

ENERGY COMMISSION

DRAFT

BIOENERGY POLICY FOR GHANA

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EXECUTIVE SUMMARY

Introduction

The goal of Government regarding bioenergy as enunciated in the energy sector policy is to modernise and maximise the benefits of bioenergy on a sustainable basis.

Biomass has dominant source of energy supply of Ghana. Used mainly for cooking and employing traditional inefficient technologies, biomass energy consumption in the form of woodfuel is twice as large as other energy sources, including electricity and petroleum. Over reliance on woodfuel is accelerating the rate of depletion of Ghana's forests.

Current global energy trends have focused on biofuels development and use. There is a great potential for producing crops which can be converted into biofuel in Ghana for use in internal combustion engines. This will help reduce over dependence on petroleum with reductions in GHG emissions. Biomass waste from agriculture and municipal sources also present another stream of bio-energy resources.

Biomass energy is likely to continue to dominate as a prime energy source in Ghana. This phenomenon, together with the steady development of biofuels as the emerging fuel, has spurred the interest and need to ensure the sustainable supply of bioenergy.

This policy paper, which is in five chapters, addresses the policy issues and recommendations for achieving the overall objectives of the Government in ensuring sustainability of the bioenergy sector.

Chapter one is devoted to woodfuels and chapter two dwells on biofuels. Chapter three and chapter four cover energy from biogas waste and electricity from biomass respectively while the fifth and final chapter concludes with a summary of the implementation programme.

Issues of Bioenergy

The following are the major issues and challenges confronting the bioenergy development and utilisation.

Woodfuels

Sustainability of supply is a key policy issue. This is complemented by the requirements for evolution of efficient technologies for woodfuel production and use, the substitution of woodfuels with modern fuels such as LPG, efficiency in packaging, marketing and transporting woodfuels as well as the strengthening of institutional and regulatory arrangements.

Biofuels

The policy issues are to ensure energy security, reduction in over dependence on imported oil and decreasing the oil import bill. Biofuels development also provide for wealth creation through employment and revenue generation, increase in export earning and climate change mitigation.

Energy from Biomass Waste

The policy issues are the effective management of waste, the availability of efficient and low cost conversion technology, pricing of energy produced from waste and the establishment and scrupulous regulation and enforcement.

Electricity from Biomass

The generation of electricity from wastes is a technically mature technology even though cost may be relatively high. Additionally, the collection and management of wastes, particularly municipal waste poses a serious limitation. International experiences, however, suggest that the collection and management issues could be surmounted. The utilisation of waste for electricity generation could contribute to meeting the power needs of the country in the medium to long term.

Recommendations

The following recommendations have been made in respect of the sustainable development of bioenergy sub-sector and for achieving the sector goals.

Woodfuels

To ensure sound management and expansion of the country's forests for sustainable supply of woodfuels, a series of measures were recommended. These range from education and awareness creation as well as incentives for sustainable supply, production and utilisation of woodfuel; establishment of data bases, standards and procedures for operators in the sector and greater collaboration among relevant MDAs, local authorities and traditional rulers.

With regard to technology, EC will provide technical and funding assistance; liaise with relevant institutions to improve training of artisans for the development and use of improved technologies. Licensing, public awareness on efficiency and agricultural extension officers will be employed to improve production and end-use technologies.

The streamlining of the transportation and marketing aspects of commercial production and consumption of woodfuels is also advocated.

Finally, improvements in demand side management and institutional and regulatory framework, including greater collaboration and consultation with the MMDAs would be required.

Biofuels

The sustainable and commercial production and use of biofuels will be encouraged while maintaining a balance in land use between traditional cash and food crop production and utilisation of land for biofuel crop production. The use of agricultural waste and waste cooking fats and oil as biofuel feed stock will be promoted. Fiscal incentives and favourable pricing mechanisms will be introduced

The local consumption of biofuels will be encouraged while exports will be discouraged and also the institutional framework for promoting biofuel production and use will be strengthened by forging greater industry players' collaboration.

Standards will be established and enforced and R&D will be supported to ensure sustainability and quality control.

Energy from Biomass Waste

Measures which have been outlined to offer the policy responses to Biomass Waste issues include facilitation of collection, incentives for use of industrial and agricultural and other waste, synchronisation of sewerage systems and legislation and incentives for channelling municipal waste for energy purposes.

The above will be complemented by the promotion of more efficient conversion technologies, efficient and adequate pricing of energy produced from waste as well as the establishment and rigorous enforcement of relevant legislation.

