

BIOFUEL AND SUSTAINABLE ENERGY IN AFRICA: LEGAL PERSPECTIVE ON THE PROSPECTS AND CHALLENGES

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Abstract: *The global transition to sustainable energy sources has heightened attention on biofuelling as a renewable alternative particularly in Africa. Many African States focus on the efforts to promote biofuel production and sustainable energy in order to alleviate energy deficits within their jurisdictions. Laws, policies and initiatives from various renewable energy laws, African Union Instruments on sustainable energy and policies are set apparatus towards sustainable energy on the continent. However, there are challenges requiring coordinated legal, policy and ecosystem investment efforts. This article examines the intersection of laws, biofuelling and sustainable energy in Africa focusing on international and national regulatory frameworks through a comparative analysis. Doctrinal research methodology is adopted to conduct the research. The article identifies gaps in existing laws and policies, assesses environmental and social implications, and evaluates the economic and technical feasibility on sustainable energy in Africa. The findings from the research underscore the need to harmonise international standards, streamline permitting processes, and enhance environmental safeguards within African States for sustainable energy and environment.*

Keywords: Biofuelling, Sustainable energy, Law, Environmental implications, Renewable Energy.

1. Introduction

The rising impacts of climate change coupled with the volatility of fuel prices has led to a sense of urgency among policymakers and stakeholders around the world to find sustainable and viable energy solutions. Against this backdrop, Ilesanmi (2018) has noted that biofuels have been championed as viable alternative with advocates arguing that biofuels can reduce dependence on costly exports, diversify energy sources and stimulate economic development in Africa and across the world. Legal frameworks have also been developed in various regions of the world to regulate the industry and ensure sustainable and effective adoption (Adewuyi, *et al*, 2020). However, in spite of the benefits of biofuels in addressing climate issues, they pose serious concerns to environmentalists, farmers, rural communities and people battling with food insecurity (Lima, 2009). These concerns are as a result of the numerous impacts and risks that biofuels pose in terms of deforestation, improper land uses, eviction and displacement of smallholder farmers as well as water consumption. Most African States are even more vulnerable to these impacts as they often lack the comprehensive legal provisions and institutional frameworks necessary for effectively navigating biofuel production and utilisation. This current situation therefore calls for States' structured legislation, treaty and policy making capable of addressing the issues associated with the production and use of biofuel in Africa as argued by Ilesanmi (2019).

This study therefore seeks to examine the legal perspectives of biofuelling in Africa with a focus on national and international legal provisions as well as the challenges and opportunities associated with biofuelling in the Continent. The study also undertakes comparative analysis of the frameworks in developed jurisdictions such as the European Union

(EU) and the United States of America (USA) for the purpose of drawing lessons for few selected African States.

The energy landscape in Africa is characterised by chronic shortages, infrastructural deficits and heavy reliance on fossil fuels which also exclude millions of the continent's population from accessing energy which also has negative impacts on the climate (Charamba, Kumba, and Makepa, 2025). This reveals the importance of diversification of energy sources where biofuels can assume primary position. As a result, the biofuel industry in Africa has witnessed significant growth driven by the need for sustainable energy and the availability of abundant renewable resources in the continent. The diverse ecosystems in Africa serve as fertile ground for the production of feedstock needed for biofuels such as biodiesel and bioethanol with countries such as Kenya and South Africa being at the forefront of biofuel policymaking. The industry has been lauded as providing significant economic, social and environmental benefits to African States, while also providing opportunities for local energy self-sufficiency (Fertahi, *et al*, 2025). On the other hand, the predominant method for cultivating biofuel feedstock involves large scale industrial production that has yielded minimal benefits for the rural labour force. The current state of the biofuel market in Africa therefore makes it important to optimise legislative regulation to ensure a balance with the benefits of biofuel adoption and the negative impacts.

Existing research has often focused on the regulation of developed systems such as the EU, while the legal frameworks in less developed systems in Africa are less examined. Furthermore, much of the existing literature focuses on technical feasibility or environmental impacts of the adoption of biofuels with little focus on the role of the law in shaping sustainable energy standards. Also, there remains little comparative analysis of how African standards align with international standards or how they address the critical challenges that may arise from the use of biofuels. This study aims to bridge that gap by juxtaposing selected national and international frameworks and by critically analysing both the law and its practical application in selected African States.

