Strategies for the Market Development of *Jatropha curcas* biofuel in Africa

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Abstract

The dearth of access to energy services is widely recognized as a critical constraint to the ability of people living in rural and peri-urban areas to escape the poverty trap. Poverty is endemic in Africa and the millennium development goals (MDGs) will only be achieved by 2015 if at least half of the population of rural and peri-urban areas of Africa are provided access to modern energy services and are economically empowered to have productive capabilities for *Jatropha curcas* Renewable Energy (RE) production. The availability of cheap and reliable energy is one of the major factors that would propel sustained economic growth of developing economies. The main objective of the study was to assess the potential for wider market development of *Jatropha curcas* RE and explore the workable strategies for the optimization of performance targets to yield sustainable livelihoods for African economies. This study observed that increases in gross domestic product (GDP) and human development index (HDI) for African economies is proportionate to meeting 'domestic and export targets' and meeting optimal targets for energy intensity ratio. This study proposes pragmatic and realistic strategies aimed at maximising the African market for optimal biofuel production by increasing performance targets. It also calls for increasing interest (by both government and RE stakeholders) to support workable strategies in terms of installation of energetic infrastructure in order to boost African economies and reduce poverty.

Introduction

There is a major challenge of providing reliable and continuous energy supply in Africa, which has resulted in many power crises in the continent over the decade. It is reported that about 585 million people in sub-Saharan Africa lack access to electricity and this figure will double by 2030 (International Energy Agency, 2007). Lessons from over-reliance on fossil fuels and hydro-electric power generation have led the continent to explore alternative forms of energy generation to meet the aspirations for full electrification and middle income status by 2020. Biomass energy, one of the many Renewable Energy (RE) (or bioenergy) options, provides attractive market benefits like environmental protection, job creation, and global potential for technology transfer and innovation. Biomass is a primary source of energy for production, transportation and distribution of energy (energy chain) for the supply of energy services and satisfaction of human needs (ECOWAS White Paper, 2006). This is so because access to energy services provides for productive activities which, stimulate alternative economic activities, yield sustainable livelihoods and bring about (rural) development (Brew-Hammond et al., 2007). Global Network on Energy for Sustainable Development [GNESD] (2011) posits that traditional biomass resources

account for over 90% of household energy consumption in many developing economies with 2.5 billion people relying on traditional biomass unsustainably mined for cooking and heating. Bioenergy, of which biomass resources are a part, offers new investments into the agricultural sector with the potential to provide market and employment opportunities for an estimated 2.5 billion people worldwide who depend on agriculture, including 900 million rural poor (FAO, 2009). *Jatropha curcas* biofuel that is sustainably harnessed and well-managed has the potential not only to mitigate climate change but also to foster the development of carbon markets (via carbon funding sources such as CDM, CIF, CEF, etc.) since they are carbon sequestration systems (CSS). The concept for the African market development proposes a free market economy where biofuel is an energy market commodity with greater market incentives to enhance diversification and strengthening of the value chain through foreign direct investment (FDI). GNESD (2011) suggested that the market approach (for a technologically mature bioenergy resource as *Jatropha curcas*) should promote technology transfers on a self-sustainable basis rather than remaining dependant on 'one-time' grants. Innovative revenue-sharing mechanism such as co-generation should be considered if *Jatropha curcas* RE is to be utilized as an effective poverty alleviation tool.

The study is justified in that if one of the global objectives of the Member States to the 'ECOWAS White Paper on Access to Energy Services' is to increase access to modern energy services of rural and peri-urban populations, then a related goal should be the strategies for the African market development of *Jatropha curcas* RE. Also the '2012 International Year of Sustainable Energy for All' justifies investments and strategies into RE market development.

Objectives of the Study

General Objective

This study was to assess the potential for wider market development of *Jatropha curcas* RE and explore the workable strategies for the optimization of performance targets to yield sustainable livelihoods for African economies.