Electricity from Biomass

It is recommended that legislation be enacted to prohibit unplanned disposal of industrial and municipal waste and also the institution of feed-in-tariffs favourable for electricity generated from waste

Conclusion

Targets have been set for the various policy response strategies a roadmap developed to facilitate the smooth and timely implementation of the policy recommendations.

INTRODUCTION

Ghana has significant biomass resources that currently provide for the majority of domestic energy use. The biomass resource presents both opportunities and risks for the energy sector development in Ghana. Historically, biomass has dominated Ghana's energy supply. Assessments indicate that biomass energy consumption in Ghana, in the form of woodfuel, is twice as large as other energy sources, especially electricity and petroleum products, combined. Biomass is largely used for cooking with traditional technologies which are inefficient. At the same time, the reliance on woodfuel is accelerating the rate of decline of Ghana's forest resources.

In addition, Ghana's relatively productive crop-lands hold the potential to produce crops that can be converted into biofuel for use in internal combustion engines for stationary or mobile applications or for direct combustion. Crops, such as oil palm, cassava, etc which are already being cultivated in Ghana can be used to produce energy. Interest has also been expressed in the development of sugar cane and jatropha based biofuel. While such biofuel hold the potential to reduce dependency on petroleum and reductions in net Green House Gas (GHG) emissions, their cultivation also poses a challenge to sustainable agricultural practices and the food-fuel balance.

Biomass wastes from agriculture, forestry, food processing, and municipal sources present yet another potential stream of biomass-energy resource. Global experience has shown that while biomass wastes appear to have little or no costs, once a use for them is discovered, the resultant increase in demand will lead to increase in prices.

It is also well established that biomass resources, if well managed, provide clean and sustainable sources of energy. On the other hand if they are poorly managed they become an exhaustible natural resource. It is estimated that biomass energy will, in the foreseeable future, provide a substantial proportion of Ghana's energy supply hence the interest and the need to ensure sustainable supply of biomass fuel.

Ghana's goal is to modernise the use of biomass and maximise the benefits it receives from its biomass resources on a sustainable basis. Meeting this goal is a challenge that requires

putting in place the necessary policies, regulatory and legislative framework as well as institutional arrangements that will build on the synergies of all stakeholders.

This document provides policy recommendations and strategic interventions that will enable the achievement of the goal to modernise and maximise the benefits of biomass energy utilization on a sustainable basis.

For the purposes of this document, the sources of bio-energy supply are categorised as follows:

- (i) Forest-based woody biomass: naturally occurring trees and shrubs in the forest and farm lands;
- (ii) Agriculture-based biomass: mainly crop residues; purpose-grown biomass crops and animal wastes;
- (iii) Short-rotation wood crops grown on surplus agricultural land are included in agriculture-based category.
- (iv) Municipal wastes: solid and liquid waste;
- (v) Industrial wastes: solid and liquid waste; and
- (vi) Other Biofuel sources: other sources of organic materials for the production of liquid biofuels such as waste oil,

CHAPTER ONE

1. WOODFUEL POLICY

1.1 INTRODUCTION

Woodfuels, consisting of firewood and charcoal, constitute the most important energy forms in Ghana. It contributes about 60% of total energy consumption in the country. While woodfuels will continue to provide the bulk of Ghana's energy supply in the foreseeable future there is the need to put in place measures to deal with the negative impacts, such as deforestation and its associated impact on people's health and the environment.

On the basis of these realisations, there is the need to ensure better management of woodfuel supply particularly, from the natural forest or woodlots through effective policies in order to achieve sustainable use of the resource. To be able to develop effective policies to ensure sustainability of biomass resource the following challenges needs to be addressed:

- (i) Sustainability of sources of supply;
- (ii) Production of efficient technologies for woodfuel production and use;
- (iii) Substitution of traditional woodfuels with more modern fuels like LPG
- (iv) Efficiency in the transportation of woodfuel;
- (v) Improved packaging and marketing; and
- (vi) Strong coordination in institutional and regulatory arrangements.

Policy objectives and strategies in respect of these challenges are:

1.2 FEED STOCK: SUSTAINABLE SUPPLY AND PRODUCTION OF WOODFUEL

1.2.1 Policy Objective

- To promote and ensure sound management as well as expansion of the country's natural forest for sustainable supply of woodfuel.

