Ghana's energy access journey so far: a review of key strategies

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Abstract

Purpose – The purpose of this paper is to present a comprehensive review of the programmes being implemented with a view to ascertaining if they adequately address the energy needs of the poor more holistically and sustainably.

Design/methodology/approach – The content of this desktop review is based on information collected through a review of available energy policy documents from the Ghana Government and related governmental agencies, such as the Energy Commission and Ghana Statistical Services, international energy-related agencies, such as the International Energy Agency (World Vision, 2013), as well as other related web searches. Additionally, global and Sub-Saharan African energy access documents were reviewed by analysing secondary data from the World Bank and UN policy reports, statistical data, strategies, regulations, protocols and other related documents (World Vision, 2013). Furthermore, some policy documents on energy access and usage were explored mainly from Senegal and Ghana to ascertain governments' policies, regulations and strategies in the implementation of energy access policies.

Findings – The paper offers all the various strategies being implemented in an attempt to establish a foothold on the problem of affording the poor with clean and affordable energies. The paper also presents the rich experiences of Senegal in its bid to see expanded access in liquefied petroleum gas usage by residential consumers.

Originality/value – The paper provides some policy and theoretical implications for improving Ghana's energy access.

Keywords Renewable energies, Desktop review, Energy access, Energy poverty, General literature review, Improved cooking access, Improved cooking technologies, Traditional literature review

Paper type General review

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1. Introduction

Energy is the "lifeblood" of the modern society, as it is needed in every facet of life for societies to thrive (Atuguba and Tuokuu, 2020). Without question, the sprawling inequities, inadequacies and lack of access to modern energy services remain crucial to the development possibilities and the quality of life of individuals and nations alike. According to the extant literature, the evidence linking the provision of energy services with the achievement of economic growth is strong and well-documented and that energy represents a critical enabler to the growing prosperity and development of nations (UNDP and World Bank, 2005; AGECC, 2010; IEA, 2011; Atuguba and Tuokuu, 2020). Other studies assert that energy is practically linked with all facets of development (Fouquet, 2016; WEHAP Working Group, 2002). Even the rise and fall of nations have historically found attribution with the extent of access and control over energy resources (Reynolds, 2011). Notwithstanding the above, the foregoing does not suggest in any way or form that energy only is sufficient to the course of advancing development, except it reinforces the basics that within the context of a resource, an input or a service, energy lies at the heart of the delivery of many aspects of human development, such as health, water, education and food, and also plays a pivotal role in the fulfillment of almost every need (Sovacool and Drupady, 2016; ECOWAS, 2005). Hence, the deprivation of energy services undoubtedly serves to marginalize, perpetuate and undermine the well-being of those for which it is inaccessible. Even more significant are the concerns regarding the forms of energy underpinning development. Whether or not these energy forms are compatible with sustainable development ought to be continuously monitored and addressed. The reliance on traditional fuels and technologies not only culminates in waste in terms of time, resources and physical energy but also poses a sustainability challenge with a significant proportion of the burden resting on the poor and vulnerable in the society, rural populations especially on women and girls (AGECC, 2010).

The past decade has witnessed a clear and consistent effort by the UN and other world bodies at re-orienting public policy in line with the promotion of access to modern energy services. In the Johannesburg Plan of Implementation which emerged from the world summit on sustainable development, the international community had been urged to take bold and concerted actions at expanding access to acceptable, reliable and affordable energy services to eradicate poverty and propel the sustainable development goals (SDGs). Indeed, the seventh goal of the SDGs emphasizes on access to affordable energy. The issue has lately been pressed further by the establishment of the United Nations Advisory Group on Energy and Climate Change which similarly called on all governments to commit to the global goal of achieving universal access to modern energy services by 2030 (AGECC, 2010). Even greater attention has come to the question of energy access as the UN General Assembly declared 2012 as the "International Year of Sustainable Energy for All" (UN resolution A/RES/65/151, 2011). What appears to be lacking, however, is the radical pursuit of the widespread obstacles standing between the dream and reality of accomplishing universal access to modern energy services. This speaks to the role of the developed world even as the acute energy situation pertains more to developing nations. If for nothing at all, then the potential repercussions of energy projects regardless of their locations should have and must sufficiently incentivize global prioritization and support.

In Sub-Saharan Africa (SSA), where the situation is most dominant, several actions, plans and policies are being pursued. These efforts have resulted in some energy policy targets in Ghana – just as in some other places – which are manifestly defined in programmes like electricity for all by 2020 and liquefied petroleum gas (LPG) and improved cooking systems for all by 2015. Unfortunately, the enhanced cook stoves target has been missed. While Ghana is appreciated as one of the few nations making progress at the

expansion of electricity for its people in SSA, it is instructive to note that the totality of the energy needs of its citizenry has barely been met. Kemausuor *et al.* (2011) indicate that the efficacy of existing policies in meeting the aspirations of increased access to modern energy services in Ghana is clearly in doubt. Very little attention has been devoted to this area in mainstream energy literature. The objective of this paper is to present a comprehensive review of the programmes being implemented with a view to ascertaining if they adequately address the energy needs of the poor more holistically and sustainably. This is intended to assist the major players in forming a more coherent view of the status of access to clean energy services in Ghana with the ultimate consequence of informing policy in the ensuing years.

The rest of the paper is structured as follows: The next section following the introduction looks at the methodology of the study. Thereafter, we examine the energy access situation within and without in Section 3. The section also offers the discussion section with special focus on some policy lessons from Senegal as well as the theoretical implications of the study. Section 4 interrogates existing programmes pursued in respect of energy access. Section 4 also offers alternative remedies in terms of the required policy and process adjustments and also attempts to answer the question "Where lies the answer?" Some concluding remarks are then presented in Section 5.

2. Methodology of the study

The content of this desktop review is based on information collected through a review of available energy policy documents from the Ghana Government and related governmental agencies, such as the Energy Commission (EC) and Ghana Statistical Service (GSS), international energy-related agencies, such as the International Energy Agency (IEA) (World Vision, 2013), as well as other related web searches. Additionally, global and SSA energy access documents were reviewed by analysing secondary data from the World Bank and UN policy reports, statistical data, strategies, regulations, protocols and other related documents (World Vision, 2013). Furthermore, some policy documents on energy access and usage were explored mainly from Senegal and Ghana to ascertain governments' policies, regulations and strategies in the implementation of energy access policies. Finally, the case of Senegal's LPG distribution and consumption model was presented as a case of best practice and lessons and policy implications drawn for Ghana.