1.1 Explicating the Nuances of Biofuel

There is no unified definition of the term 'biofuel' as the term may be interpreted broadly or narrowly. In a broad sense, the term biofuel is sometimes used to characterise all biological sources of energy including traditional ones such as animal dung and fuel wood. However, in a narrow sense, the term is often used to describe modern liquid fuels which serve as alternatives to fossil fuels. According to (Mahapatra *et al*, 2021), biofuels refer to any fuel derived and produced from organic materials such as plants and agricultural crops and which can be an adequate substitute for fossil fuels. The distinguishing feature of biofuel is that its raw materials are derived from biomass such as agricultural crops and other biodegradable materials.

There are various perspectives by scholars classifying biofuels on the basis of the feedstock used in their production. Based on such classification, biofuels can include solid biofuels, liquid biofuels, and gaseous biofuels. Amigun *et al*, 2011) examined five types of biofuels with the main point of difference being the form of agricultural produce used in their production. These forms include bioethanol, biodiesel, biogas, bioethanol and biohydrogen. The authors however noted that bioethanol and biodiesel are the major forms of biofuel used in most African States.

The benefits of biofuelling have been examined extensively in literature with many scholars attributing the use of biofuels to diversified energy sources, reduced greenhouse gas emissions, (Donald, 2011) infrastructural development (Amigun, *et al*, 2011), and the creation of rural employment, among others.

1.2. Sustainable Energy Framework: International and national policies

The international legal framework for sustainable energy can be found embedded within treaty provisions on the mitigation of climate change (Lima, 2009). International instruments governing sustainable energy include the Rio Declaration, the United Nations Framework Convention on Climate Change, the Paris Agreement and the Sustainable Development Goals (specifically Goal 7: affordable and clean energy). However, these provisions are fragmented across different international treaties and agreements with no clear and succinct international framework thereby limiting the effectiveness of global energy governance (Oniemola and Akinbusoye, 2023).

At the Regional level, the African Union's Agenda 2063 as well as the ECOWAS Renewable Energy Policy aimed at providing access to electricity through renewable sources such as biofuel (Muhammad, Adeyemi, and Jacob, 2024) all foreground issues of sustainable energy albeit without enforceable mechanisms specific to biofuelling (Eze, Ugwu, Moses, and Angus, 2025). At the African's national levels, a few studies have been examined the sustainable energy policies in African countries as noted by Ilesanmi (2023). Thus, (Olujobi *et al*, 2020) in a study on the use of renewable energy in electricity generation in Nigeria found that Nigeria has no coherent legal framework on renewable energy as the existing policies are fragmented, thereby making it difficult to effectively regulate the sector. Scholars' submissions on the state of the law in other African States have also reached similar conclusions with many of them emphasising the need for comprehensive regulatory frameworks (Muok, Kirui, Theuri, and Wakhungu, 2008).

While biofuels present a significant opportunity to facilitate the transition towards a more sustainable energy source on the global scale, their widespread adoption and commercialisation are linked to a complex regulatory landscape that includes municipal laws, treaties policies and guidelines that facilitate and constrain the production and utilisation of biofuels (Bhardwaj, Wankhde, Saini, Osorio-Gonzalez, and Brar, 2024). In many African States, legislation addressing the production and use of biofuels is often fragmented. For instance, Nigeria has the Bio-Fuel Policy and Incentives but multiple studies observe that implementation remains weak, and regulatory clarity is lacking (Onyi-Ogelle, and Ekwunife, 2017). Other studies have also observed that few African States such as Ghana, Senegal and Cape Verde have become pioneers in policymaking that supplements regional efforts in biofuelling, however institutional coordination, inadequate regulatory oversight and an absence of coherent frameworks pose significant obstacles to their effectiveness.

In contrast to the African Union (AU), the EU has established a much more robust framework for biofuelling and sustainable energy in the form of the European Union Energy Directives (RED II, the Revised Renewable Energy Directive 2018/2001). These Directives establish binding targets for renewable transport energy; impose sustainability criteria for biofuels; and place limits on the use of food and crop based biofuels to prevent adverse indirect land use changes (Marie, Moser, and Puschnigg, 2020). In the USA, the Renewable Fuel Standard (RFS) provides regulatory incentives for biofuel adoption and specifies volumes of biofuel blending (Younes, Fingerman, Barrientos, Carman, Johnson, and Wallach, 2022). Evidently, legal frameworks in the EU and the US are more comprehensive and tend to combine mandatory subsidies, sustainability criteria, land use regulation and environmental impact assessment requirements (Golub, and Shinkaruk, (2021).