1.2.2 Policy Strategies

- Prepare an inventory of woodfuel resources in Ghana

- Identify, survey, map, assess and register the potential woodfuel resource stock outside the forest reserves in collaboration with Traditional Authorities (TAs), District Assemblies (DAs) and Forest Service Division (FSD).
- Support FSD and Agricultural Extension Units of Ministry of Food and Agriculture to create awareness on the need for sustainable supply, production and utilisation of woodfuel.
- Support Non-Governmental Organisations (NGOs) and Community-Based Organisations (CBOs) to create awareness for the development and management of suitable woodfuel species.
- Encourage timber concessionaires to utilise forest and sawmill off-cuts for woodfuel production.
- Collaborate with FSD to enforce regulations on the control of fringe communities in the harvesting and sale of the woodfuel in the forest reserve.
- Enact legislation to register and licence all commercial woodfuel operators (suppliers, producers and sellers) by the DA and FSD to be given exclusive trading rights;
- Establish standards and operational procedures for woodfuel operators; (non-compliance to these would attract the necessary sanctions)
- Create, develop and maintain a data bank and resource documentation centre for woodfuel at district (DAs / FSDs), regional and national levels.
- Identify and provide incentives (financial and non-financial) for the development of woodlots in savannah and transitional zones under international funding protocols such as the Desertification Fund and Clean Development Mechanism (CDM) Fund
- The DAs should liaise with traditional authorities to educate and release land to prospective individuals (especially women) and groups for woodfuel woodlots and plantation establishment.

1.3 TECHNOLOGY: EFFICIENT CONVERSION AND UTILISATION OF WOODFUEL

1.3.1 Context

Production Technology

Traditionally charcoal-making techniques have low efficiencies. With improved charcoal-making technologies, charcoal yields could significantly increase and made more cost competitive. While some improved charcoal production technologies have been tested and demonstrated in pilot projects, the use of these technologies are limited owing to the high initial capital cost. In addition, the seasonal charcoal producers find the improved charcoal

technologies more time consuming in terms of monitoring of the production process which keeps them away from their normal farming activities.

End-use Technology

The traditional woodfuel stoves have low efficiencies and as well generate a lot of smoke in the cooking environment which leads to health hazards, especially respiratory diseases. The nationwide promotion of improved charcoal stoves such as Ahibenso and Gyapa could shave off wood demand by half. Even though the improved stove is about 20% more expensive than the traditional stoves, the expected savings on fuel cost is said to be significant to pay off on the investment of the improved stoves.

1.3.2 Policy Objectives:

To introduce:

- New and innovative ways of producing woodfuel more efficiently and cost effectively.
- More efficient but less expensive woodfuel cook stoves.
- Capacity building for improved cookstoves manufactures.

1.3.3 Policy Strategies

- Energy Commission should provide technical assistance and funding for programmes to transfer improved carbonisation technologies and higher levels of efficiency in the production, distribution and use of woodfuel.
- Strengthen through technical assistance existing institutions for testing and certification of improved production and end use technologies for woodfuel.
- Liaise and coordinate with relevant governmental and non-governmental agencies to train artisans in the production of improved stoves
- Licence or register commercial charcoal producers to enable the EC to support them to adopt improved production technologies.
- Create public awareness on energy efficiency and conservation practices and health impacts (especially on women) in the use of woodfuel.
- Provide logistical support for the Agricultural Extension Officers to expand technical assistance and the creation of awareness on the adoption of improved carbonisation technologies to charcoal producers.

1.4 TRANSPORTATION

1.4.1 Context

Charcoal and fuelwood are produced commercially far from the major consumption centres and are transported by road over distances of more than 100 kilometres.

Many of the vehicles used in the transportation of woodfuel are relatively old and very often are over-loaded thus posing great danger to other road users as well as causing deterioration of the road infrastructure. While road transport plays a very critical role in the woodfuel industry, there is the need to ensure it is done in a safe, efficient and reliable manner. In addition to the above, there are not dedicated vehicles for the transportation of charcoal.

Even though regulations exist on the use of over aged vehicles and overloading of vehicles for the transportation of goods and petroleum products there is as yet no such specific regulation for transportation of charcoal.

1.4.2 Policy Objective

To regulate the quality, quantity, and ensure safe transportation of woodfuel.

1.4.3 Policy Strategies

- EC in collaboration with other relevant stakeholders to issue conveyance permit to dealers and transporters of commercial woodfuel.
- EC in collaboration with the Motor Traffic Unit of the Ghana Police Service to compel all vehicles conveying woodfuel to conform to the appropriate regulations of the Road Traffic Act 2004, Act 683 (Road Traffic Regulation 2006) i.e. axle load, vehicle height etc.
- EC in collaboration with DA to establish a monitoring and evaluation framework for capturing relevant data relating to the transportation of woodfuel at the district level.
- EC in collaboration with Forestry Commission to put in place regulations, monitor and ensure that feedstock for export charcoal come from wood residues and/or forest plantations.