3. The energy access situation within and without

3.1 Global energy access at a glance

This section of the paper relies heavily on IEA's world energy outlook series. In the 2011 report, it is indicated that about one-fifth of the world's population lacked access to electricity in 2009, which translates to about 1.3 billion inhabitants. Some 2.7 billion people, approximately 40% of the global population, have also been cited as being without access to clean cooking facilities. Similar figures with slight variations have been quoted in the 2011 human development report (UNDP, 2011) and also in the 2012 edition of world energy issues monitor (WEC, 2012). Given the estimates for 2000 (IEA, 2002), it is observed that global access to electricity has seen some level of improvement. However, access to clean cooking energy is noted to have worsened with an excess of about 300 million people now relying on biomass for cooking and heating purposes [1]. According to the latest figures by the UNDP (2018), about 1 billion people worldwide lack access to electricity with majority of them in rural areas. Additionally, around 3 billion representing 40% of the world's population do not have access to clean fuels for cooking (Ritchie and Roser, 2019).

From the angle of the regions, it is shown that 95% of the population lacking access to clean energy services are located in either SSA or Asia with a concentration of the burden revolving around the single biggest nations [2]. While SSA hosts only 12% of the global population, it is said to account for almost 45% of those without electricity. In terms of regional population shares, 78% of the people in SSA rely on traditional cooking facilities with a developing country average of 51%. A comparable trajectory is observed with electricity access: nearly 70% of the population lack access to electricity in SSA, but the share is limited to only 25% for developing countries generally. SSA, Indonesia and India are found to be the dominant users of biomass.

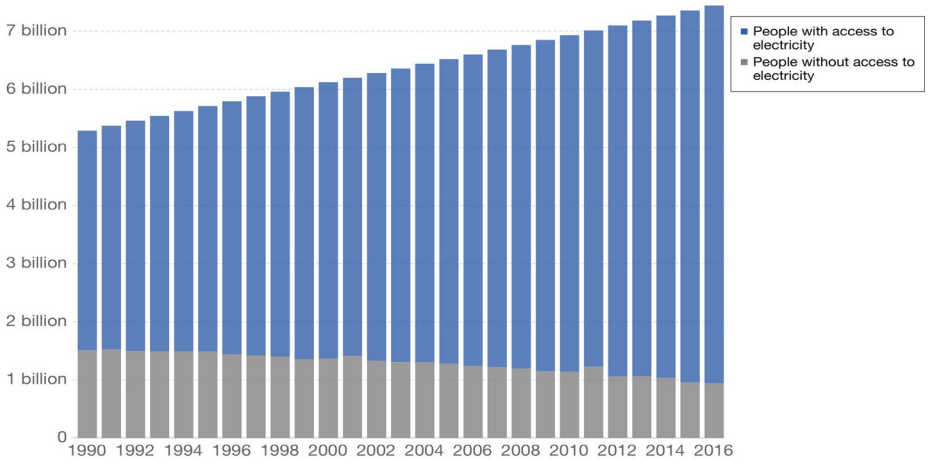
Meanwhile, a more nuanced understanding of the situation is obtained when viewed along with the rural–urban split [3]. On average, the proportion of those either lacking access to clean cooking facilities or without access to electricity is each found to be five times higher in rural than in urban areas [4]. Specifically, the IEA (2011) estimates that more than 80% of the people lacking access to modern energy services live in rural areas. The energy access challenge is further established to exhibit some symbiotic relationship with poverty. This dimension is understood from the 2011 human development report (UNDP, 2011). The report showed that deprivation from clean cooking fuel is most prevalent in the two most impoverished regions of the world; SSA and South Asia. Over 90% of the multidimensionally poor lack access to clean cooking fuels in these regions. SSA leads the chart with a striking share 98.3%, which is closely followed by South Asia (94.1%). The implication is that almost all people below the poverty line do not have access to clean cooking fuels in these regions. By extension, these regions can logically be said to be home to the majority of deaths afflicted on people for relying on unclean fuels for cooking purposes. Compared to Europe and Central Asia, only 28.6% of the multidimensionally poor live without the services of clean cooking fuels.

In recent times, the global access to electricity has seen a steady increase. In 1990, over 71% of the global population had access which increased to about 87% in 2016 (Ritchie and Roser, 2019). On the other hand, "In 2015, the total number without electricity fell below one billion for the first time in decades; very likely the first time in our history of electricity production" (Ritchie and Roser, 2019, NA). The figure is even high in SSA, which is the poorest region in the world. For instance, according to the IEA (2016), only 35% of the population in SSA has access to electricity and 40% of the about one billion population lack access to electricity (Warner and Jones, 2018). Thus, the services of modern energy do not just elude the poor, but the level of denial apparently demonstrates a robust regional pattern (Figure 1).

As with fuels for cooking, electricity access by the poor shows extreme disparity by the levels of access in the regions. In all, 62.3% of the multidimensionally poor are without access to electricity in Sub-Saharan Africa, compared to 0.4% for Europe and Central Asia put together. What this means is that many more people in this particular situation in SSA are invariably being denied the benefits of education, proper medical care and enhanced incomes among others than anywhere else in the world. This is incumbent on the fact that the current phenomenon limits the opportunity of having electricity play the direct role of improving productivity, lengthening study times and enriching medical care which mainly could have lifted these individuals out of poverty.

3.2 Situation of energy access in Ghana

3.2.1 Situation of access to lighting energy. The EC estimated in 2017 that 83% of the population have access to the electricity as at the end of 2016. This is more than 3.5 times the level of electricity access in 1990 (23%) and nearly twice the level in 2000 (43%). Among the factors that have led to Ghana's increased access rate was the launch of the National Electrification Scheme (NES) in 1989 and the District Capitals Electrification



Source: The World Bank (2019)

Figure 1.
Number of people with and without electricity access in the world

Programme (DCEP). By 2008, access to electricity was pegged at 55%. This is reported to have placed Ghana in the third place in SSA, coming after Mauritius and South Africa (Kemausuor *et al.*, 2011). Figure 2 shows the energy access forecast by the Ministry of Energy, UNDP and Ghana EC, among others.

The GSS conducts periodic national population and housing census, and towards the end of 2010, they established the electricity access to be 64.2%. The EC also conducted a national electricity access survey as part of a wider energy access survey to determine the access to various forms of energy in the country. According to the EC survey, the national household access to electricity in 2010 was 60.4%. Indeed, to achieve higher access rate, the government initiated several policies and strategies including the National Electrification Scheme in 1989 and the DCEP which had the goal of extending the transmission grid. These reforms included the establishment of regulatory mechanisms for operations and pricing of electricity, by establishing the EC (technical regulator) and the Public Utility Regulatory Commission (the economic regulator), unbundling the energy sector value chain and opening the sector to private investment. According to Edjekumhene *et al.* (2001), these reforms were in response to high government debts, high international oil prices, overdependence on dwindling hydro resources and the poor performance of state-owned enterprises. While access to electricity seems to generally enjoy some steady improvement, an examination of the pattern of access demonstrates an urban-dominated trend (Figure 3).