Studies have examined the challenges that may arise in the production and use of biofuels in Africa and across the globe. These challenges include environmental degradation, land tenure conflicts, lack of infrastructure and policy limitations. Other studies highlight social concerns such as displacement of communities, economic challenges such as the high costs of feedstock supply and financial risks of agricultural production. With regard to opportunities, studies suggest that where biofuel initiatives are well-regulated and integrated into broader

sustainable energy and agricultural policies, positive outcomes are possible. For example (Khellaf, 2018) finds that biofuel adoption can result in improvements in energy access, improved livelihoods and emission reductions. Other studies also indicate that biofuel policy making backed by legal, financial, and institutional support can result in increased adoption in biofuelling in Africa. By examining the existing literature on biofuelling, international and legal frameworks and policies, this study highlights the crucial role of law in ensuring that African States enjoy the benefits of biofuel adoption and that the industry is properly regulated.

2. Biofuelling and Sustainable Energy Regulation: International Perspective

Although there are no specific international treaties on biofuelling, numerous legally binding and non-binding international instruments are relevant to the sector by addressing climate change, sustainable energy and the management of natural resources that are crucial to biofuel production. These laws are examined below.

There is the United Nations Framework Convention on Climate Change (UNFCCC) 1992

The UNFCCC in Article 4 provides that precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects should be comprehensive, take into account different socio-economic contexts, cover all relevant sources, sinks and reservoirs of greenhouse gases and adaptation and comprise all economic sectors. The article places an obligation on member parties to regulate levels of greenhouse gases concentration in the atmosphere to avoid the occurrence of climate change on a level that would impede sustainable economic development (United Nations Framework Convention on Climate Change, 1992). This provision, by implication, requires governments to implement sustainable energy initiatives necessary for the reduction of GHG emissions.

There is also the Paris Agreement, 2015. The Paris Agreement, while not specifically targeted towards biofuelling establishes the basis for efforts towards promoting the utilisation of sustainable energy in countries across the world. The Agreement enshrines a binding objective to restrict global warming to levels of 2°C below pre-industrial levels and to pursue efforts to limit the increase to 1.5 °C while delivering universal access to energy. By this provision, actions that have the potential to reduce greenhouse gas emissions (GHG) can be said to fall under the ambit of the agreement.

Another regulatory international legal framework is the Kyoto Protocol 1997. Although the use of biofuels is not mentioned in the climate treaty, the Kyoto Protocol obliges Annex I Parties to implement climate change mitigation policies and measures, such as an increased use of renewable forms of energy which can include biofuels (Kyoto Protocol, 1997). The Kyoto Protocol in Article 10 identifies the importance of renewable energy as a contributor to climate change mitigation and provides that all parties, taking into account their common but differentiated responsibilities and their specific development priorities, shall formulate, implement, publish and regularly update national regional programmes containing measures to mitigate climate change in the energy, transport and industry sectors.

There is also the Convention on Biological Diversity 1992. The Convention on Biological Diversity also applies to biofuelling as it governs biodiversity conservation and the sustainable use of its components. Biofuel feedstocks can be regarded as both a component of diversity as well as an element of habitat for biodiversity thereby falling under the ambits of the Convention. The Conference of the Parties to the Convention on Biological Diversity, in its decision titled Agricultural Biodiversity: Biofuels and Biodiversity recognised the importance of promoting the positive impacts of biofuel production while minimizing the negative impacts on biodiversity and the livelihoods of local and indigenous communities. In achieving this aim, the decision supports the full and effective participation of local and

indigenous communities in the implementation of activities necessary for the sustainable production and use of biofuels.

There are various human rights conventions that serve as regulatory frameworks. International human rights conventions may be applicable in biofuel production particularly as it relates to the impacts on food security, labour conditions, and land use. The International Covenant of Economic, Social and Cultural Rights in article 11 establishes a legal obligation on the part of member states to ensure the most efficient development and utilisation of natural resources to ensure the fundamental right of everyone to be free from hunger. This right has been interpreted in the General Comments of the Committee on Economic and Social Rights as meaning that every person should have physical and economic access at all times to adequate food in quality and quantity. Where biofuel production results in food insecurity in local communities, it can be regarded as a violation of this convention.

