

# Growing Demand for Biofuel and its Impact on Sustainable Rural Development in Nigeria

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## Abstract

The recent upsurge in the demands for energy as well as the anticipated shortages and uncertainties associated with current energy sources, has necessitated the need to explore energy options from renewable sources. Hence, modern biofuels, which is obtained primarily from renewable biomass, are being given top priority in most countries owing to their great potentials in offering opportunities for achieving meaningful strategy for environmental and socioeconomic growth. Admittedly, one major goal of advocating for biofuels projects is the development of the rural economy. Consequently, anchoring on content analysis, the paper explored the implications of biofuel production on rural development. It is the contention of this paper that environmentally friendly and socially acceptable biofuel projects can be of immense benefit to the rural economy in most developing countries, Nigeria inclusive. The paper concludes with the recommendation that assessment of other options for rural growth is germane owing to the fact that biofuel production may not be an exclusive panacea to rural development problems.

**Keywords:** Bioenergy, Biofuels, Demand, Impact, Nigeria, Renewable, Rural development, Sustainable development.

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## 1. Introduction

There is no gainsaying the fact that energy is vital for social and economic development of any economy. This has inadvertently led to an increase in the demand for energy worldwide (Poornima and Suren, 2013). However, it is important to note that fossil fuels which have been the backbone of most economies over the years are now unreliable on account of their damaging effects on the environment via the emission of Greenhouse Gases and unsustainability of the resources. (Goldemberg, 2007).

In realization of these facts, governments of various countries are beginning to explore promising alternative sources of energy. Besides, the increased global concern on climate change is a factor driving interest in expanding bioenergy use, which is both renewable and environment friendly (Msangi *et al.*, 2007). Consequently, Karth and Larson (2000) and CARC (Canadian Agri-Food Research Council) (2003) opined that biofuels are increasingly becoming important sources of renewable energy capable of competing with the fossil fuels and addressing the energy needs of the world. Thus, it has been widely accepted that biofuels have the capability to achieve the goals of sustainable development through the reduction of carbon emissions, an important component of climate change mitigation (FAO (Food and Agricultural Organization of United States), 2005a).

Biofuel is a type of energy derived from renewable plant and animal materials. Examples of biofuels include ethanol (often made from corn in the United States and sugarcane in Brazil), biodiesel (vegetable oils and liquid animal fats), green diesel (derived from algae and other plant sources) and biogas (methane derived from animal manure and other digested organic material). [See Tables 1&2 for types of biofuel and major producing countries]. Biofuels are most useful in liquid or gas form because they are easier to transport, deliver and burn cleanly (Gail and Khamarunga, 2009). These biofuels can be put to a variety of uses such as heating, cooking, transportation, electricity generation etc. (Dufey, 2007). Table 1 shows types of biomass resources and biofuel produced.

**Table-1.**Types of Biomass Resources and Biofuel Produced

Biomass Resources	Biofuel Produced	Energy Services
Agriculture and forestry residues	Wood pellets, briquettes, biodiesel	Heat, electricity, transport
Energy crops: biomass, sugar, oil	Char/charcoal, fuel gas, bio oil; bioethanol	Heat, electricity, transport

*Continue*

Biomass processing wastes	Biogas, bioethanol, solvents	Transport
Municipal waste	Refusederived fuel, biogas	Heat, electricity

Source: Domac *et al.* (2005)

**Table-2.** Top Five Biofuel Producers in the World

Country	Ethanol(Million liters)	Biodiesel(Million liters)	Total
United States	41.0	2.1	43.1
Brazil	26.0	1.6	26.7
France	0.9	2.6	3.5
Germany	0.8	2.6	3.2
China	2.1	0.4	2.5
Subtotal	70.8	9.3	80.1
Rest of the world	5.2	7.3	12.5
Total	72.0	16.6	92.6

Source: REN21 (2010).