On average, electricity access in urban areas in Ghana are higher as compared to the SSA average. As at 2014, while urban access rate in Ghana was 90.8%, that of SSA was 68.9%. In rural areas, the story is similar, as shown in Figure 4. While Ghana's rural access rate increased from 1% in 1991 to 63% in 2014, that of SSA increased from 8.3% in 1991 to 17.9% in 2014. A number of factors, including geographically dispersed population and low income, have been cited for the low rural access rate (GLSS 2014).

Of these, only 26.9% of households in rural Ghana use electricity for lighting compared to 78.5% of urban households. The implication is that more than two-thirds of rural households rely mostly on kerosene for their lighting needs relative to only about one-fifth of urban households (Figure 5). The smallest percentage of households (16.6%) to use

electricity for lighting are the Savannah rural households who also are found to have the lowest per capita income of GH¢130 (GLSS, 2008; World Development Indicators, 2018). This seems to lend credence to the inextricable link between income and access to modern energies. Data from a study by the Ministry of Health [5] indicate that seven in ten

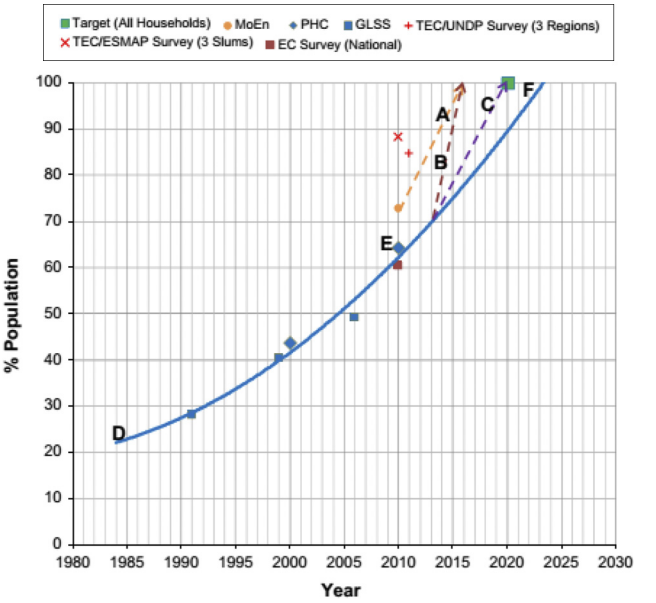


Figure 2.
Forecast of Ghana's electricity access

Source: Mensah *et al.* (2014) , available at: https://www.academia.edu/8328883/Energy_access_indicators_and_trends_in_Ghana Same year (2010), different statistics

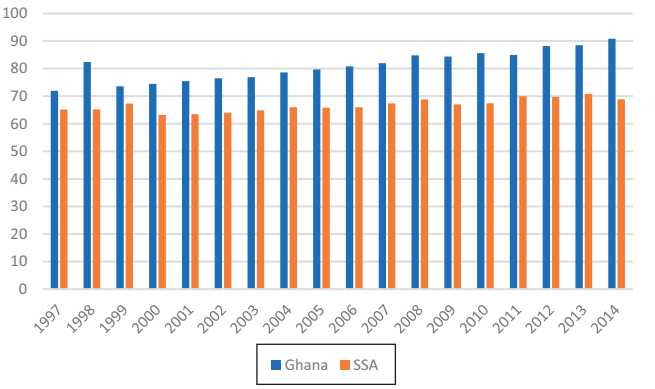
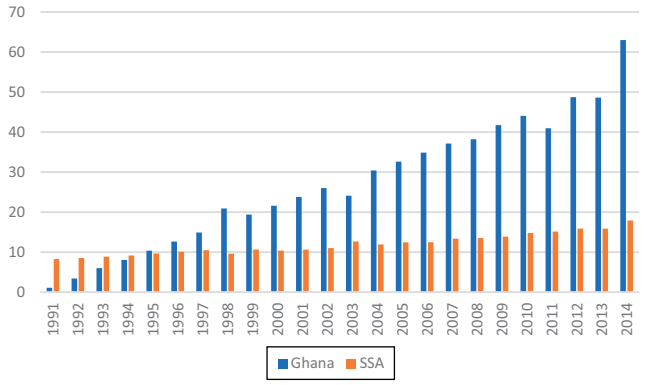


Figure 3.
Access to electricity, urban (% of urban population)

Source: Authors' illustration based on data from the World Development Indicators (2018)



Source: Authors illustration based on data from the World Development Indicators (2018)

Figure 4.
Access to electricity, rural (% of rural population)

households use either charcoal or wood (35% each), and one quarter use LPG/natural gas/biogas. Only about one quarter of Ghanaian households (27%) use clean fuel for cooking.

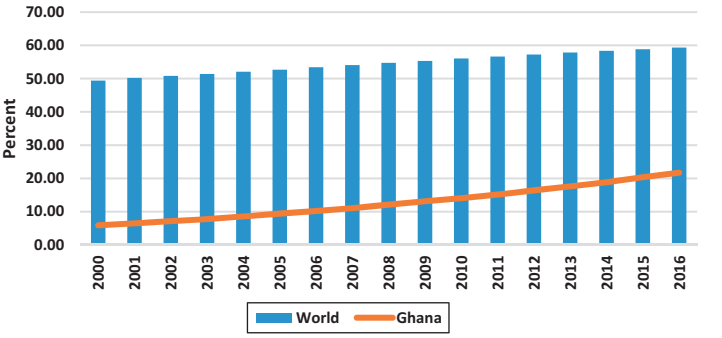
3.2.2 Situation of access to cooking energy. The term clean cook stove can be referred to as technology that is clean from a household air pollution perspective, for example, LPG, electric or very high efficiency biomass-burning stoves. This may imply movement from traditional fuel sources to more efficient and modern fuels and falls under SDG 7.

A study by finds that clean cook stove can offset 7.5 tons of CO_2 equivalent and a replacement of three-stone fire with the cook stove will save roughly 440 times more CO_2 equivalent. These findings imply that fuel-efficient cook stoves have the potential to reduce CO_2-equivalent emissions from cooking and health-related challenges, which will go a long way to reduce the about 8% contribution of deforestation to global greenhouse gas emissions (Romm, 2016).

Wood fuel (charcoal and firewood) remains the primary source of fuel for cooking in Ghana. In 2008, an estimated 11.7 million tons of biomass was consumed (MOE, 2010), which constituted 65.5% of the total primary energy consumed in the country. According to GSS, 84.1% of households in Ghana are indicated to have used biomass for cooking purposes with the relative shares of charcoal and firewood being 30.6% and 53.5%, respectively. Considering the urban–rural divide, it is found that urban households rely more on charcoal (52.9%) for their cooking needs.