However, it is noteworthy that none of these treaties in of themselves are adequate in providing specific guidance to countries on biofuel policy making, rather, countries need an harmonisation of the different treaties to address the interplay of environmental, food, agricultural, trade and energy sectors involved in biofuelling. These considerations exist within the policy framework in the United States and the European Union which are briefly examined in the following subsections.

2.1 Examining the European Union Policies and Directives on Biofuelling

The European Union (EU) is generally regarded as a global leader in renewable energy and biofuelling regulation. The EU formulated its first Renewable Energy Directive (Directive 2009/28/EC of the European Parliament and of the Council, 2009) as far back as 2009 and the Directive has been subjected to numerous amendments in response to parliamentary debates and complaints from stakeholders with the most recent Directive being the Renewable Energy Directive II (Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources, 2018). Article 3 of the Directive requires member states to collectively ensure that the share of energy from renewable sources in the Union's gross final consumption of energy in 2030 is at least 42.5 %. Member States are also expected to take measures to ensure that energy from biomass is produced in a way that minimises undue distortive effects on the biomass raw material market and an adverse impact on biodiversity, the environment and the climate. Article 25 of the Directive requires each member state to set an obligation on fuel suppliers to ensure that the minimum share of renewable energy within the final consumption of energy in the transport sector is at least 14% by 2030.'

One of the concerns of biofuel production in the EU is the fact that it may lead to the use of non-agricultural land such as forests, peatlands and wetlands in the production of crops for biofuel feedstock, a process known as indirect land use change (ILUC), which has the possibility to worsen greenhouse gas emissions in the region. The Directive addresses these concerns by providing for a 'freeze and phase-out' of high ILUC risk crop-based biofuels in the transport sector (Joint Research Centre: EU Science Hub. "Renewable Energy- Recast, 2030). The Directive also provides for detailed sustainability criteria that biofuels used in the transport industry must comply with to be eligible for financial support from public authorities and to be included in the count towards the 14% target. This includes the prohibition of sourcing from lands with biodiversity value or high carbon stock such as primary forests wetlands and peatlands.

Other provisions of the Directive include provision of support schemes for energy and electricity from renewable sources; provision of stable financial support to renewable energy projects in member states; joint projects between member states with regard to the production of renewable energy; amongst others. With regard to public participation, the Directive in Article 15d requires member states to ensure public participation in proposed renewable energy

projects and also promote the public acceptance of such projects by means of direct and indirect participation of local communities in those projects. Extensive provisions are also made in Article 16 of the Directives on the process of granting permits to entities desirous of building, repowering and operating renewable energy plans, thereby ensuring that the process is streamlined and easily accessible. These extensive provisions of the Directive, while not binding, offer ample guidance on the regulation of biofuelling in Europe and address the numerous criticisms usually made against biofuel adoption.

Biofuelling in the United States is regulated primarily through the Renewable Fuels Standards (RFS) established under the Energy Policy Act of 2005 and expanded by the Energy Independence and Security Act (2007). The RFS mandates that transportation fuel sold in the US should contain a minimum volume of renewable fuels, categorised into conventional biofuels, advanced biofuels, cellulosic biofuels and biomass-based diesel. These mandates are enforced through a system of Renewable Identification Numbers (RIN) which ensures the traceability of biofuel production and blending (IEA Bioenergy, 2024).

While the RFS has succeeded in scaling domestic ethanol and biodiesel markets, critics have argued that it has worsened concerns about food security, encouraged monoculture cultivation of feedstock, particularly corn, and produced limited greenhouse gas benefits compared to the projections under the law (Adusumilli and Leidner, 2014). This is because unlike the EU, the US does not have comprehensive sustainability criteria in its legal framework on biofuelling; instead it relies heavily on economic incentives and market mechanism. This raises questions about the adequacy of a purely market-driven model in addressing environmental and human rights concerns that arise in discussions on biofuelling.