1.5 MARKETING

1.5.1 Context

In Ghana woodfuel is produced both for the local and export markets. The woodfuel supply chain consists of feedstock owners, producers, dealers/transporters, bulk sellers, retailers and

exporters. In the local market places, there are bulk and retail sale dedicated areas. Even though woodfuel is inflammable energy product there is no fire precautionary measure in place for bulk marketing and transportation.

Access to data from the key players in the woodfuel industry is a challenge. In addition significant charcoal dust is created at the point of production and bulk sales points which could be captured and briquetted. During transport some dust is also created which is blown by wind into the environment. Proper bagging of the charcoal would have to be introduced to prevent the dust from blowing into the environment.

The Energy Commission has developed a provisional regulation prohibiting charcoal and firewood produced using wood directly from the forest for export.

The major challenges confronting the marketing of woodfuel are:

- Inadequate data on woodfuel supply and demand.
- Disposal of charcoal dust.
- Improper handling and packaging
- Potential fire outbreak in bulk charcoal markets and transportation

1.5.2 Policy objectives:

- To develop a comprehensive database for woodfuel supply and demand.
- To minimise charcoal dust creation, environmental and health impacts.
- To control fire outbreaks in the production and handling of charcoal.

1.5.3 Policy Strategies

- Enact LIs and bye laws for the recycle or compacting of charcoal dust into briquettes, etc.
- Create awareness on health impacts of inhaling charcoal dust and other particulate matter and promote the use of protective mask for commercial handling of charcoal.
- Enact LIs and bye laws for improved packaging and labelling of charcoal.
- Enforce safety regulations in the production, transportation and marketing of charcoal.
- Enact regulations for sustainable supply of woodfuel to both local and export markets.

1.6 DEMAND-SIDE

1.6.1 Context

There is over reliance of woodfuel as household cooking fuel in the country. Over 90 percent of rural households depend on fuelwood for cooking. Charcoal on the other hand is the dominant cooking fuel used in the urban areas. About 61 percent of urban households use charcoal as their main fuel for cooking.

LPG use in the country on the other hand accounts for only 4-6 percent of the residential sector. This is concentrated in the urban areas among the middle and higher income groups¹. Factors such as unstable supply and inaccessible of LPG throughout the country have contributed to the bottlenecks in the widespread use of LPG. Besides these challenges in meeting the LPG demand, there is the issue of high cost of gas stove and its accessories.

1.6.2 Policy objective

To increase LPG penetration rate to 50 percent by 2015.

1.6.3 Policy Strategies

- EC should develop new policy strategies for the promotion of LPG for the residential and commercial sectors.
- EC should develop plans and programmes for the use of natural gas from the Jubilee Oil Field in the residential and commercial sectors.
- Vigorously promote the use of LPG as residential and commercial fuel.
- Improve access to LPG in the country by supporting measures aim at widening LPG distribution network to increase access for rural dwellers.
- Reduce subsidy on LPG and redirect it to subsidize LPG-related appliances for the poor.
- NPA should grant licences for more LPG filling plants to be opened in the country.
- Increase LPG production at the refinery.
- Expand production of domestic LPG cylinders.
- The Energy Commission and the National Petroleum Authority should design financial packages to support fabrication of single and double LPG burners.

¹ According to Ghana Living Standard Survey GLSS 4 (2000, Ghana Statistical Services) and the Ghana Population Census (2005, Ghana Statistical Services), LPG serves as cooking fuel for about 4 – 6 percent of households in the country; 10% households in the urban areas and only 0.6% households in rural areas.

1.7 INSTITUTIONAL DEVELOPMENT

1.7.1 Context

There is weak collaboration among the relevant institutions for the supply of biomass feedstock especially on the development of woodlots and utilisation of forest logging residue and sawmill off-cuts in the country. Institutional linkage in the research and development of efficient charcoal production and end use technologies is weak and requires strengthening. There is the need to provide formal policies and regulations to support the development of an effective woodfuel market in the country. Some the major challenges to be expected include:

- The effective monitoring of feedstock and production technologies of charcoal for export.
- Strengthen institutional linkages in the direction of policy coordination, research, monitoring and evaluation to manage the development and use of woodfuel.

1.7.2 Policy Objectives:

- EC to serve as the institution to coordinate and manage the development and use of woodfuels in the country.
- Mobilise both the private sector at the formal and informal as well as micro, small, medium and large scale levels to provide quality manufacturing of equipment and plant as well as service delivery.

1.7.3 Policy Strategies

- Provide policy guidelines for implementation of carbonisation technology as part of the management of forest concessions.
- Provide policy guidelines for incorporation as part of the management of forest concessions.
- Enact LIs and regulations on charcoal production, transportation and marketing.
- Provide funding for technical training and enterprise development services for the private sector operators.
- Intensify inspection of charcoal production, transportation and marketing facilities in consultation with Metropolitan, Municipal and District Authorities (MMDAs).