On the other hand, 80.2% of rural dwellers largely depend on firewood. The use of biomass in its traditional form is found to have very serious health implications, including acute respiratory infections, lung cancer, reduced lung function, carbon monoxide poisoning and immune system impairment which are among the diseases caused by indoor pollution. An estimated 2 million deaths globally are linked to the use of biomass because of indoor pollution, with most of these deaths coming from developing countries (UNDP, 2011). The implication is that there is an urgent need for policy to reorient the pattern of usage of cooking fuels in Ghana, particularly for the rural areas, to curtail the disease burden and the scale of deaths that are or could potentially be arising from this source.

The use of LPG for cooking in Ghana is limited. In all, 9.5% of households use LPG for cooking with about 35% of these concentrated in Accra and nearly 13% in other urban centers. LPG is practically not used for cooking in the rural areas given that only 1.5% of



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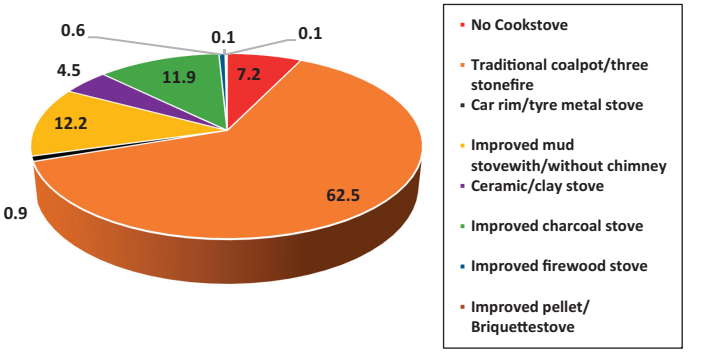

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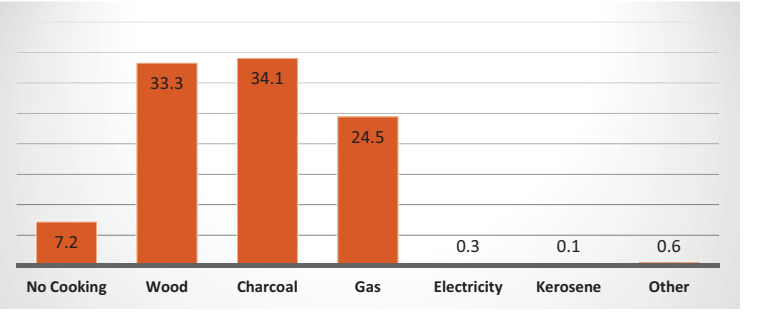


(c)

Sources: (a) Author's computation based on data from World Development Indicators (2018); (b) and (c) GLSS 7-Ghana Statistical Service (2019)
Notes: (a) Access to clean fuels and technologies for cooking (% of population); (b) distribution of type of biomass cookstoves; (c) sources of fuel for cooking in Ghana

Figure 5.
Sources of fuel for cooking in Ghana

households in the rural areas make use of this variety of energy for cooking. Kerosene and electricity play an insignificant role in cooking. In rural areas, 2% of households also rely on crop residue as their cooking energy source.

According to the Ghana Living Standard Survey (2014), households which own stoves increased from 7% in 1998 to 10% in 2013 in rural areas. This calls for more education and policy direction to encourage the adoption of clean cooking technologies in rural areas. At the national level, the GLSS (2014) noted that 41.3% of households use wood, 31.5% use charcoal, while 22.3% use natural gas. Thus, efforts should be directed at efficient stoves to ensure efficient utilization of fuels through the use of improved cook stoves.

A wide variety of resources are being used as fuel for cooking. These include fuel wood, kerosene, LPG, electricity, biogas, biomass and solar energy. According to Figure 6, Ghana's access to improved cook stoves increase from 6% in 2000 to 20.8% in 2014. This is on the back of a national target to have universal access by 2015. Firewood and charcoal remain the primary and main source of energy for cooking in rural communities and some peri-urban towns (Broni-Bediako and Amorin, 2018). Apart from the health and environmentally related challenges, Ghana is a signatory to the COP21 to reduce carbon emission and has a mandate under both the Millennium Development Goals (MDGs) and the SDGs to promote good health, especially well-being of women. Ghana, therefore, needs to adopt practical measures to enhance clean technology for cooking.

According to Figure 6, SSA recorded a lower access rate of 12.9% as of 2014. Because of its importance, Goal 7 of the SDGs lay strong emphasis on clean cooking fuels and technologies. This is because there is an empirical evidence that suggests that access to clean cooking fuels and technologies can boost the health of people, save time, especially for women, and reduce poverty. Women generally play the major role in biomass-based energy cooking systems, especially in countries like Ghana where fuel wood is the major source of

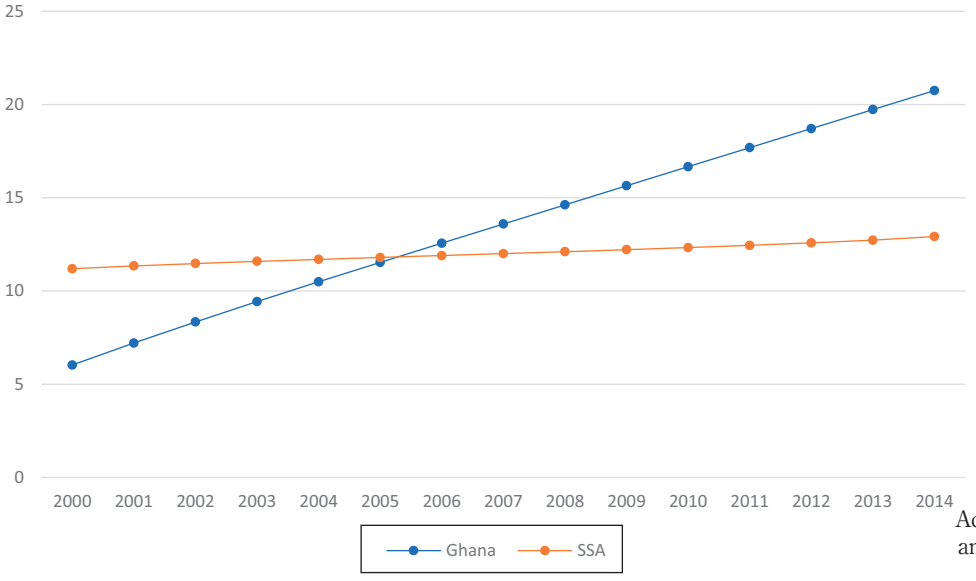


Figure 6.
Access to clean fuels and technologies for cooking (% of population)

Source: Authors illustration based on data from the World Development Indicators (2018)

fuel. Women and children suffer the greatest share of the health burden, as well as the time losses and physical impacts of fuel collection, processing and transportation. As in 2018, access to electricity is 85% according to the Ministry of Energy.