2.2 Biofuel Regulations in Some Selected Jurisdictions

When compared to the provisions in the EU and USA, significant gaps exist in the legal frameworks on biofuelling in Africa. Despite widespread biofuel adoption in recent years, no specific enforceable legislation exists yet on biofuelling, instead regulatory provisions can be found in African Union instruments and regional policies in certain regions such as West Africa. The African Union's Agenda 2063, which is a development framework that sets out the continent's long-term vision and goals, includes the aspiration for a sustainable and low-carbon energy sector and emphasizes the importance of renewable energy and energy efficiency in achieving sustainable development in Africa (African Union Agenda 2063). Similarly, the African Charter on Human and People's Rights in Article 24 also imposes an obligation on Member States to adopt measure to ensure the realisation of the right to a sustainable environment and this could be interpreted to mean the obligation to adopt measures necessary to protect and preserve the environment, including during the implementation of projects aimed at realizing a sustainable energy transition.

In West Africa, the ECOWAS Regional Renewable Energy Policy provides some guidance on biofuelling (ECOWAS Renewable Energy Policy, 2015). The policy was formulated for the purpose of promoting an increase in the use of renewable energy sources in the supply of electricity and providing access to energy services in rural regions. It aims to increase the share of renewable energy used in Africa's electricity sector to 19% by 20230 and provide access to energy for 25% of rural populations through mini grids by the same year. Among the sources highlighted in the policy are wind, solar, small-scale hydroelectric power sources and biofuels which are expected to complement conventional power sources. Although the strategy's main focus is on the power sector, it is relevant to this discuss as it takes into account the possible generation of biofuels in complementing conventional energy sources.

It is evident that unlike the EU's strict sustainability criteria or the US' blending mandates; African states generally rely on policies without binding enforcement procedures. Moreover, African countries have failed to domesticate the provisions of international treaties,

BIOFUEL AND SUSTAINABLE ENERGY IN AFRICA: LEGAL PERSPECTIVE ON THE PROSPECTS AND CHALLENGES

thereby limiting the application of the agreements in addressing sustainable energy in the continent. The lack of a harmonised framework therefore creates uncertainty for investors and heightens the risk of land grabs, environmental degradation and human rights abuses in Africa. Nonetheless, Africa's abundant biomass resources and large rural workforce offer opportunities for biofuel adoption where legal frameworks are implemented.

The primary legislation governing sustainable energy and biofuelling is the Renewable Energy Act of 2011. The Act governs the development and utilisation of renewable energy sources for the production of heat and power in an efficient and environmentally sustainable manner. The Act recognises biofuel as a form of renewable energy and states that one of its objectives is to regulate the production and supply of biofuel. Under the Act, the duty of raising awareness on biofuelling and fostering collaboration between public and private institutions is placed on the Energy Commission. The Commission is also expected to promote the benefits of renewable energy to members of the public and make recommendations to the government on necessary financial incentives needed to promote biofuel adoption in the country.

In addition, the Renewable Energy Act recognises the need for local stakeholder involvement in biofuel adoption and therefore requires the Commission to consult local stakeholders and train and support local experts in the field of renewable energy. The Energy Commission is expected to work in collaboration with the Public Utilities Commission in the recommendation of financial incentives needed to encourage the production and utilisation of renewable energy sources. The law also provides for the licensing of biofuel activities, oversight on the designation and pricing of biofuels and incentives such as customs duties exemptions, tax breaks and research and development support for renewable energy projects. In summary, the Act aims to reduce the country's dependence on fossil fuels, promote sustainable development and protect the environment.

The relevant legislation on biofuelling and sustainable energy in Kenya is the Energy Act 2006. Other legislation expected to apply to the biofuel industry includes the Agriculture Act, the Forest Act 2005, the Water Act and the Trade and Industry Act. The Energy Regulatory Authority (EPRA) also recently unveiled new Draft Biofuel Regulations to govern the production, sale and utilisation of biofuels in the country. The Regulations set standards for blending biofuels with fossil fuels and the promotion of safety and environmental sustainability in biofuel production (Moraa and Ogada-KNA, 2025).

The Energy Act makes extensive provisions on biofuelling and its regulation in Kenya. The Act makes provisions for renewable energy such as non-fossil sources including biomass and plant gas. The Act in section 103 places a duty on the Minister of Energy to promote the development and utilisation of renewable energy technologies including but not limited to biomass, biodiesel, bioethanol, biogas, among others. In carrying out this function, the Minister is expected to formulate a national strategy for coordinating research in renewable energy and promote a framework for the efficient and sustainable production, distribution and marketing of biofuelling. However, a noticeable difference in the Energy Act is that while it makes provision for licensing requirements for petroleum and fossil fuels, no such requirement is made with regard to biofuels. Scholars have opined that the reason for this omission is to foster an environment for biofuel production without the initial encumbrance of licensing.