CHAPTER TWO

2. BIOFUEL

2.1 INTRODUCTION

The development of biofuel will enable Ghana achieve the following strategic objectives:

- (i) Energy Security.
- (ii) Reduce oil import bill and save foreign exchange.
- (iii) Provide an avenue to reduce poverty and wealth creation through employment generation.
- (iv) Increase export earning potential.
- (v) Climate change mitigation

2.2 Policy Objectives

The policy objectives of Government's biofuel development programme would be:

- (i) To substitute national petroleum fuels consumption with biofuel by 10% by 2020 and 20% by 2030.
- (ii) To remove institutional barriers in order to promote private sector participation in the biofuel industry.
- (iii) To create favourable regulatory climate to ensure development of a competitive market, favourable pricing regime and high quality products.
- (iv) To improve the efficiency of production technologies and techniques of biofuel with the aim of reducing costs and also raising the quality and efficacy of the product through prioritized research and development programmes;
- (v) To, in the medium to long term, become a net-exporter of biofuel.
- (vi) To reduce carbon dioxide emission.

2.3 POLICY ISSUES AND RECOMMENDED POLICIES

2.3.1 Policy Target

The policy actions and instruments needed to promote the development of the biofuel industry are focused around the above strategic and policy objectives.

The policy targets set for the substitution of national consumption of petroleum products (20%) with biofuel by 2030 may be achievable if the issues are well understood and the necessary political commitment is forthcoming and resources are available.

To achieve the targets would require strategies focusing on the following actions:

- Encouraging the commercial scale production of biofuel feedstock;
- Creating demand for biofuel; and
- Sustaining supply of biofuel.

The specific policy actions and instruments required to achieve the above actions are presented below:

2.4 ENCOURAGING SUSTAINABLE COMMERCIAL SCALE PRODUCTION OF BIOFUEL FEEDSTOCK

2.4.1 Context

Ghana is a predominantly an agricultural country with considerable experience in the cultivation of cash crops such as cocoa. The experience with the cultivation of cocoa should provide key lessons for the cultivation of biofuel. Presently, cocoa is cultivated mainly by individual farmers with the government providing technical assistance and marketing support. The current biofuel crops cultivation initiatives in Ghana involve individual farmers, farmer cooperatives and plantation operations. Land for the cultivation of biofuel crops is acquired through private negotiation with traditional landowners.

There are presently no known legislations prohibiting the acquisition of land for the cultivation of biofuel crops. The acquisition of land for biofuel crops cultivation, therefore, conforms to the normal requirements of traditional land owners for any cash crop. Government can, however, encourage traditional land owners, especially traditional rulers, to facilitate the acquisition of land for cultivation of biofuel crops. In general, it is expected that, the financial benefits, would provide the incentive to commit land for the cultivation of biofuel crops. Concerns relate to the large amount of arable land required for crops as well

as the energy and pollution balance of the whole cycle of ethanol production. Recent developments with cellulosic ethanol production and commercialisation may allay some of these concerns.

The current trend whereby certain crops such as palm fruit are being used for biofuel production is seriously contributing to food shortage on the global market. The use of land for biofuel crop cultivation should be regulated to avoid the use of fertile land for food crop cultivation.

The current observation is that foreign investors are targeting biofuel seeds for export after cultivation. However, in order to ensure job creation it is preferred that biofuel seeds will be processed into crude oil before export as a practice currently experienced in the palm oil and timber industries.

2.4.2 Policy Strategies

- Sensitise MOFA to create policies that will balance feedstock and food production.
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- Promote local consumption of biofuel and regulate export.
- Promote the use of damaged and waste agricultural produce for bioenergy production.
- Promote the use of waste cooking fats and oil as biofuel feedstock.
- Acquire lands for joint ventures with private companies who meet sustainability criteria.
- Energy Commission should liaise with the Lands Commission and National/Regional Houses of Chiefs to make land available to biofuel feedstock companies interested in farmer/outgrower-based production techniques.
- Government should give feedstock production the same support as other agricultural produce such as cocoa, cassava, oil palm.
- Government should give zero corporate tax for 10 years to be enjoyed by companies involved in feedstock production with labour-intensive methods beyond threshold levels to be determined by the Energy Commission in line with global benchmarks.

2.5. CREATING DEMAND FOR THE PRODUCT

2.5.1 Context

The biofuel programme will only succeed if there is immediate demand for the commodity. An imperative driver for sustaining the programme is for Government to create the conditions that would allow the demand of the product to grow.

