostly in rural areas, still lacked access to electricity while 40% cook mainly with traditional biomass, mostly gathered in an unsustainable manner [26]. In the absence of a concerted effort to increase energy access, the absolute number of those without electricity and modern cooking possibilities is not expected to fall substantially in the next few decades. This tie with the situation in the NWRC where local efforts have been mobilised to circumvent the dwindling energy access as a supplement to energy supply.

In Cameroon precisely in the NWR for instance disruptions in power supply, unexpected large and widespread periods of darkness or the emergence of unintended consequences of any power supply source are amongst the factors influencing access to energy. This has precipitated communities without electricity to increase energy access through SSHEP as the absolute number of those without electricity and modern cooking possibilities especially rural areas is witnessing a considerable drop.

Significant parts of the NWR today have access to modern and clean energy services. From a SD perspective, a sustainable energy expansion needs to increase the availability of energy services to groups and communities that currently have no or limited access to them such as the poor, those in enclave and far off rural areas and those without connections to the grid. SSHEP sources in the NWR are already resolving these issues as compared to conventional energy sources that are lagging behind from coverage in remote and far off areas of the Region due to high transmission cost and distance effect.

It is clear that Renewable Energy (RE) can play a role in reducing the energy demands, especially in rural areas, where only 18% of the population has access to electricity [21]. The outbreak of SSHEP schemes in the NWR and the subsequent inclusion of Small-Scale Renewable Energy (SSRE) schemes in the government plan of action [26] led to improved RE policies that have gone a long way to boost private and foreign investment in the sector for future development. The adoption of SSRE sources as alternative solutions to energy issues by communities in the NWR has taken a leading role in sensitizing the public about the benefits of Renewable Energy (RE).

The recent energy law (2011) reorganising the energy sector in Cameroon made some provisions to promote Renewable Energy Generation (REG). This implies the place occupied by SSRE sources in the energy sector has been recognised making their sustenance imperative as it is already the case among local communities in the NWR.

Although the implementation of this law is still expected to be effective, activities related to SSHEP have been well specified for each RE type. The remote and enclaved or far-off areas where these HEP plants are located constitute a major hindrance to road construction. This makes it very difficult to transport equipment and material that is needed for grid extension to disfavoured electricity supply areas. Kingomen is one of those villages in the NWR where the poor nature of roads has contributed enormously in reducing the energy penetration rate in the Region (plate 1).

Plate 1: Self-reliant development.

Villagers involved in the construction of their roads. Photo I: the road leading to Kingomen. Photo II: the road leading to the power house. Photos by Bongwirnso E. April 2016.

In these communities, farming off-days are often used to organise community work to improve the state of roads (plate I). Road construction and maintenance is amongst the prime priorities of most villages. Although Kingomen is just some 8km from Kumbo, the chief town of Bui Division, it still lags behind in road infrastructure. Villagers have thus taken upon them to mend their roads through community labour. This makes it easier for material and equipment to be transported to the sites easing the process of SSHEP production and distribution. The pipes, HEP transformers, turbines, cables etc. used on the schemes are transported to the project sites thanks to this initiative. It thus becomes factual that SSHEP plants serve as supplements for electricity supply as access to energy and accessibility are taken care of by the communities themselves.

c. Technological availability.

The peculiarity in most community development projects in Sub-Saharan Africa is that they are often assisted technologically and financially by the state while the community is taught how to manage and run the projects themselves; [10]. The case in the NWR of Cameroon is different as the population has been abandoned for decades to cater for their basic necessities (water supply, energy etc). As regards energy supply for example the Kingomen, Shiy, Djottin and Bamdzeng villages encountered enormous difficulties in their attempts to link their communities to the national grid. Common adage holds that necessity leads to invention, and so, in most localities in the NWRC, the unanswered plight by the indigenous population to get linked up to the national grid spurred the anxiety to work out strategies to resolve their energy problems. According to [30], many governments, as a result of Small Hydro Power (SHP) technology awareness campaigns have incorporated SHP into their rural electrification plans.