South Africa, in recent times, has strategically advanced the domestic adoption of biofuels and has initiated numerous measures to integrate them into the national energy infrastructure. The legal framework for biofuelling in South Africa is governed by the Biofuels Industrial Strategy (BIS) and its corresponding Biofuels Regulatory Framework (BRF). The BRF includes a Feedstock Protocol to guide sustainable sourcing of biofuel and a Mandatory Blending Regulation which mandates the blending of 2% bioethanol and 5% biodiesel into petrol and diesel, respectively. This framework, aimed at energy security and economic development, requires biofuel producers to obtain licenses and adhere to national specifications

and standards to ensure minimal environmental impact. The goal of the policy is to promote sustainable energy, alleviate poverty and contribute to energy security and climate change goals. However, the Feedstock Protocol which aims to mitigate the risk of biofuel adoption excludes crops such as maize and alien crops such as jatropha as potential biofuel feedstocks. Instead it prioritises the use of multi-purpose crops, crops grown on shallow lands and rainfed crops. This exclusion of maize, it has been argued, is not sufficient to ensure that biofuel production does not affect maize prices.

Nigeria as early as 2007 formulated its Biofuel Policy and Incentives aimed at boosting its biofuel production and reducing the country's reliance on fossil fuels. The policy aims to establish a thriving fuel ethanol industry that utilises agricultural products as a means of improving the quality of automobile based fossil fuels in Nigeria. Some noteworthy provisions of the policy include the introduction of a biofuel blend (10% ethanol) and various incentives aimed at stimulating market demand for biofuels and promoting their production such as tax exemptions and preferential loans. The policy includes the establishment of a Biofuel Energy Commission and Biofuel Research Agency and a target that by 2020 100% of biofuels consumed in the country will come from domestic production. However, it is safe to say that the provisions of the policy remain mere ambitions as the government has failed to implement them in the years since the policy has been formulated.

Other legal provisions applicable to sustainable energy in Nigeria include the National Renewable and Energy Efficiency Policy 2015 which seeks to set out a framework to address the challenge of inclusive access to modern and clean energy resources, improved energy and climate objectives. Additionally, there is the Environmental Impact Assessment Act which in section 2 makes it mandatory for environmental impact assessments to be carried out for projects that are likely to have a significant impact of the environment. This can be interpreted to apply to large-scale biofuel production projects that may threaten water resources and biodiversity in the country. The Climate Change Act 2021 makes provisions for Nigeria's just transition and prescribes measures for reducing greenhouse gas emissions which can also encompass biofuelling. The Electricity Act 2023 also places a continuing obligation the Independent System Operator to promote the generation of electricity from renewable energy sources including biomass.

The effectiveness of national legal frameworks is closely linked to the existence of strong and functional institutions. Numerous institutions in the selected states are saddled with regulatory and oversight functions in biofuelling, howbeit with different levels of effectiveness. In Nigeria, institutions such as the Federal Ministry of Environment, the National Environmental Standards and Regulations Agency (NESREA), and the Nigerian National Petroleum Corporation (NNPC) have roles to play in environmental matters and biofuelling regulation. However, duplication of functions, poor funding, absence of technical expertise and the lack of governmental oversight has limited the effectiveness of these institutions in the country (Olujobi, Olujobi, and Ufua, 2020).

In Ghana, biofuel matters fall under the mandate of the Ministry of Energy and Petroleum, with the Environmental Protection Agency and Ministry of Food and Agriculture being responsible for upstream activities in the sector. Downstream activities and regulatory issues such as the licensing of refineries and distributors are performed by the National Petroleum Authority. Issues relating to land acquisitions and registrations for biofuel feedstock production are under the purview of the Lands Commission and Town Planning. However, these institutions have often failed to carry out their functions and there is an absence of policy implementation on the part of institutions in the country. Moreover, long delays in land registration and incessant bureaucratic channels has resulted in the loss of public trust in the institutions and subsequently limited active public interest in biofuel production (Kissi, Sarkodie, Takase, and Amankwah, (2025).

