

A Review of a Bioenergy Policy Implementation in Sub-Saharan Africa: Opportunities and Challenges- A Case of Nigeria, Ghana and Malawi

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Abstract—In response to the global recognition of bioenergy as a significant source of renewable energy necessary for mitigating the global environmental challenge, the Governments of various African countries are starting to develop their economic and energy policies towards the adoption, development, production, and utilization of biomass for production of biofuel in some African communities. Although, Government's role and policy have been identified as key factors for effective adoption of biomass energy, the implementation, its production, and utilization is not yet at fully blown stage in most countries of sub-Saharan African. Despite the challenges of non-competitive price of biofuel with fossil fuel and threat of electronic vehicle induced biofuel demand decrease, biofuel has potentials for alternative uses worthy of consideration in African countries. This paper reviews the current developments in adopting biofuel production and utilization in some sub-Saharan African countries, identifying the causes of being at the early stage, despite the enormous potential. This paper also recommends a strategy for achieving a relatively rapid outcome in bioenergy policy implementation in sub-Saharan African.

Keywords— Bioenergy, biodiesel, biofuel, biomass, policy, Sub-Saharan African

1 INTRODUCTION

The environmental degradation global warming challenges have been attributed to over-dependence on fossil fuel and carbon emission (Atabani et al., 2013). Hence, as part of the global responsibility of safeguarding the earth and in consistence with the Kyoto protocol agreed by the United Nations, governments around the world have developed biofuel policies. African countries have also been co-signatories to the agreement of the Kyoto protocol pertaining to the global reduction of carbon emissions which was put in place to address the challenge of global warming (Mitchell, 2011). The developing countries were implored to adopt policies that promote greener growth as a means of reducing environmental carbon burden, in an attempt to increase energy security, increase rural development and decrease CO₂ emissions (Sielhorst et al, 2008. Biofuel refers to fuel made from biomass which are used for automotive, thermal and power generation purposes (such as bio-oil, biogas, biodiesel, bio-ethanol) while the biofuel policy is an expression of the political will, regulation and legislation of Government on the adoption of biofuel, usually sought after by local or foreign investors (Ohimain, 2013).

2 GLOBAL TRENDS OF BIOFUEL MARKET: THE ROLE OF AFRICA IN CURRENT GLOBAL BIOFUEL PRODUCTION

World biofuel production has been forecast to reach 42.6 billion gallons by 2025, with ethanol accounting for approximately three-quarters of the output. U.S, ethanol production was at an average output of 935,000 bpd in 2014 while biodiesel production was estimated at 83,000 bpd in 2014. The US biodiesel production forecast for 2015 and 2016 was put at 82,000 bpd and 84,000 bpd respectively (Biofuel International, 2015) while the production was targeted at 132.6 billion litres of ethanol in 2017.

However, the African continent has been lagging behind compared to other continents in biofuel production despite the high potential to be a bio-energy major supplier. Africa accounted for less than 0.05% of global biofuel production in 2013, and none of the African countries was found among the ten top producers even in 2017. The exportation of ethanol from Africa to the European Union, which has been mainly from Egypt, Sudan, Mauritius, and Zimbabwe, have been only in relatively meager quantities like 3,423 tonnes between 2009-2011, while Brazil's production was 138,209 tonnes (PANGAEA, 2014) and 4.3 billion litres second to US in ethanol production.