Apart from health and discomforts, inefficient cooking methods have also contributed to deforestation in Ghana. It is not surprising that in 1900, Ghana had 8.2 million hectares of forest which has been reduced to 1.2 million as of 2008 because of charcoal production, settlements and unproductive farming activities. Estimates available at Ghana Forestry Commission indicate that deforestation stands 2% annually. These statistics were affirmed by the Ghana Standard Living Survey (2008), which revealed that as of 2005, 80% of rural households and 53% of urban households use wood fuel for cooking (Figure 7).

In rural areas, households which own stoves increased from 7% in 1998 to 10% in 2013. This calls for more education and policy direction to encourage the adoption of clean cooking technologies in rural areas. In response to this trend, the Rural LPG Promotion Programme was first launched at Garu-Tempane in the Upper East Region in November 2013, where 1,500 pieces of 6 kg cylinders and cook stoves were distributed on pilot basis. The roll-out of the programme was started in 2014 with the distribution of cylinders and cook stoves in Tano South, Ajumako-Enyan-Essiam, Tolon and Central Gonja districts. In all, 14,500 pieces of 6 kg cylinders, cook stoves and related accessories have been distributed in five low access districts so far. However, without proper planning, sustainable financing sources and proper data to implement this policy, the national targets have not been met (Figure 8).

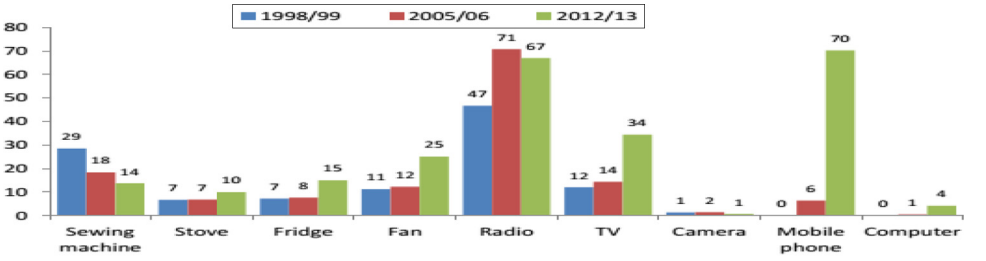


Figure 7.
Clean cooking stove ownership in rural Ghana

Source: Ghana Living Standard Survey (2014)

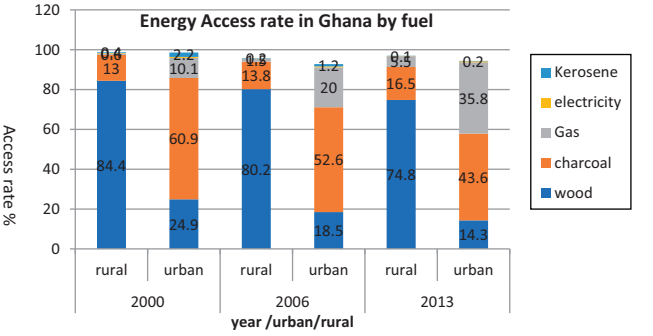


Figure 8.
Energy access rate in Ghana

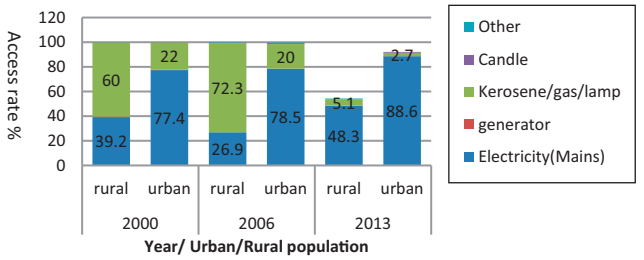
Source: Ghana Living Standard Survey (2014)

Poor communities and nations are affected far more severely and directly by energy poverty than developed countries. The most vulnerable are poor rural communities which spend the most significant percentage of income on energy. To make matters worse, the continuous rise in oil prices coupled with the sharp decline in foreign exchange earnings are also crucial processes influencing the energy sector in Africa. These increases result in great community hardship, while on the other hand, these steer development decisions towards investing in renewable energy technologies (Kammen and Kirubi, 2008). Again, breaking up monopolistic institutions by liberalizing generation and distribution sectors provides an opportunity for implementing new approaches to rural electrification. Governments' ability to make available right incentives and institutional framework paves the way for a new set of players to emerge and dominate reformed rural electricity markets in the near future. Some of these players include cooperatives, non-governmental organizations, private entrepreneurs and communities (Karekezi, 2002). Through the adoption of technological and institutional leapfrogging, Africa stands a chance to gain significantly by merging sector initiatives with experience and lessons from South Asia and Latin America. The regions with their remarkable current strides to nurse and harvest rural electricity markets will stimulate and encourage private investment. Some important regulatory tools to address energy poverty include licensing, standards and guidelines, tariffs, transmission charges, metering and performance-based contracting for all energy services (Kammen and Kirubi, 2008) (Figure 9).

Recorded as the region with the highest levels of population in poverty, SSA also has the least access to modern commercial energy. For centuries, SSA has lagged behind not only in gross domestic product per capita but also in access to electricity globally. Electricity consumption levels are strikingly as low as 126 kWh per capita or 150 times in the levels in industrialized countries (World Bank, 2001).

3.3 Discussion and implications of the study

This section of the paper discusses the policy and theoretical implications of the study. Energy is an essential input for economic development of any country. Consequently, low access to clean energy hinders economic growth and, therefore, requires special attention (Bhattacharyya, 2011). Energy is a derived demand and the ability to use any form of modern energy depends on the affordability of energy-using appliance and the ability to pay for the fuel on a regular basis (Bhattacharyya, 2011). The most commonly cited figure on energy access is that there are about 2.7 billion people without adequate access to clean cooking energy and about 1.3 billion people are without access to electricity (UNDP, 2011). In SSA, about 587 million people do not have access to electricity (WEO, 2009). SSA's energy



Source: Ghana Living Standard Survey (2014)

Figure 9.
Energy access by source of lighting

access situation is far worse in terms of rate of electricity access, and of the ten least electrified countries in the world, nine are from SSA (Bhattacharyya, 2011). Also, about 2.39 billion people use biomass for cooking and heating purposes in the aforementioned countries. Many health effects are attributed to the household usage of solid fuels: infectious respiratory diseases, chronic respiratory diseases, premature deaths and blindness, asthma, heart disease, etc. About 1.5 million premature deaths that occur are directly linked to indoor air pollution in developing countries (WEO, 2006). Women and children are more exposed to such conditions and are vulnerable (Bhattacharyya, 2011).