2.5.2 Policy Strategies

- Energy Commission should use part of Energy Fund to create biofuels awareness and public education with active involvement of leading energy NGOs in Ghana.
- Promote the advantages of using biofuel as fuel enhancer.
- National Petroleum Authority (NPA) should promote the dispensing of biofuel blend to government vehicles, mass transportation and generating sets.
- NPA should develop strategy for all refineries in the country to consider biofuel blend.

2.6. SUSTAINABLE PRODUCTION AND SUPPLY OF BIOFUEL

2.6.1 Context

In order to develop a viable biofuel industry the supply of the products has to be sustained. Biofuel production, supply and marketing strategy should focus on the use of fiscal incentives and regulatory mechanisms that would facilitate entry into the biofuel market and also ensure the quality of the products within acceptable standards. One measure required to sustain supply of biofuel is to establish adequate storage and distribution facilities throughout the country.

2.6.2 Policy Strategies

- Create extra incentive to protect the rural small to medium scale biofuel producers.
- Establish storage and distribution facilities.
- Build enough stock to meet demand.
- Reduce the requirements and period for permitting and licensing.
- Introduce fiscal and tax incentives for the biofuel industry such as Government granting zero import duty and VAT on equipment for the processing of biofuels for 10 years and income tax reliefs for 10 years of operation for biofuel companies.
- Legislate a ban on biofuel imports.

- Energy Commission should liaise with Enterprise/Business Development Service (EDS/BDS) organizations like NBSSI and Empretec to train Ghanaian entrepreneurs to start Biofuel SMEs.
- NPA should liaise with Ghana Investment Promotion Centre to establish biofuel refineries as Public-Private Partnerships (PPPs) in each of the regional capitals in the four/five poorest regions of the country.
- EPA should facilitate development of local carbon market with linkages to international carbon markets for purchase of Greenhouse Gas Emissions Reductions from biofuel production.

2.7 INSTITUTIONAL FRAMEWORK

2.7.1 Context

In the past, attempts to nurture new industries have failed to yield the desired result because there has not been clear framework which allocated the requisite mandates to the relevant institutions. This has led to duplication of efforts and lack of direction. Framework for clear definition of an institutional responsibilities should be established for the biofuel industry. The biofuel industry could face the same problem if the institutional issues are not properly addressed. Working relationship between industry players and regulating institutions should be facilitated to encourage smooth operations and collaboration in the biofuel industry.

2.7.2 Policy Strategies

- Facilitate participation in bioenergy planning, policy formulation and implementation through workshops, seminars and meetings between bioenergy industry players, policy-makers and regulators.
- EC, EPA and MOFA should be responsible for all “upstream”² activities related to the biofuel industry. Where EC would license biofuel production and export and Environmental Protection Agency (EPA) in collaboration with MOFA would issue permit for biofuel feedstock cultivation.
- All regulatory matters on downstream activities related to biofuel supply should rest with the NPA. This would include licensing of refineries, transporters, distributors and retailers, consumer protection issues and pricing.

² “Upstream” activities refer to all activities from the feedstock production to extraction of raw oil.

- Ghana Standards Board should ensure product quality standards and certification
- Bulk Oil Storage and Transportation (BOST) should ensure the establishment of facilities for strategic stocks and bulk storage of biofuel.

2.8 PRICING AND INCENTIVES

2.8.1 Context

Ensuring cost recovery for the production and supply of biofuel is imperative if the industry is to survive. The price setting mechanism put in place for biofuel must ensure cost recovery and competitiveness with the petroleum-based substitutes. At current prices, biofuel is much more expensive than the petroleum products. For biofuel to be price competitive with petroleum products, some level of subsidies on biofuels is required. It is however important that in the process of providing such subsidy it does not impose any drain on the national economy. This could be achieved through the implementation of the following strategies.

2.8.2 Policy Strategies

- Exempt local consumed biofuel from levies and taxes.
- Impose levies and taxes on biofuel exports.
- Introduce guaranteed market price for biofuel.
- NPA should determine the Biofuel Purchase Prices for 2-year periods in advance on a rolling basis up to 2020 (possibly based on import parity/FOB or linked to projected crude oil prices) and purchases guaranteed by BOST over this period.

2.9 QUALITY OF BIOFUEL

2.9.1 Context

There is the need to ensure the quality of biofuel. To ensure that the quality of biofuel supplied to the market is of high standard, there is the need to put in place regulations to achieve quality standard in production.

2.9.2 Policy Strategies

- Develop and enforce standards on the biofuel crude.
- Review and enforce standards on locally produced biofuel and its derivatives.