3. States and Stakeholders Responsibilities and Responsiveness

The legal frameworks on biofuelling assign roles not only on governments but also on private stakeholders and local communities. States are often required by law to ensure biofuel production and adoption in a way that is sustainable and takes the needs of the local population into consideration. Investors are also often expected to obtain licences, adhere to land use laws and compare to blending standards where applicable. However, the reality in many African countries indicates a failure to carry out these responsibilities as seen in countries such as Ghana where many biofuel projects were carried out without stakeholder engagement and a failure to protect the rights of local communities (Ahmed, Campion, and Gasparatos, 2017). In many instances, communities have borne the cost of the government failures through displacement, food insecurity and environmental degradation while the investors enjoy numerous incentives. The evidence of failure to include local populations and the resulting failures of the biofuel projects therefore indicate the need to include local populations in decision making to ensure effective and long-lasting adoption in Africa.

3.1 Environmental and Social Impacts on Biofuel and Energy

According to the Intergovernmental Panel on Climate Change, biofuels can result in both positive and negative impacts and their utilisation needs to balance a range of environmental, social and economic objectives which are not always compatible (Chum, and Faaij, (2011). The IPCC has also noted that the potential social, environmental, economic and technological implications of biofuels may range from a local scale to the global scale and which may call for regulations and solutions at all levels.

An important advantage of biofuel use is their contribution to the reduction of greenhouse gases. However, there have been criticisms on the ecological and climate change impacts that may occur during the biofuel production process with significant attention paid to the effects of land use conversion. Critics assert that utilising large expanses of land for cultivating biofuel feedstock such as starch and oil rich crops, can jeopardise biodiversity through deforestation, monoculture and invasive species while simultaneously contributing to air, water and soil degradation. Furthermore, despite being promoted as a solution for GHG reduction, the actual effectiveness of biofuels in achieving this goal is under serious debate, particularly when emissions related to direct and indirect land-use change throughout the biofuel life cycle are factored into the analysis (Senelwa, Etiegni, Odipo, Balozzi, and Imo, 2012).

In Africa, weak enforcement of environmental laws worsens these effects. For instance, although the Environmental Impact Assessment Act in Nigeria requires EIAs for projects with significant ecological effects, the level of compliance is quite low and many projects would go ahead without adequate assessment (Obaji, 2022). Comparative lessons from the EU also highlight the gaps in Africa. In the EU, the RED II imposes strict sustainability criteria preventing the production of biofuel feedstocks on high-biodiversity lands and also requires biofuel industries to carry out mandatory greenhouse gas savings assessments. The enjoyment of the advantages of biofuels in Africa therefore requires the inclusion of clear provisions on land-use change, emissions accountability and biodiversity protection.

The adoption of sustainable energy has the potential to mitigate energy poverty Africa, and its effective utilization could contribute positively to socio-economic development, education, health, food security and rural development (Khellaf, 2018). In fact, studies found that the energy transition to sustainable energy has already led to the creation of over 1.9 million jobs in the continent, and this number is estimated to grow substantially with the rising growth of investment in the sector (Irena, 2022). On the other hand, in several African states, large-scale land acquisitions for biofuel plantations have displaced rural communities, undermined customary land rights, and exacerbated food security by diverting arable land from

food production to energy crops. For example, jatropha projects in some parts of Africa led to the displacement of farmers without adequate compensation and resulted in social conflicts (Ahmed, Campion, and Gasparatos, 2017). Similarly, the signing of a contract between the Mozambique government and a London-based company involved the allocation of 30,000 hectares for a sugar plantation to produce bioethanol. This allocation generated criticism from local communities and international donors who argued that the project would absorb the bulk of available water and displace more than a thousand families to whom the plot had been earlier promised. Due to immense pressure on the government, the contract was eventually cancelled.

3.2 Human Rights Implications

The adoption of biofuelling in Africa intersects closely with human rights issues particularly the rights to food, water, health and a safe environment. The conversion of agricultural produce to biofuel feedstock usually drive food scarcity and cause increased prices of food thereby causing food insecurity in developing countries (Eide, 2002). In instances where the production of biofuel impacts agricultural production and results in food insecurity, it could be said to have impaired the right to food by reducing the accessibility and adequacy of food in violation of the provision of the human right to food.