3 BIOFUEL PRODUCTION SITUATION REPORTS IN SOME AFRICAN COUNTRIES

Table 1 shows bioenergy policies in Nigeria, Ghana, and Malawi. The Nigerian draft biofuel policy was later reviewed in 2010. It has been noted that current National African policies are not uniform. A recent report (PANGAEA, 2015) indicated that only nine countries (Mali, Nigeria, Senegal, Tanzania, Ethiopia, Angola, Mozambique, South Africa, and Swaziland) had implemented a specific biofuels policy. Additional fourteen more countries (Burkina Faso, Cote d'Ivoire, Ghana, Guinea-Bissau, Senegal, Sierra Leone, Democratic Republic of Congo, Equatorial Guinea, Kenya, Rwanda, Madagascar, Mauritius, Zambia, and Botswana) are currently developing biofuel policies, and they are yet to embark on implementation (PANGAEA, 2015). The remaining countries, constituting about 50%, either include bioenergy as a part of their energy policies or do not have any significant biofuel policy (PANGAEA, 2015). Africa to the European Union, which has been mainly from Egypt, Sudan, Mauritius, and Zimbabwe, have been only in relatively meager quantities like 3,423 tonnes between 2009-2011 compared to Brazil's 138,209 tonnes production (PANGAEA, 2014).

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Table 1. Bioenergy policies in some sub-Saharan African countries

Country	Year of drafting	Name given to policy	Policy drafted by	Name of Reviewed policy	Proposed Biomass	Types of incentives
Nigeria	2007	Official gazette of the Nigerian Biofuel policy and Incentives	NNPC	Official gazette of the Nigerian Biofuel policy and Incentives, 2010	Millet, sorghum, sugar, and Jatropha	Tax holiday, withholding tax on interest,
Ghana	2005	Strategic National Energy Plan	Energy Commission	Draft Bioenergy Policy of Ghana, 2010	Jatropha	
Malawi	2009	Malawi Biofuel Draft Position Paper	Biofuel Advisory Council & Biofuels Association of Malawi	-	Jatropha, sorghum, sugarcane	
	2003	National Energy Policy				



Fig. 1: Map of Sub-Saharan African Countries showing the Current Status of National Biofuels Policy (PANGEA, 2015).

3.1 BIOFUEL PRODUCTION AND POLICY IMPLEMENTATION IN NIGERIA

Even though Nigeria is one of the world producers of crude oil, petroleum products are still imported today because there is a shortage in the supply of fuel from the local refineries, the shortage in the supplies is being catered for by importation. Presently, Nigeria is still at the seeding stage of bio-fuel production. The blending of petroleum fuel is still largely based on importation. Recent reports claim that only imported fuel is blended (Bamikole, 2012), petroleum-based fuel produced in the Kaduna and Port-Harcourt government-owned refineries in Nigeria were not largely blended. Although the government mainly operates petroleum refineries, some private firms had obtained approval for production operations.

The Federal Government responded positively to the environmental responsibility by formulating the biofuel policy in 2007 (NNPC, 2007). The biofuel policy was formulated to promote the adoption, production, and utilization of biofuel in Nigeria and attract investors by promoting various incentives like tax holiday. The NNPC formulated biofuel policy was later reviewed after three years by stakeholders (PPRA, 2010). The programme for developing the biofuel industry in Nigeria was divided into two non-distinct phases. The first phase being the seeding phase involves the

importation of bioethanol and biodiesel with Premium Motor Spirit (PMS) and Automotive Gas Oil (AGO) in ratios of up to 10% and 20%, respectively (i.e., E10 and B20). The second phase includes local production of biofuel, feedstock and biofuel plants. The biofuels industry is to enjoy a pioneer status while the driver of the biofuel policy is the Ministry of Petroleum Resources (PPRA, 2010; Abila, 2012). However, since biofuel is a non-petroleum based fuel and a renewable energy resource, which is often wrongly perceived as challenging the petroleum industry, a conflict of interest in advancing the development of biofuel within the Ministry of petroleum may exist. The Nigerian National Petroleum Corporation (NNPC), endorsed the first biofuel refinery in Nigeria, hoping that the project would create employment for about 58,000 (Ogbuanu, 2008). The first bioethanol plant using cassava as a feedstock was commissioned in Nigeria in the year 2014, Allied Atlantic Distilleries Ltd (Vanguard, 2014) in the Ogun State of Nigeria.