Specific Objective

The specific objectives were to:

1. assess the potential for market development of *Jatropha curcas* RE by determining domestic and export targets, climate suitability, energy intensity ratio and land area for cultivation.
2. identifying, through a series of strategies, ways of optimizing the performance targets, which translates into measurable outputs such as increased GDP and HDI.

Materials and Methods

The materials used were obtained from literature sources in journals, books, internet and the library. The study, including design parameters, was carried out based on similar studies obtained elsewhere on the energy subject. The secondary results of the study were obtained using calculations of primary data in literature.

Methodology:

The study began with an assessment of the potential for market development of *Jatropha curcas* RE (first objective) by determining domestic and export targets, climate suitability, energy intensity ratio and land area for cultivation. This assessment of the potential was done by eliciting information from the Energy Commission of Nigeria (ECN), The Energy Centre, KNUST, Kumasi, Ghana and other regional

centres of excellence regarding the energy issue. The parameters for this assessment were chosen from similar studies on this subject from literature.

Feasibility studies for the African Market Development of Jatropha Curcas Biofuel were conducted using the four parameters mentioned namely; 'export and domestic targets', 'climate suitability', 'energy intensity ratio' and 'land area for cultivation'.

Results and Discussions

Table 1: Potential, Constraints and Output Expected

S/N	Potential for African market development	Constraint to be overcome	Output Expected
1	**Domestic and Export Targets**	Tax laws, policy instruments and market factors that discourage investment in *Jatropha curcas* RE	**27.79 billion barrels** of Jatropha biofuel [calculated from 2/3 of total uncultivated land area of Africa]
2	**Climate Suitability**	Solar radiation constraints occasioned by climate change	**300W/m^2** of solar radiation annually
		Poor rains occasioned by uncertain hydrology linked to climate change	**400-900mm** of rainfall annually
3	**Energy Intensity Ratio** [Definition: Energy intensity is a measure of the amount of energy it takes to produce a dollar's worth of economic output.]	Overcoming constraints to increase in access to energy for productivity by enhancing energy capital, rural electrification via biofuel industries	Shift from **$1889.00 (2006) to [$10,000.00 - $30,000.00]**
4	**Land Area For Cultivation**	Improving the land quota allocated for cultivation of *Jatropha curcas* RE	**20,214,086.67 sq. km** of Africa's uncultivated land should be put into productive biofuel plantations

In line with the first specific objective of assessing the parameters for the (and using the above as standards required for the) African Market Development of *Jatropha curcas* Biofuel, these results will yield as springboards to enable the uptake and upscalling of the "African Experience" of *Jatropha curcas* Biofuel Market Development: (i) Increase in GDP by over 50%, (ii) Increase in HDI thereby cruising African economies closer to middle income status, (iii) Increase in cultivable lands (for Jatropha plantations) by more than 70%, (iv) Increase in energy intensity ratio to $20,000.00.

For a 50% increase in GDP, there is need for increased 'domestic and export target' via projected demand in intensive cultivation requiring capacity building to enable producers reach their optimal performance targets. Sequel to this, there will be an increase in cultivable land by more than 70% by reviewing the land-use maps of Africa's agricultural system. This review of agricultural land-use maps remain one of the strategies to increasing perform

ance targets of bioenergy crops thereby meeting the second specific objective of the study. Energy intensity ratio will rise (to $20,000.00) when energy efficiency is achieved through optimal production techniques attained through the installation of energetic infrastructure to ease market accessibility of energy services.

Conclusion

Increase in performance targets for *Jatropha curcas* RE expectedly yielded results in 'domestic and export targets' and requiring stronger participation in cultivation, production and value chain addition and/or processes. This can be achieved only when RE service providers are trained, retrained, motivated (via tax incentives, etc.) and empowered for greater biofuel production which will reduce dependence of fossil fuels (as sources of power generation), yield socio-environmental benefits (e.g. job creation, cleaner air, etc.), and reduce poverty (through creation of productive economic activities).

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