The adoption of biofuelling in African countries is frequently lauded for its capacity to boost agricultural employment, promote the economic stability of rural populations and promote economic diversification and higher incomes (Khellaf, 2018). In countries like Nigeria and Ghana, where fuel importation constitutes a significant strain on the local population, biofuels are often promoted as a pathway to energy security and economic diversification. However, the cost-benefit analysis of biofuels has revealed that the benefits of biofuel adoption may have been overstated especially when a comparison is made between the required input of energy and raw materials involved in their production (Müller-Langer, F., Majer, S. & O'Keeffe, S. (2014). Biofuel production often demands heavy upfront investments in infrastructure, subsidies for feedstock cultivation and long-term fiscal incentives that are not always available in African countries. The food-versus-fuel debate also raises economic concerns about biofuels. Diverting arable land to the production of energy crops may increase a country's dependency on food importation, causing trade imbalance and increased food prices where storage facilities do not exist. Moreover, reliance on export-oriented biofuel production risks exposing African countries to volatile global commodity markets thereby making the revenues from biofuels unpredictable. A balanced economic approach would therefore require the implementation of strong legislative safeguards to ensure that biofuel production benefits African states.

The adoption of biofuels in Africa is technically feasible given the fact that the continent has vast natural resources, including agricultural residues, energy crops and organic waste, which can serve as feedstock for biofuels. Various biofuel technologies such as ethanol production from sugars and starches and biodiesel from vegetable oils are already being explored in various parts of the continent such as South Africa and Kenya. However, the lack of access to modern conversion technologies, processing facilities and the infrastructure required for biofuel production and distribution serves as a challenge to the use of biofuels in some African countries (Aduloju, 2021). Moreover, the successful adoption of biofuelling depends on the local availability of feedstocks spare parts and skilled manpower which may not often be available in developing African countries as evidenced in Burundi where the biomass gasification of peat was abandoned due to limited local technology (Muzee, 2012). Additionally, the absence of clear policies and legislation on mandatory blending standards and incentives for investors hinders the growth of the biofuel sector in African countries where those laws do not exist (Fertahi, Elalami, Tayibi, Taarji, and yamlouli, 2025).

4. Conclusion and Recommendations

This study has examined the opportunities and challenges in biofuel adoption in Africa from the perspective of the legal frameworks in the continent. Biofuelling presents a formidable means of meeting the energy and sustainability demands of countries in Africa while also providing numerous socio-economic advantages for the continent. However, the examination of case studies and relevant literature reveals that while biofuels have the potential to stimulate rural employment and reduce dependence on fossil fuels, the absence of strong regulatory frameworks has limited the success of biofuel adoption and allowed environmental degradation, displacement of local communities and increased food insecurity to persist. Jurisdictions such as the EU and the United Kingdom have sought to address these challenges through policy directives and legislation aimed at protecting the environment and the citizens and ensuring the realisation of the benefits of biofuelling and sustainable energy. There is therefore a need for stringer legal frameworks to ensure the full enjoyment of the benefits of biofuelling on the continent.

In light of the identified challenges and opportunities of biofuelling in Africa, this article makes the following recommendations:

1. Harmonisation of International Standards: There is the need for harmonisation of international standards on biofueling into one comprehensive instrument to ensure that countries have a reference point for policy making and that citizens can hold their governments accountable for failing to meet their obligations under international law.

2. Enhance Environmental Safeguards: Given the possible negative impacts of biofuels on the environment, African countries need to make provisions mandating the environmental sustainability of biofuel projects. A leaf can be borrowed from the European Union where sustainability criteria are in place to ensure adherence on the part of stakeholders.

3. Streamline Permitting Processes: Permitting processes in biofuelling across Africa should be streamlined with clear procedures and requirements to be met by institutional investors. This will make it easier for entities desirous of investing in the biofuel sector to have a clear guideline to follow.

4. Improve Legislative Frameworks: Conscious effort on the part of national African governments is also required to enact comprehensive biofuel legislation. Such laws should include provisions for local community participation, environmental protection and clear assessment of negative impacts of biofuel projects.

5. Strengthen Existing Institutions: The success of legal frameworks is dependent on effective institutions. As a result, existing regulatory institutions must be strengthened to carry out oversight functions and implement the provisions of existing laws.

6. Increase Stakeholder Engagement: Since local communities will be the ones involved in farming of biofuel feedstock and the utilisation of the biofuels, there is the need for increased involvement of local communities through better awareness-raising about the nature and impacts of biofuels.

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BIOFUEL AND SUSTAINABLE ENERGY IN AFRICA: LEGAL PERSPECTIVE ON THE PROSPECTS AND CHALLENGES

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