2.10 RESEARCH AND DEVELOPMENT (R&D)

2.10.1 Context

Besides the cost reduction initiatives there is opportunity to build a self-reliant biofuel industry in which most of the equipment required for the production and supply of biofuel can be produced locally. To achieve this objective, there is the need to support local private sector enterprises to develop the capacity in manufacturing biofuel related equipments.

Majority of the research institution are not well equipped and resourced to undertake specialised engineering research and development in biofuel production equipments.

The conduct of R&D and other related activities for the development of biofuel, especially next generation biofuels, would require substantial amount of funds to implement. Meanwhile these activities are critical for the smooth development and sustenance of a biofuel industry. Sustained funding is required to support these activities.

2.10.2 Policy Strategies

- Prioritise and support R&D in biofuel production chain.
- Equip the research institutions to research into the production of biofuel related equipments locally.
- Allocate a portion of biofuel export levies for R&D.
- Budget funding from the GETFund on an annual basis for tertiary education and research institutions to provide research support to biofuel industry.

2.11 HUMAN RESOURCE DEVELOPMENT, SCIENCE AND TECHNOLOGY

2.11.1 Context

Sustaining the biofuel industry requires adequate capacity in engineering, science and technology development. Engineers and technicians are required to undertake all manner of engineering activities including design for equipment for production and supply, while agronomists and chemists are needed to develop the science aspects of the biofuel technology. This capacity is currently not available in Ghana in the right quality and quantity to develop and sustain a vibrant biofuel industry and has to be developed quickly.

The main issue with human resource development is how to nurture the high level of human resources and capacity that are required for the industry.

2.11.2 Policy Strategies

- Promote the study of biofuel engineering, science and technology in the country's tertiary institutions, i.e. Universities, Polytechnics and other high level institutes of learning.
- Support linkages between local organisations (educational and research institutions as well as production companies) and their counterparts in countries more advanced in biofuel technology.

CHAPTER THREE

3 ENERGY FROM BIOMASS WASTE

3.1 INTRODUCTION

Waste-based energy is derived from waste materials of municipal or industrial origin and residues from agricultural activities. Municipal wastes consist of both liquid and solid waste generated by municipalities while industrial wastes are generated from industrial activities, including residues from wood processing. Agricultural wastes are primarily residues generated from agricultural activities including crop cultivation, livestock and animal husbandry. The potential for the production of agricultural residues for energy purposes could be large. Currently millet and sorghum stalks, maize cobs, palm oil and groundnut shells and fibre, baggase, coconut husks and shells are all used as fuel.

Unlike other energy sources, waste-to-energy projects have two objectives. In addition to generating useful energy, these projects are designed to ensure safe and effective disposal of municipal wastes. It is in this respect that the exploitation of waste for energy purposes, especially municipal solid wastes, has grown in importance owing to the growing sanitation problems in large cities and towns in Ghana.

Biomass wastes of various types can be converted into heat and power. Annual generation of wood residues from logging and wood processing is estimated to be about two million tonnes. It is estimated that between 150 kg and 200 kg per capita of municipal solid wastes are generated in Ghana annually with the 10 regional capitals, together, generating over 2 million tonnes per year. Similarly, livestock and poultry wastes were estimated at about 11 million tonnes in 2009. If carefully managed and exploited, livestock and poultry wastes could be important sources of biogas production for heating and power generation.

With the growing production of wastes in the country, there is the need to continue to make efforts at exploiting wastes for energy purposes. To achieve this objective will require effective policies and strategies.

The major policy issues that need to be addressed in order to create the environment for the effective exploitation of waste to energy are as follows:

- (i) Effective collection and management of waste;
- (ii) Efficient and low cost conversion technology;
- (iii) Pricing of energy produced from waste; and
- (iv) Establishment and continuous enforcement of regulations;

3.2 EFFECTIVE COLLECTION AND MANAGEMENT OF WASTE

3.2.1 Context

Currently millet and sorghum stalks, maize cobs, palm oil and groundnut shells and fibre, baggase, coconut husks and shells are all used as fuel. The wastes are however dispersed and cost of collection is high.

The logging off-cuts and wood processing residues are also highly dispersed which results in high collection cost of this waste. There is accessibility challenge to logging off-cuts and inappropriate disposal of the wood processing residues. The solid waste in general is unsorted. There is also high cost in their collection. Above all, infrastructure for central sewerage facility for liquid and solid wastes treatment and disposal is inadequate or non existence. There is least enforcement of environmental standards for industrial waste disposal.

3.2.2 Policy Strategies

- Ministries of Food and Agriculture and the Local Government as well as the municipal authorities should establish central collection and milling points for paddy rice.
- Compel, by legislation, to dispose of the logging off-cuts and wood processing residues.
- Create incentives for logging off-cuts and wood processing residues to be used for energy purposes.
- Legislate and create incentives for the use of municipal wastes for energy purposes.
- Create incentives for the use of industrial wastes for energy purposes.
- Introduce or expand the existing centralised sewage systems.