Energy access estimates are difficult to establish because of the imprecise definition of the term "access" and lack of good quality data arising from poor understanding of the traditional energy use because of dispersed and distributed nature of energy and focus on supply of commercial energies in the national energy balances and less focus on where it is used and by whom (Bhattacharyya, 2011). More importantly, a forecast by IEA suggest that unless policies are implemented to address the access issue, the number of people without access will not decline in the 2030 horizon (Bhattacharyya, 2011). About 650 million people in SSA will live without electricity access until 2030 and about 620 million will still use biomass for cooking in the 2030 horizon (Bhattacharyya, 2011). It is, therefore, important to examine Ghana's energy access journey and policy implications and implementations strategies that Ghana is adopting in addressing the SSA energy access problem.

Although a wide range of options are adopted to help address the energy access problem, the existing policies rely on the government to provide access by subsidizing supply to consumers such as kerosene for lighting and cooking purposes, LPG for cooking purposes and electricity (Bhattacharyya, 2011). To resolve the energy access problem, rural electrification initiatives need to be analysed considering other factors: as electrification has a less chance of succeeding in cost competitiveness, quality of supply and initial investments compared with other fuels. Meanwhile, electricity alone cannot resolve the problem of energy access in the rural areas, as other fuels would be used by the poor to meet cooking demands. It appears that policymakers tend to ignore or forget this simple truth or maybe because of better prestige and visibility of electrification projects (Bhattacharyya, 2011), more effects are placed on electrification projects instead of a combination of the extension of other energy sources such as LPG and kerosene access.

3.3.1 Policy lessons from Senegal. Bensch and Peters (2013) posit that there are two approaches that can reduce households' charcoal consumption and the rate of deforestation. These are switching to non-wood fuels such as LPG and kerosene or the usage of improved cook stoves. These are efficient and, hence, use less fuel to achieve the same purpose. In Senegal, both demand-side strategies were explored and experimented. Indeed, a National LPG subsidy and promotion programmes have existed since the 1970s. Therefore, Senegal's LPG consumption per capita is among the highest in West Africa. Nevertheless, most households have continued to use charcoal, at least as a complementary fuel.

According to Schlag and Zuzarte (2008), Senegal initiated the butanization programme in the early 1970s, to introduce LPG in place of traditional biomass fuels, because of high deforestation rate. The programme proceeded by introducing import subsidies for improved cook stoves and required cookware, and the Blip Banekh, an LPG-compatible stove. This did not achieve the expected results. The programme was re-examined, and in 1976, the Senegal Government opted for the implementation of a direct fuel subsidy on 2.75 kg (and later 6 kg) LPG fuel cylinders, funded by taxes on other petroleum products. Annual growth in consumption during this period was between 10% and 12%. In 1998, the government began to reduce the subsidy by 20% per year with the goal of eliminating it altogether by 2002. Since then, the subsidy's elimination consumption of LPG in Senegal has continued to

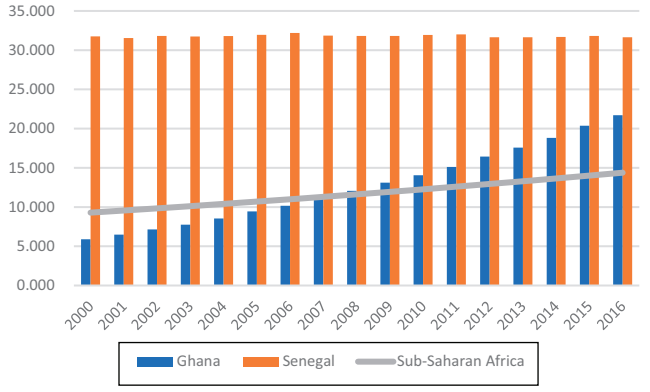
expand, though at a slower pace (by 2005 annual consumption was 140,000 tons). The programme also incentivized the private sector to invest. Because of competition between entities in the private sector, LPG prices remain affordable for most households, and it is now the primary cooking fuel in 71% of urban households. In the capital city of Dakar, over 90% of households use LPG for cooking (Sokona *et al.*, 2003).

Figure 10 shows the access to improved cooking technologies in Ghana, Senegal and SSA. Though Senegal's access rate has been more than 31% between 2000 and 2016, growth has remained stagnant. Ghana's access increased from 5.9% in 2000 to 21.7% in 2016.The Sub-Saharan average was 9.3% in 2000 and 14.4% in 2016.

On the positive side, by offering discounts on smaller units of fuel, the government hoped to provide an adequate incentive to encourage fuel switching. The success of Senegal's fuel subsidy can hardly be overstated: annual domestic consumption of LPG rose from 3,000 tons in 1974 to 100,000 tons in 2000, almost all of which is sold in the smaller cylinders designed for household use. In addition, the implementation of the programme was punctuated by periodic reviews.

However, Diouf and Miezan (2019) found that the programme was ill-devised and was compounded by the structural poverty in rural areas, hence the low penetration in those areas. Indeed, the Senegalese Government's biogas programme that had aimed at installing 8,000 digesters between 2009 and 2013 failed to reach its goals, as less than 600 units were built.

3.3.2 Theoretical implications of the study. Theoretically, this paper establishes that energy access should not focus on the extension of electricity alone to households as Bhattacharyya (2011) noted. Energy access should consider the inclusion of a variety of energies and distribution appliances, including electricity and other modern forms of energy such as LPG. Policymakers in SSA should consider a holistic approach that places the issue of energy access in its proper context of income generation, monetization and provision of affordable supply. Thus, each SSA will have to search for their energy access solutions using a multi-dimensional approach and bottom-up policy by creating opportunities for higher income generation for the affordability of commercial energies; development of local energy markets considering specific local energy situation (resources, needs, capacities, strengths and constraints) and adopting supply mechanisms and organizational structures to cater for local needs. Additionally, policymakers should ensure market interventions of



Source: WD (2020)

Figure 10.
Access to clean fuels and technologies for cooking

financial viability of energy supply as well as ensure community participation in the decision-making and policy implementation process.

4. Review of strategies for providing energy access in Ghana

This section of the paper attempts an evaluation of the various strategies adopted in Ghana in an attempt to promote access to modern energies. The review is generally centered on the economic, social and technical viability of such schemes. Nonetheless, the prime focus would be to assess the extent to which such schemes meet energy need requirements of the poor in Ghana. According to Bhattacharyya (2006), for any commercial energy to penetrate the energy demand of the poor successfully, they would have to satisfy some economic factors:

- First, they would have to be suitable and flexible in meeting the energy requirements of the poor.
- Second, they need to have some competitive advantage over traditional energies in terms of the burden of cost and financial requirements.
- Finally, the adoption of such energies should result in a stream of financial flows to the poor for their use to be sustainable.