The very low levels of government sponsored installations are argued to be partly due to limited human capacity in this area. Meanwhile the law [31] governing the energy sector in Cameroon stipulates that, any private limited company undertaking the production, transmission or sale of electricity in Cameroon must be in possession of the appropriate technology and finance. The small-scale local energy schemes operating in the NWR on their part possess the technology but do not have enough funds needed to put in place modern energy schemes. It is in the search of these strategies that an indigene of Kingomen village for example, adapted his knowledge in motorbike repairs, acquired in Nigeria, in the energy domain leading to the production of electricity. This initiative was independent of any state assistance given to these communities in terms of any technical support in the production process of this energy. The scheme thus makes use of locally based technicians such as carpenters, bricklayers, welders and labourers who assist in the construction of small dams and laying of the pipes on the line.

The experience in Djottin village is similar involving college level electrical scientist who tried this knowledge in his village using very poor equipment but succeeded in lighting up the village. If such talents could be identified and given appropriate and advanced training to come back as professionals and not amateurs in these villages, their contributions in the development of the electricity sector will be enormous and this will go a long way to reduce too much reliance on the state. Through these efforts, electricity supply has been supplemented using locally available technology notwithstanding the very limited financial support.

d. Financing.

Lack of initial financial means to adequately invest into the RE sector hinders the development of potential renewable energy sources. This also implies lack of reliable infrastructure in the sector to kick start potential development. However, the lack of funds by governments to invest in the extension of conventional HEP supply has been found to deter some private investors from venturing into this sector in developing countries; [10].

The immediate obstacle for many poor households and governments in developing countries is lack of financial resources to ensure energy supply. In the NWRC no small-scale electricity suppliers benefitted from subvention of any kind. This explains why SSHEP engineers complain that they have been left alone to handle energy issues in their villages as only the Kingomen SHEP scheme received material aid from their elite. In Shiy village, the SSHEP scheme was put in place by the community without any assistance from the state. In Djottin village, the project relies on the meagre income that accrues from servicing relating to repair of worn out parts on the scheme. Such an atmosphere is deplorable making endeavours in the RE direction to seem unsustainable.

For RE sources to be sustained, there is a crucial need for subvention or better still subsidies. SSHEP producers are also left alone in the provision of equipment that is mainly made up of locally fabricated HEP generators. These are seedbeds that have been supplemented by funds raised during special festivities organised in these villages, which today stands as the only financial source available in communities where SSRE schemes are found. This goes a long way to reduce government spending on electricity extension lines to remote rural areas that takes very long-time lapses to be done.

e. Labour/Land provision.

Community energy is commonly differentiated from non-community energy by the (assumed) level of participation and involvement of community members in the process of developing a project and/or the outcomes of the project [32]. Micro energy schemes especially for rural areas that are far from the national grid in the NWRC greatly rely on community assistance. This assistance that is always either in terms of labour, finance or land offered by proponents of renewable energy in a community is often of great help to schemes of this nature.

In Kingomen, community assistance is in the areas of land and labour. Although some e.g [33] use this 'process-outcome' approach to map the broad variety of community projects that may exist, others adopt a normative perspective, where 'more' (participation or benefits flowing into the community) is better; [34]. This is one explanation for the substantial body of empirical research on community energy focusing on understanding factors that encourage and facilitate participation in energy projects ([35], [36], [37], [33]). In shiy village, the community was mobilised to provide labour required in the construction of the SHEP plant; photo 3. This mobilisation is in line with the importance of identification with a place-based community in facilitating participation: a sense of belonging to a particular place is observed to inspire voluntary efforts to develop community renewable energy to generate local benefits ([35], [8], [37] [32]). This sense of belonging and place attachment has been observed to be mutually reinforced through participation in community projects ([38], [39], [40] [41]).

Photo2: labour provision by Shiy villagers for community development.
Villagers assisting to put in place the pipe line for their SSHEP scheme.
Photo by Bongwirnso Emmanuel (project technician), Nov. 2016.

During the implementation phase of the SSHEP schemes, villagers are mobilised to provide the necessary labour for the schemes. This is often done on off-farm-days that often come once a week. The community organises during such days, community work involving road construction and participation in other development projects in the village (photo 3). The power plant exploited this opportunity by using the available labour force to achieve the task of laying down the pipes on the pipe line used for SSHEP production. Similarly, the piece of land on which the scheme is based was granted by the village council owing to the importance of the scheme to the village. During the laying of pipes on the pipe line (penstock) to conduct water from the HEP dam to the power house, there was total mobilisation as more than 300 villagers came out in their numbers with the necessary tools to support the scheme with man power (photo 3). Photo 3 shows how community labour is provided in the implementation phase of the Shiy local HEP scheme. This labour force consisted of bricklayers, welders, carpenters and other unskilled labourers. The participation of the villages does not end only at the inception stage of the scheme for when it is operational, maintenance is their sole responsibility. This is an added advantage as time and money are saved as the necessary labour force is readily available thus serving as supplement to electricity supply.

f. Compensating electricity supply losses.