Implementation of the biofuel policy is not very noticeable in the Nigerian society since the petrol that was produced in Warri, Kaduna and PortHarcourt was reportedly unblended with ethanol (Bamikole, 2012) though the petrol being imported into Nigeria were blended. The forecast year 2015 for full biofuel policy implementation has not witnessed the expected development in biofuel adoption. Charting the future of biofuel policy implementation in Nigeria will be influenced by the socio-political and economic trends. The effect of the current withdrawal of major crude oil buyers from the international oil deal with Nigeria and economic downturn may weaken the political will of the government towards biofuel policy implementation. The recent change in the political climate is another factor that may affect the biofuel policy implementation in Nigeria as there may be a change in the interest of the administration towards the biofuel industry. The recent security challenges of Boko haram insurgencies and herdsmen issues may be sources of distraction to both the feedstock farmers and Government on the implementation of biofuel policy. Presently, the biofuel policy which is based on the blending of biofuel with petroleum is still in the early stage with the supplies of biofuel for blending expected from importations.

3.2 BIOFUEL PRODUCTION AND POLICY IMPLEMENTATION IN GHANA

The policy objectives of Ghanaian Government on biofuel development programme also include the substitution of the national petroleum fuels consumption with biofuel by 10% by 2020 and 20% by 2030. Some of the feedstock recommended for biofuel production includes the seaweed. Some Ghanaian tertiary institutions were enlisted in the algae biofuel project (Sapp, 2015) to gain better access to biomass resources through research (Antwi-Bediako, 2012). The Ghanaian Renewable Energy Act 832 became binding in 2011. However, there was a need to regulate the indiscriminate land grabbing and conflict which occurred as a fall out of the enactment (Antwi-Bediako, 2012).

Biofuel adoption in Ghana is not yet at an advanced stage because the food-fuel issues are still significant. Consequently, efforts of researchers are being directed towards food production by encouraging biotechnology-enhanced food production. Ghanaian scientists and farmers have agreed on the country's need to harness the benefits of biotechnology food production in the country (Biofuels International, 2015). Land use issues are also paramount. There had been a massive land acquisition for biofuel feedstock cultivation by smallholders, out-growers, and large industrial farms for national and international consumption. The pressures had been on land as a result of large-scale biofuel feeds (jatropha, palm and soya bean) production which has attracted international interest because of the favourable climate that suits agriculture. Research indicated that as of 2009, around 452,000 hectares had been claimed by investors in three approved projects. Issues of land grabbing and protests by landowners have led to the formulation of policies to regulate land acquisitions for biofuel investments in Ghana. The Government of Ghana needs to develop a policy to govern commercial land acquisition. The Ministry of Agriculture charged the Energy Commission with drafting such legislation. If Ghana can overcome the food/ fuel land usage challenge, the country has a potential of replacing 17.3% of transportation fuels by 2020 and 13.3% by 2030 (Kemausuor, 2013). However, more land will have to be dedicated to energy crops to achieve the supply target. Improving the yield of feedstock and utilization of algae and ligno-cellulosic materials in biofuel production can also enhance the biofuel (Kemausuor, 2013, Iddrisu et al., 2015).

3.3 BIOFUEL PRODUCTION AND POLICY IMPLEMENTATION IN MALAWI

Malawi has been compared to Brazil and Sweden as a pioneer in biofuel production efforts (Stecker, 2013). Malawi has been regarded as the only African country that has fully integrated biofuels into its energy system (ESPA, 2017). Despite the early venture of Malawi into biofuel in Africa, Malawi needs to develop a specific national biofuels policy which will harmonize all policies related to biofuel to effectively govern her biofuel industry. The development of biofuels in Malawi has been hampered by the lack of a specific policy on biofuels.

The current production of ethanol in Malawi is 18 million litres. However, there is a plan to increase it to 49 million litres (Sapp, 2015). Though the national policy has been E20, the government desires to boost E100 supplies for flex-fuel vehicles. A major challenge in Malawi is the need to harmonize the various existing policies including the National Energy Policy (Stecker, 2013). The Government and stakeholders initiated Biofuels Advisory Council and the Biofuels Association of Malawi to develop regulatory biofuel policy which will be needed to promote biofuel production. The amount of ethanol that was blended into petrol was cut by half from 20% to 10% in 2006 when unleaded petrol was introduced into Malawi in 2006, however the policy which stipulates blending has not been well adhered to by buyers due to lack of adequate enforcement by the

regulatory agency, Malawi Energy Regulatory Authority (MERA).