3.3 EFFICIENT AND LOW COST CONVERSION TECHNOLOGIES

3.3.1 Context

Currently conversion technologies for agricultural, wood, municipal and industrial wastes are inefficient. Meanwhile the investment capital required to install these technologies are comparatively higher making the energy supplied relatively expensive. Another challenge with the municipal solid waste generated in the country is its high content of incombustible materials.

3.3.2 Policy Strategies

- Promote affordable and more efficient conversion technologies, including stoves.
- Legislate and create incentives for separation of wastes for energy purposes.
- Create incentives for the use of industrial wastes for energy purposes.

3.4 ELECTRICITY FROM WASTE

3.4.1 Context

There is potential for the exploitation and use of waste for the generation of electricity in many areas especially in the wood processing industry. Some biomass-fired co-generation projects have been implemented in the past.

Two key factors have hindered the exploitation of co-generation especially in the wood processing industry even though there seem to be some potential for it. First, most of the potential co-generators have access to cheaper power supply from the grid. Second, there are virtually no financial or fiscal incentives neither are there regulatory requirements that would encourage them to generate and sell electricity to the grid. Table 1 below shows biomass-fired co-generation plants in Ghana.

Table 1 Biomass-fired co-generation plants in Ghana

Name of Industry	Location	Industry Type	Capacity (MW)	Current Status
Mim Timbers	Sefwi-Wiaso	Sawmill	0.40	abandoned
STP Ltd	Kumasi	Il	1.20	operational
Samatex Ltd	Samreboi	Sawmill	0.55	operational
Benso Oil Palm	Benso	Oil palm	0.50	operational
Twifo Oil Palm	Twifo Heman	Oil palm	0.70	operational
Kwae Oil Palm	Kwae	Oil palm	2.10	stopped in 1998

Municipal solid wastes may also be converted into electricity. There is currently no such project in Ghana.

3.4.2 Policy Strategies

- Legislate against unplanned disposal of industrial and municipal waste
- Develop feed-in-tariffs favourable for electricity generated from waste

3.5 PRICING OF ENERGY PRODUCED FROM WASTE

3.5.1 Context

There is no major issue with heat generation from agricultural, wood, and industrial wastes. On the other hand it is relatively expensive to generate heat from municipal waste. It is as well relatively expensive to generate electricity from all wastes.

3.5.2 Policy Strategies

- Institute discriminatory pricing in favour of energy produced from waste.
- Develop feed-in-tariffs for electrical energy produced from waste.

3.6 ESTABLISHMENT AND ENFORCEMENT OF REGULATIONS

3.6.1 Context

Regulations for the disposal of all kinds of waste exist in the country. However, enforcement is not effective.

3.6.2 Policy Strategies

- Compel, by legislation, to dispose of the logging off-cuts and wood processing residues.
- Create incentives for logging off-cuts and wood processing residues, municipal and industrial wastes to be used for energy purposes.

CHAPTER FOUR

ROADMAP FOR IMPLEMENTATION

Table 2 shows the specific activities to be undertaken in the medium term towards the implementation of the policy recommendations made in this document.

Table 2 Road Map for implementation of Bio-energy Policy

Year	Activities	Results	Responsibility
September, 2010	Establish Bioenergy Unit within the Energy Commission to organise stakeholder consultation and develop implementation programme	This will provide enhanced institutional focus on bio-energy	Energy Commission
December, 2010	Allocate a portion of the Energy Fund each year to be used for technical assistance to bioenergy producers/equipment manufacturers and R&D	Sustainable funding source for the bio-energy industry created.	Energy Commission
January – March, 2011	Obtain Cabinet Approval for bioenergy policy recommendations	Bio-energy policy for Ghana adopted by the Government	Ministry of Energy
June, 2011	Establish a Technical Committee within the Energy Commission to address issues relating coordination between relevant agencies like MOFA, EPA, NPA, etc.	A dedicated technical committee on bio-energy available.	Energy Commission
July 2011	Organise Bio-fuel Policy Implementation Forum	Key stakeholders are sensitised on their roles regarding the implementation of the bio-fuels policy recommendations	Energy Commission
August 2011	Commence full implementation of Bio-fuel policy recommendations	Implementation of bio-fuels policy recommendations	All stakeholders
December 2011	Prepare relevant Regulations on bio-fuels for Cabinet approval	Appropriate regulations governing the bio-fuels sector prepared	NPA and Energy Commission