Conventional or large-scale HEP supply has been hogged down by technical losses on transport lines in most developing countries. It should be noted that tariffs applied to users also include production, transportation, and distribution losses; [42]. The fact that government granted four concession licenses to American Electricity Society-Société Nationale de l'éléctricité (AES-SONEL) led to great losses recorded that at times attained 30% of energy production meanwhile international norms have been fixed to a maximum of 10% losses; [43].

There are also non-technical losses or more precisely commercial losses which are as a result of poor management of customers and fraud. Cases have been reported of customers abusively charged since the revision of tariffs in May 2008; [44] (Reseaux Associatif des Cosommateurs de l'éléctricité). These losses encured during production, transportation and distribution are transfered to consumers by the electricity supplier; the then AES-SONEL. The following diagram gives us a summary of the current electricity supply losses in Cameroon.

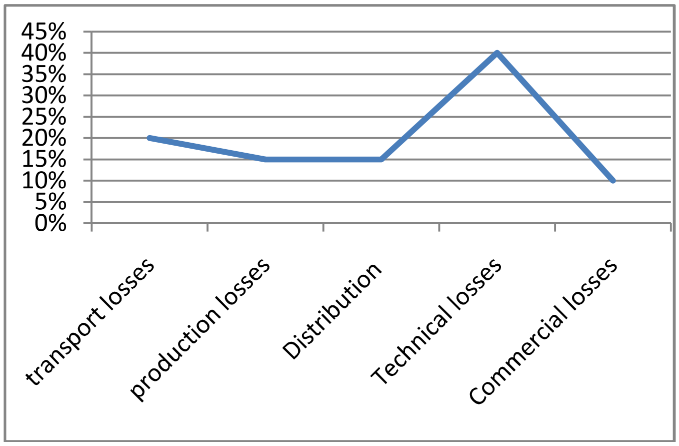

Figure 03: An illustration of electricity losses in Cameroon.

Source: RACE, November 2010.

Figure 3 shows that 40% of electricity is wasted through technical losses. The billing of commercial users is very expensive, which also affects their income levels. The fact that electricity cannot be stocked signifies that when it is produced it should be transported and consumed as fast as possible. Consumers in Cameroon are thus twice penalised added to the daily inconveniences, power cuts and poor quality of electric current.

On the contrary, SSHEP production does not incur such losses. Electricity supply in communities is often at small scale and has to do with limited number of consumers. Moreover, energy loss during transportation is as a result of "thermal effect" which is the heating provoked by the passage of electric current in a conductor. This thermal effect creates energy losses that are themselves dependent on the resistance of conductors, distance covered and the intensity of the current transported. High tension (HT) lines transport electricity from production to distribution points and experience great energy losses (20%, figure 03 above).

Field evidence shows that SSHEP plants are circumcised and as such do not entail any transportation over long distances. In this light they don't witness any thermal effect. The energy that is produced is supplied to consumers without any hitches as consumers do not pay any high tariffs to compensate for any losses incurred during production. Only a symbolic token (2000CFA Francs) is required of them for maintenance. This is thus a supplement to electricity supply even though these types of schemes can equally be used to resolve personnel related issues.

g. Personnel related issues.

After the privatisation of AES-SONEL in 2001 jobs were lost. In order to efficiently maximise profit, the number of workers employed by former SONEL had to be reduced because there was change of status from public limited company (non-profit making) to private limited company (profit making) as depicted by the percentage of shares owned by the state 44%, 51% AES and 5% former workers of SONEL who had been retained; [43]. Consequently, the quality of services offered consumers had to diminish as there was no more instant response by workers in times of breakdown. The available personnel is not enough to meet the demand of the enterprise. In this light an electrical fault that leads to power failure can leave the population in the dark for weeks or even months without electricity supply due to insufficient personnel. This state of affairs can be explained by the fact that the company needs more personnel to carry out its operations. As such, electricity coverage rate in Cameroon remains shabby with roughly 60% of the national territory covered despite the creation of the Rural Electrification Agency (REA); [44]. The rate of rural electrification is still at a hopeless 18%.