From the foregoing, it is important to state that biofuel can be broadly categorized into two: the modern and traditional biofuels. However, the thrust of this study is the modern biofuel, which according to Goldemberg and Suani (2004) refer to fuels produced in a sustainable way for electricity generation, heat production and transportation, from agricultural and forest residues and solid waste. This modern biofuel is basically composed of liquid fuels (ethanol and biodiesel) and biogas. Ethanol and biodiesel are the two common types of biofuels majorly used in the energy sector.

Undoubtedly, divergent policies affect the biofuel sector globally, nevertheless the goals of biofuel development projects in most countries as stated by (Dufey *et al.*, 2007), (Baun *et al.*, 2009) include energy security; rural development; trade development, and mitigation of adverse impacts of climate change. Correspondingly, Faaij and Julije (2006) noted that irrespective of the varying nature of policy goals, the driving forces in biofuel development projects are rural development and employment generation.

In addition, Biofuels already constitute the major source of energy for over half of the world's population, accounting for more than 90% of the energy consumption in poor developing countries (FAO (Food and Agricultural Organization of United States), 2005a). Aside from lessening the dependence of energy driven economies on limited fossil fuel sources, bioenergy has continued to receive increasing attention from those concerned with promoting agricultural and environmental sustainability through the reduction of carbon emissions, an important component of climate change mitigation (Msangi *et al.*, 2007). Furthermore, bioenergy is regarded by some to be a potentially important contributor towards the economic development of rural areas, and a means of poverty alleviation via the generation of employment and incomes i.e. linking biofuel development directly or indirectly with multiple Millennium Development Goals (FAO, 2005b; Kammen, 2006). Subsequently, bioenergy is seen as a highly promising and largely untapped renewable energy resource, and its potential environmental and socioeconomic advantages are becoming more obvious as technological improvements continue to emerge. Hence, the thrust of this paper is to discuss profoundly the influence of biofuel production on the development of the rural areas, with greater emphasis on developing countries like Nigeria. In the light of the preceding, the study will construct answers to the following questions:

- What is the rationale for embarking on biofuel projects by governments across the world?
- To what extent does biofuel production leads to rural development?
- What policy approaches can be put in place by government to accelerate rural development benefits of biofuels?

Following the introduction, we have section 2, which examines in details the reasons for rising demand for biofuels; section 3 explores the impact of biofuel projects on rural livelihood, section 4 discusses policy approaches to maximize rural development benefits of biofuels. Section 5 concludes the study.

## 2. The Rising Demand for Biofuels

There is a renewed interest in renewable energy sources and particularly bioenergy. This interest stems from the growing demand for energy ensuing hike in world fossil fuel prices and concerns about global warming. Although, at the world energy market, fossil fuel consumption still dominates, however, the anticipated uncertainty in future supply as well as potentially unsustainable patterns of energy consumption, and the costs of expanding proven reserves of fossil fuels have led many energy analysts and managers around the world to seek alternatives from other, more renewable resources, such as bioenergy (Msangi *et al.*, 2007). In addition, the steadily increasing trend of gasoline prices overtime strengthens the rationale for seeking cheaper supply alternatives. Besides, minimizing the undue reliance of energy driven economies on limited fossil fuel sources, necessitates the search for bioenergy which has the potentials of promoting agricultural and environmental sustainability through the reduction of carbon emissions (Msangi *et al.*, 2007)