This paper would, therefore, be guided by such indicators and the analysis of the various strategies. Since pre-independence, efforts geared towards increasing energy access in Ghana have been paramount to all decision-makers and governments. After the Electricity Supply Ordinance of 1920, the power sector has seen some vital policy interventions undertaken over the course of these years including the following.

4.1 The Volta River Scheme

Before the late 1990s, the energy sector in Ghana operated a vertical monopoly system with the Volta River Authority in-charged of generating and transmitting electricity to every part of the country (Kumi, 2017). Indeed, the first energy policy prepared to promote energy access in Ghana was the Volta River Scheme originated as far as early independence. It was Ghana's first President who initiated the Volta River Project and saw to its completion (Botchway, 2000). The scheme had two grand ambitions:

(1) a fully integrated and nationally owned aluminum industry processing Ghana's own bauxite with Ghana's own power and Ghana's own labour into a full range of finished aluminum products; and

(2) abundant and cheap power, which would in turn make possible the modernization through industrialization of the Ghanaian society.

The programme successfully paved the way for the utilization of resources and provided power for Valco and other parts of Ghana.

4.2 The Rural Electrification Programme (1972)

The Rural Electrification Programme (1972) was developed after the Volta River Scheme. This ambitious programme had the objective of increasing electricity access for the rural population (Botchway, 2000). Rural electrification and its attendant benefits have been found to be considerably responsible for rural development (GoG/NDPC, 2006; Wolfgang, 1978).

4.3 National Electrification Scheme

Under the Rawlings regime in 1989, Ghana launched a National Electrification Scheme (NES) in 1987 to extend electricity to every nook and cranny of the country by the year 2020 (National Development Planning Commission, 1997). The NES was in two folds: the DCEP and the Self-Help Electrification Programme (SHEP). DCEP was to electrify the then 110 district capitals, while the SHEP targeted communities within 20 km of the national grid. The objective of NES was to increase electricity access to all communities with a population above 500 by the year 2020 (EC, 2005). To connect all communities with a population above 500 in 1989 to the national grid, there were 4,221 communities in Ghana that had a population higher than 500 of which only 478 had access to electricity supply. The Master Plan outlined six five-year implementation phases (1990–2020) – 30 years. In 1989, the Government of Ghana (GoG) endorsed the NES with the overall goal of achieving universal access by 2020. Challenges envisaged within this programme included: low density of potential consumers of rural areas; low income levels in rural communities; significant distances required for medium-voltage lines; the costs of medium-voltage; and low-voltage lines, transformers and service drops (Brew-Hammond, 2009).

On the positive side, Ghana's energy access drive has been well coordinated and aggressively implemented. On the other hand, the access programme was highly dependent on donor support. Hence, when this assistance became less consistent, access rate was affected. In addition, the country was slow in adopting strategies to connect Island and geographically dispersed rural areas. Further, there were minimal incentives for private sector participation. Finally, there were no policy correlation between electrification access rate and access to improved cook stoves.

4.4 Self-Help Electrification Programme

Under the SHEP, communities that are 20 km from the national grid can bring forward their electrification projects provided they procure all the low voltage poles required for the low voltage network and have a minimum of 30% of the houses within the community wired. Since the inception of the NES, all the then 110 district capitals have been connected to the national grid system. From 1990 to date, 2,450 towns have been electrified, and more than 2,000 of these were connected through SHEP (Figure 11).

This is a GOG complementary programme to speed up the process by electrifying towns and villages which were prepared to help themselves (Table 1).

4.5 National LPG Programme

In 1990, the GoG launched a National LPG Programme under which the Tema Oil Refinery was to be modernized and a massive LPG campaign implemented. This offered the opportunity to promote LPG as an alternative energy to charcoal and fuel wood. The promotion targeted urban households, public institutions requiring mass catering facilities and the informal commercial sector including small-scale food sellers (UNDP-Ghana, 2004). To enhance LPG access in rural areas, financial incentives were provided through the Unified Petroleum Price Fund scheme to motivate transporters who traveled to rural locations outside a radius of 200 km from the LPG production center in the coastal area of Ghana (Asante *et al.*, 2018; Ahunu and Ackah, 2017). However, the expected results was not achieved, as of the 6% of households in 2004 and about 9% in 2005 using LPG as their primary source of fuel for cooking, 70% lived in the largest cities of Ghana – Greater Accra and Ashanti regions (Kemausuor *et al.* and Duker, 2011).

4.6 Strategic National Energy Plan

The Strategic National Energy Plan (SNEP) was completed by the EC in 2006. The SNEP is a comprehensive way of looking at the available energy resources of the country and how to tap them economically and timely to ensure a secured and adequate energy supply for sustainable economic growth by 2020 (EC, 2006). Thus, the goal of SNEP is to contribute to the development of a sound energy market that would provide sufficient, viable and efficient energy services for Ghana's economic development through the formulation of a comprehensive plan that will identify the optimal path for the development, utilization and efficient management of energy resources available to the country. Unfortunately, SNEP was not adopted formally by the government, and one of the challenges for the energy sector today is how to redress this situation and make SNEP a binding policy document (Brew-Hammond, 2009).

4.7 Ghana Energy Development and Access Project

Ghana Energy Development and Access Project (GEDAP) was approved by the World Bank Board on July 26, 2007, with an original closing date of November 30, 2012. The total project

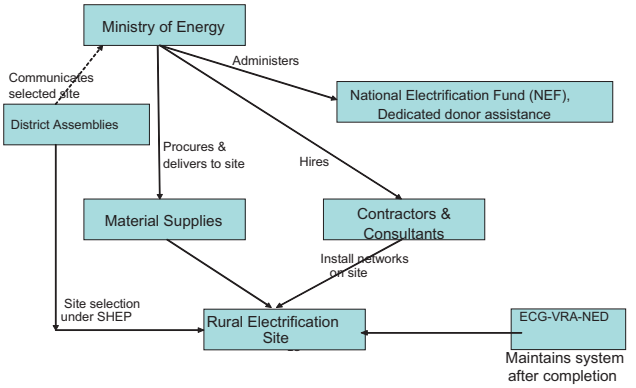


Figure 11. Implementation of rural electrification

Source: Authors' illustration based on the rural electrification framework, Ministry of Energy, (2017)

Table 1. Government of Ghana complementary programme

Project phase	Years	No. of towns electrified
Completed projects		
SHEP 1	1990–1992	50
SHEP 2	1993–1995	250
SHEP 3-Phase 1	1996–1998	280
SHEP 3-Phase 2	1998–2000	494
SHEP 3-Phase 3	2000–2002	700
SHEP 4-Phase 1	2002–2004	193
SHEP 4-Phase 2	2006	226
SHEP 4-Phase 3	2007	229
SHEP 4-Phase 4	2008	269
SHEP	2009	146

Source: MoE (2011).

costs at appraisal were estimated at US$210.6m, of which IDA financed US$90m and the Global Environment Facility US$5.5m. Other financiers include the African Development Bank, the Africa Catalytic Growth Fund, the State Secretariat for Economic Affairs (SECO, Switzerland), GoG and Electricity Company of Ghana (ECG). Following the contributions of the Global Partnership on Output-based Aid, total financing for GEDAP increased to US $227.5m (World Bank, 2015).