According to a recent study carried out by the former AES-SONEL, 25% of users were of the view that they were satisfied with the quality of service offered them by the company which is too small in a country where electricity is considered a basic necessity and a fundamental right of the citizen; ([43], [44]). This has rendered the company unpopular with offices at the supreme court full of complaints as a result of poor services rendered users due to lack of personnel that lead to prolonged black outs and the consequent losses recorded as foodstuff in refrigerators often get bad and even when power is re-established households electrical appliances most often get damaged by the high alternating current; [21].

With such an unstable atmosphere as concerns electricity supply, communities in the NWR have laid seedbeds through the different energy schemes that have been constructed to resolve their energy issues. Small scale RE schemes in the NWR of Cameroon are excellent seedbeds for energy supply as the schemes are run and managed by locals mitigating the effects of personnel related issues. The fact that the project initiators are indigenes of communities where these schemes are located resolves first a technological drawback and second personnel issues. In this light, breakdowns on the schemes are attended to within the shortest delay. This nearness to services rendered has increased promptness in reacting to consumers' needs leading to little or no complaints on behalf of the users as 94% of electricity users in Shiy, Kingomen and Djottin are satisfied by the services rendered by the personnel. This has gone a long way to improve quality in electricity supplied and a boom in socioeconomic activities as health services, shops, barbing saloons, secretariats etc., could be observed operating without power cuts rendering surplus electricity to be extended to neighbouring communities.

h. LSSHEP as isolated, off-grid/feed-in electricity plants.

Renewable energy technologies can be deployable in a decentralized and modular manner. This makes them suitable energy sources for small grids or off-grid solutions, thus ideal for power supply in rural off-grid regions where connection to the grid is either prohibitively expensive or technically very difficult to achieve; [42]. Renewable energy technologies are therefore arguably one of the viable solutions to the modern energy supply in the SSA region where it is estimated that 66% of the continents population lives [20]. According to [45] (a renewable energy policy network), off-grid renewable energy solutions are among the cheapest and most sustainable options for rural areas in many regions of the developing world.

SSHEP plants are equally considered as isolated electricity systems. This is because the surplus energy produced can be inserted into the national grid. With these systems, it becomes possible for villages or communities to inter-connect. Cases exist where SSHEP schemes supply other communities with electricity and the feed in tariff flows back into the community where it serves for other development projects [46]. In the NWRC however, three out of the four SSHEP plants are owned by private individuals meanwhile the SSHEP plant in Shiy village is a community owned scheme. These schemes have ignited the setting up of small businesses that use electricity like grinding mills, secretariats, barbing saloons, micro-finances and above all health units. In Kingomen, Djottin and Shiy villages, health units make use of electricity produced by SSHEP systems. This has considerably reduced the distance the inhabitants of these communities usually cover to seek medical care. Health practitioners in these health units testified they have been able to operate most of the health machines thanks to the availability of SSHEP.

These energy systems also possess relatively low load factor since the rural households mainly consume electricity during evening hours. Given the fact that such schemes are built to supply rural households and probably small and medium size enterprises with electricity, it impedes them from exorbitant fuel prices, reducing running cost and provides goods and services to consumers at relatively affordable prices. Children study at night thanks to SSHEP. This has greatly impacted their performance especially those at the primary level as secondary schools are found in towns and cities far away from these communities.

IV. CONCLUSION

From the above analysis it is clear that local HEP initiatives are seedbeds that can supplement energy supply in the NWR in particular and Cameroon at large. But this can only be possible if the framework laws (particularly the 1998 and 2011 energy laws) guiding renewable generation in Cameroon are fully applied. The vulnerability of small-scale renewable energy schemes in the NWR is already perceptible due to lack of state subvention as it was noticed that schemes operating in this part of the country never benefitted from state aid of any kind contributing to their poor and inefficient nature. Meanwhile the environmental benefits of such schemes are enormous in the area of waste production as they rely more on nature. This type of energy supply method can help in bridging the energy deficit the country suffers from and facilitates the development and deployment of socioeconomic activities in remote and far off areas. It is therefore, imperative for government to redirect its energy policy if any and invest in SSHEP initiatives if she intends joining the drive towards a smooth energy transition. Given that the use of RE is one of the key solutions to energy issues in remote and enclave areas, inability to encourage the transfer and deployment of these skills could help aggravate the energy situation in these areas as explained by some of the hindrances identified relating to different renewable energy types in the NWR, Cameroon in general and Africa at large.

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