Some of the potential feedstock suggested for biofuel production in Malawi includes sorghum, sugarcane cassava, maize, sunflower, jatropha, soybeans, and cotton. Although, molasses has been used as feedstock, the supply was inadequate in such a way that Ethco, one of the two national ethanol producers had to run the ethanol plant on half capacity due to non-availability of sufficient molasses as feedstock (Sapp, 2015).

4 OPPORTUNITIES FOR BIOFUEL ADOPTION IN SUB-SAHARAN AFRICAN COUNTRIES

Opportunities abound for biofuel adoption in African countries owing to the favorable resources available. One of the main resources is the availability of arable land for cultivation of biofuel feedstock which is supported by the favourable African climate and human resources. Also, there is a ready market to absorb the biofuels to be produced. In Nigeria, for instance, the population of over 150 million people and more than 12 vehicles to 1000 people (Idusuyi et al., 2012) are positive indicators of a ready biofuel market. The adoption of biofuel will boost agro-economic development in Sub-Saharan African countries. In the light of the dawn of electronic vehicles (CAA, 2019), bioenergy has the potentials of being used as alternative fuels in hybrid electronic vehicle which usually have dual function drive systems. Although biofuels has the potentials to replace the fuel for gasoline drive systems of such vehicles, the economical production and sustainability issues need to be considered. Biofuels has great potential to be used also in the household sector as a cooking fuel, but there is a need to work on the competitiveness of the price with existing energy alternatives. Regulating the charcoal sector and providing tax incentives to bioethanol producers and users can be the way forward (ESPA, 2018).

There abounds a variety of potential feedstocks available in Nigeria which are yet to be harnessed. If well-harnessed, Nigeria will be able to sufficiently supply her local community and have excess biofuel for exports leading to the integration of the agricultural and energy sector of the economy. There will be job creation for the teeming youth and farmers. There will also be a reduction in the urban-rural migration, thereby gradually solving the problem of over-population in some African cities.

5 CHALLENGES OF BIOFUEL ADOPTION IN SOME SUB-SAHARAN AFRICAN COUNTRIES

The choice of agricultural products such as cassava, sweet potatoes, maize, palm oil, sugar cane which are a major source of staple food in Nigeria had a retarding effect on the production of biofuel in Nigeria. Moreover, jatropha which is one of gazette feedstock in the Nigerian biofuel policy is not yet fully established. Although efforts were made by the Ministry of Agriculture towards the promotion of cassava plantation for increasing food supplies and reduction/replacement of wheat-based by cassava-based confectioneries

importation as a measure to conserve the nose-diving food reserves. The food-fuel debate has been a major concern especially in some African countries like Nigeria where food insecurity is the main challenge, and over 70% of the populace spends about 80% of their income on food and sustenance (Abila, 2014).

The problem of indiscriminate land grab has been identified as one of the major challenges to the progress of biofuel adoption in Ghana for instance. A level of conflict had occurred between original land-owners and food crop farmers in the local communities whose lands were being taken. There is a need for a clear policy on biofuel crop-land acquisition to safeguards the local community land rights.

Another impediment to the implementation of biofuel policy is lack of development in the agricultural sector. In Nigeria the economy is suffering from over-dependence on the available fossil fuel obtained from the Niger-Delta region to the detriment of developing the non-oil sector/agricultural sector of the economy which is to be the bedrock of feedstock production for biofuel development and utilization. Although, the introduction of electric vehicles has been largely viewed as a threat to future biofuel market demand, there are contrary claims that though electric vehicles are improving on emissions and cost, the improvement was not enough to make driving an electric car the smart choice for consumers, considering time-saving and reduction in environmental impacts (Think Bioenergy , 2018) .