## 3. Implications of Biofuel Production on Rural Development

Undisputedly, biofuel production is a topic faced with different driving forces and diverging interests. It is to be noted that while the global North is in favour of biofuel production so as to mitigate the effects of fossil fuels and invariably minimizes its dependence; the global South on the other hand sees it as a way of rather promoting rural development (Gmunder and Portner, 2009). As a matter of fact, it has been increasingly noted that biofuel production provides employment opportunities, access to new markets and helps in the expansion of agricultural production technology. It also increases purchasing power and decreases vulnerability to food and energy price shocks. This in no small measure would lead to significant welfare gains (Gmunder and Portner, 2009). Consequently, biofuels support rural development by increasing farm income. They offer hope of economic growth, especially for

developing countries near the equator, where energy crop production is expected to be particularly cost-effective. They also offer modest greenhouse gas emissions reductions (Steven and David, 2010). According to Poornima and Suren (2013), the production and use of biofuels are increasingly gaining attention in many countries to address various energy needs and that ethanol and biodiesel are the two dominant biofuels, which are extensively used in the transportation sector. As at the present, ethanol and biodiesels are blended with gasoline and petroleum based diesel, respectively and used in conventional diesel-fueled vehicles (World Watch Institute (WWI), 2006). Thus, biofuels have been considered by many as a panacea to global society's problems. Table 3 presents significant changes resulting from the production of biofuels that have direct bearing on rural development.

Conversely, recent studies have affirmed that biofuels have a notable effects on food security (FAO, 2008), landuse rights (Lorenzo *et al.*, 2008) and on the environment (Scharleman and Laurance, 2008). Subscribing to the preceding, Steven and David (2010) remarked that rising energy demand is likely to put pressure on food production and the environment, have significant distributional effects, and induce reorganization in agriculture. This is more evident in the rural South, where the rapid expansion of biofuel production is having both adverse and positive effects. However, the magnitude of the impacts of biofuel production is yet to be ascertained owing to the dearth of sound scientific research on biofuels.

**Table-3.**Various Rural Development Aspects Associated with Biofuel Production

Aspects to rural development	Direct Relationship	Indirect Relationship
Local job creation	X	
Higher level income		
Better energy services	X	
Improved local health	X	
Good infrastructure facilities		X
Improved knowledge and skills		X
High productivity Quality of life		X
Stabilized local economy	X	

Source:Poornima and Suren (2013)

#### 4. Policy Approaches

As stated in preceding sections, modern biofuels are highly promising in meeting rural development needs. However, development of biofuel projects requires effective measures to enhance the benefits and also to avoid certain environmental and socioeconomic risks that could emerge in the process (Poornima and Suren, 2013). Hence, it is imperative according to Rossi and Yianna (2009)that a proper appraisal of the local biophysical and socioeconomic conditions is done as it will help in identifying the most efficient and cost effective measures for each specific rural area. Ensuring environmentally, economically and socially sustainable biofuel production requires policy action in the following broad areas:

- protecting the poor and food-insecurity;
- taking advantage of opportunities for agricultural and rural development;
- ensuring environmental sustainability;
- reviewing existing biofuel policies;
- making the international system supportive of sustainable biofuel development.

#### 5. Conclusions

It has been established clearly in the study that modern biofuels have the potential to contribute to the development of rural areas, particularly in developing countries like Nigeria. This includes energy services to the rural community, present jobs and livelihood options and create good local health environment. However, it is important to note that the strategies to establish biofuel projects that would impact positively on the rural people differ from one region to another based on local energy needs, environmental resource base and other socioeconomic priorities of the region. This is necessary especially in Nigeria where there are geographical variations across the various regions in the country. Governments should develop and promote biofuels policies, regulations and programs that take into account the needs and interests of small farmers and people in rural communities. Consequently, it is out of place to assume all biofuel projects will yield expected results in all cases and in all places. Hence, the need for proper appraisal and analysis.

#### References

Baun, A., G. Berndes, M. Junginger, F. Vuille, R. Ball, T. Bole, C. Chudziak, A. Faaij and H. Mozaffarian, 2009. Bioenergy: a sustainable and reliable energy source.A review of status and prospects. Paris: IEA Bioenergy. pp: 108.

CARC (Canadian Agri-Food Research Council), 2003. An assessment of the opportunities and challenges of a bio-based economy for agriculture and food research in Canada. Ottawa: Canadian Agri-Food Research Council.