The programme has three targets: the sectors institutional performance and suitability, the improvement of electricity distribution and increase in the share of electricity from renewable sources.

4.7.1 Electricity distribution improvement. This component has been completed. It helped to upgrade the ECG distribution system, reduce technical energy losses on the network and improve the quality of supply to consumers. A 2012 loss reduction study estimated these to be about 11%, which is considered to be reasonable and which could not have been achieved without the interventions under the original project scope. As a result, overall system losses were brought down from 26% in 2007 to around 22% in 2012.

4.7.2 Electricity access and renewable development. Implementation of activities under this component is proceeding well. ECG and Northern Electricity Department have connected over 150,000 households to their distribution networks. In addition, solar photovoltaic (PV) systems were provided to 17,000 remote rural households who have little prospect of getting grid supply in the near term. This programme demonstrated a successful business model involving the participation of small rural credit agencies for distributing PV systems to remote rural communities where the grid is not expected to reach. One activity that is still under implementation is the construction of pilot mini- and micro-grids in inaccessible areas in and around Lake Volta (Ackah *et al.*, 2020).

4.7.3 Institutional performance and suitability. Reaching agreement on this contract has proven to be slower than anticipated because of the ongoing reforms of the Ghanaian power market. In recent years, the ECG has been unable to meet its obligations under the Project Agreement with IDA related to financial performance ratios. This is largely a result of unsatisfactory revenue collection combined with the accumulation of customer arrears from public sector institutions and state-owned enterprises (World Bank project paper on GEDAP, 2015).

The GEDAP programme has seen a great success despite current financial and technical challenges in the power sector that it largely sought to address. The second compact of the GEDAP programme is currently going on and its efforts of integrating solar power and other renewables into the grid will yield high results as energy access and energy security will increase.

4.8 Solar Rooftop Project (2016)

The Ministry of Power, through the EC, started implementing a Rooftop Solar PV Programme in the country in fulfillment of the President's Rooftop Solar PV initiative announced in 2015. As a part of the preparatory activities, the EC has implemented some pilot projects to ascertain the technical feasibility and viability of the initiative (EC, 2015). The primary objective of the programme is to provide 200 MW peak load relief on the national grid through solar PV technology in the medium term. The first phase of the national solar rooftop programme has come to an end with a high number of people patronizing. The first phase is largely successful.

4.9 Sustainable Energy for All

Achieving Sustainable Energy for All (SE4ALL) is essential to reaching the MDGs while growing our economies and safeguarding the environment. At a time when 1.3

billion people worldwide lack access to electricity, when 2.7 billion people do not have clean and safe cooking facilities and when a shift to sustainable energy use is imperative to protect the Earth's climate, the UN Secretary-General has launched a global initiative to achieve *Sustainable Energy for All*. The initiative aims to bring together the three pillars of sustainable development: economic, social and environmental to ensure stakeholders take concrete actions towards achieving the following three critical objectives by 2030:

(1) ensuring *universal access* to modern energy services;

(2) doubling the global rate of improvement in *energy efficiency*; and

(3) doubling the share of *renewable energy* in the global energy mix.

5. Conclusion

Lack of access to modern energies is to a reasonable extent both a cause and consequence of underdevelopment. The 60% to 70% of Ghanaians residing in the rural communities continue to be the worse victims of this complex interrelationship. This paper presented a review of the various strategies being implemented in an attempt to establish a foothold on the problem of affording the poor with clean and affordable energies. The paper offers useful policy lessons from Senegal. Our study is consistent with recent studies conducted by Sakah *et al.* (2017) and Atuguba and Tuokuu (2020) that although Ghana has a myriad of policies and guidelines to develop the energy sector, particularly renewable energy, the problem has always been how to effectively implement them.

Following the discussions in the section above, it is established that not a single strategy would fully satisfy the modern energy requirements of the poor and that innovation and diverse complementation of various programmes must be exacted in finding a workable solution to the energy access problems of the poor. It is also established that the most fundamental challenge in accessing modern energies remains the precarious economic conditions of the poor, and any semblance of an impeccable policy design must be mutually coupled with innovative financing and productive economic activities. Additionally, the distinct technical features of the varying technologies and resource endowments must be effectively captured in the crucial attempt to minimize cost. Consequently, we suggest the under-listed policy adjustments:

- As different communities in Ghana have different resource endowments, such as wind in the coastal areas, solar in the savannah regions and small hydro-resources in the middle belt, the selective and judicious adoption of these unique features particularly in faraway rural communities would be most suitable.
- LPG is not presently a viable and affordable option in the promotion of fuel switching of the rural-poor and so policy should instead focus on improved cook stoves as a more pragmatic strategy. The government should adopt a medium-term strategy that incentivizes the private sector to invest in improved cooking distribution in rural areas.
- Local community participation must be seen as an inexorably linked component of the energy planning process. Not only would this help in sustaining energy programmes but also would help a great deal in ensuring the penetration of technologies that otherwise faces acceptability problems like biogas. Vast amount of waste is generated in Ghana and there is no reason why they cannot be harnessed to remedy the energy access problems.

- Above all, energy access initiatives should be necessarily integrated with productive uses of energy, especially in rural areas with enterprise-based approaches as the underlying anchor.
- Finally, social interventions of the government such as the Livelihood Empowerment against Poverty should be linked to strategies that can improve energy access.

Notes

1. The analysis here is arrived at by comparing the values for the year 2000 with those of 2009 as found in the world energy outlook for 2002 and 2011.
2. These countries include: Nigeria, India, Indonesia, Pakistan, Bangladesh, Ethiopia, Kenya and Tanzania.
3. See Figures 1, 2 and 3 for details.
4. Note that the rural–urban access disparities at the regional and national levels are in most cases wider than what is reported here as the average here refers only to the global scale.
5. Ghana Statistical Service (GSS), Ghana Health Service (GHS) and ICF 2018. *Ghana Maternal Health Survey 2017*. Accra, Ghana: GSS, GHS and ICF.

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