6 A STRATEGY FOR ACHIEVING A RELATIVELY AND RAPID OUTCOME IN BIOFUEL POLICY IMPLEMENTATION

In order to achieve a relatively rapid outcome in bioenergy policy implementation, there is a need to assess the existing working system and identify the major players. The major players have been identified as the Government, investors, farmers, and traditional land-owners, the youth, media researchers and research institutions leaders who are to interact in such a way as to achieve the implementation of the biofuel policy. Establishing a thriving biofuel industry is an all-encompassing endeavor, which demands contributions which cut across different sectors; the Government is to exercise strong political will in driving the biofuel policy implementation, coordination of other stakeholders lie mainly on the government.

Aggressive pursuance of the actualization of biofuel development is needed on the side of the government (Oshewolo, 2012). Continuity of projects should be encouraged by successive governments. A dedicated government agency such as Biofuel Energy Commission is to be put in place to monitor the implementation of the biofuel policy from time to time and carry out the necessary review as implementation progresses. The focus can be shifted from food as biofuel feedstock to turning waste into energy in biofuel policies. The Government also needs to provide enabling and

adequate infrastructures such as power supply, road network and water to boost production of biofuel.

The role of the Federal government is paramount in promoting the market demand for biofuel. The 2007 policy is, however, more on the passive support than on promulgating and legislating, which are actions that are necessary to drive the demand for biofuel. The demand for biofuel has not gathered momentum mainly because of the relatively high price of biodiesel or biofuel compared to fossil fuel, which is a discouragement to would be investors.

Farmers need to know more about the improvement of farming practices to enhance quality and yield. The challenge of food security or competition with food source should be tackled by developing dedicated biofuel plantations from the available lands that have not been put to use in various regions of the country. Farmers should be encouraged to practice modern mechanized agriculture.

Land-owners rights needs are to be accommodated in biofuel policy. Private-public partnership in investment needs to be encouraged towards biofuel production. Youths unemployed are to be sensitized to take up job opportunities inherent in biofuel feedstock production. End users need to be aware of the environmental benefits of using the blended petrol in their vehicles. The media can create awareness to the stakeholder and the entire populace about the environmental benefits and opportunities for the youth.

The researchers should be sensitized towards proactive research for more economical methods and utilization of locally available feedstock for biofuel production, while the government should be ready to facilitate the funding of biofuel research to develop home grown technology to encourage indigenous production of biofuel. Biofuel research groups and centers of excellence should be put in place and equipped for research, training, and re-training.

7 CONCLUSION

Although, the Federal Government has made efforts towards the adoption of biofuel in Nigeria, The projection of nationwide production set at 2015 is not yet realized. There are enormous biofuel investment opportunities in Nigeria. However, the major obstacles to the realization of this biofuel adoption plan and objectives need to be addressed. Strategies for realizing the objectives include operating a stake-holder driven biofuel policy by the government considering food security and electric vehicle issues, media awareness, aggressive will on the side of the government, review of the biofuel policy, reintegration and re-framing of the agricultural sector, petroleum sector, research and technology, trade and industry.

The problems of indiscriminate land grab and food insecurity have been identified as clogs in the wheels of progress for biofuel policy implementation in Ghana and Malawi respectively. The National Governments in

African countries need to promote the biofuel policy in their various countries and formulate regional biofuel policies to drive bio-fuel production in specific African regions. The problem of hunger should be tackled headlong as a pre-requisite for biofuel production to enable reasonable biofuel production success in Africa. The focus can be shifted from food as biofuel feedstock to turning waste into energy in biofuel policies. More attention is to be paid to developing clear sustainable policies that pursue second, third and even fourth generation biofuels. The benefit of biofuels needs to be harnessed without damaging the African means of livelihood and ecosystem.

ACKNOWLEDGEMENT

This work was supported in part by the LOREAL-UNESCO FWIS Postdoctoral Award, 2015. The contributions of The European Conference on Sustainability, Energy & the Environment panelists at Brighton, UK are also acknowledged.

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