Domac, J., K. Richards and S. Risovic, 2005. Socio-economic drivers in implementing bioenergy projects. Biomass and Energy, 289(2): 97-106.

Dufey, A., 2007. International trade in biofuels: Good for development? And good for environment? , London: International Institution for Environment and Development.

Dufey, A., V. Sonja and V. Bill, 2007. Biofuels: Strategic choices for commodity dependent developing countries. London: Common Fund for Commodities and International Institute for Environment and Development.

Faaij, A.P.C. and D. Julije, 2006. Emerging international bio-energy markets and opportunities for socio-economic development. Energy for Sustainable Development, 10(1): 7-19.

FAO, 2005b. Bioenergy and the millennium development goals. Forestry Department, FAO,Rome, Italy. Available from <http://www.fao.org/forestry/energy> [Accessed July 9, 2014].

FAO, 2008. Biofuels: Prospects, risks and opportunities. World Food and Agricultural Review. Available from [www.fao.org/es/esa](http://www.fao.org/es/esa) [Accessed July 10, 2014].

FAO (Food and Agricultural Organization of United States), 2005a. Bioenergy and the millennium development goals. Forestry Department; FAO, Rome,Italy. Available from <http://www.fao.org/forestry/energy> [Accessed July 9, 2014].

- Gail, K. and B. Khamarunga, 2009. Biofuels for sustainable rural development and empowerment of women: Case studies from Africa and Asia. Energia Secretariat, The Netherlands. pp: 46.
- Gmunder, S. and B. Portner, 2009. Biofuels and developing countries. Available from [www.bioenergyinafrica.net](http://www.bioenergyinafrica.net).
- Goldemberg, J., 2007. Ethanol for a sustainable energy future. *Science*, 315(5813): 808-810.
- Goldemberg, J. and T.C. Suani, 2004. Renewable energy- traditional biomass vs. Modern biomass. *Energy Policy*, 32(6): 711-714.
- Kammen, D.M., 2006. Bioenergy in developing countries: Experiences and prospects. In *bioenergy and agriculture: Promises and challenges*, Eds., P. Hazell and R.K. Pachauri. Washington, D.C.
- Karth, S. and E.D. Larson, 2000. Bioenergy primer-modernized biomass energy for sustainable development. New York: United Nations Development Programme. pp: 133.
- Lorenzo, C., D. Nat and V. Songer, 2008. Fuelling exclusion? The biofuels boom and poor people's access to land: FAO and IIED, 2008.
- Msangi, S., S. Timothy, R. Mark and R. Valmonte-Santos, 2007. Global scenarios for biofuels: Impacts and implications for biofuel security and water use. A Paper Presented at the Tenth Annual Conference on Global Economic Analysis Special Session on CGE Modeling of Climate, Land use and Water: Challenges and Applications. 7-9 June, 2007. pp: 1-16.
- Poornima, S. and K. Suren, 2013. Sustainable biofuel production: Opportunities for rural development. *International Journal of Environment and Resource*, 2(1): 1-13.
- REN21, 2010. Renewable 2010 global status report. Paris: Renewable Energy Policy Network for the 21st Century, 2010.
- Rossi, A. and L. Yianna, 2009. Making sustainable biofuels work for small holder farmers and rural households: Issues and perspectives. Rome: FAO.
- Scharleman, J.P.W. and W.F. Laurance, 2008. How green are biofuels? *Science*, 319(5859): 43-44.
- Steven, S. and Z. David, 2010. Agricultural biotechnology can help mitigate climate change. *Agricultural and Resource Economics*, 4(2): 1-12.
- World Watch Institute (WWI), 2006. Biofuels for transportation, global potential and implications for sustainable agriculture and energy in the 21st century. Washington, D.C. Available from [www.worldwatch.org/pubs/biofuels](http://www.worldwatch.org/pubs/biofuels) [accessed [Accessed July 9, 2014].