

# National Biofuels Policy 2010-2030



October 2010

**National Biofuels Policy**

**Ministry of Energy and Mining**

**October 2010**

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## List of Acronyms

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BOD	Biochemical Oxygen Demand
CDM	Clean Development Mechanism
CO <sub>2</sub>	Carbon dioxide
EFW	Energy-from-Waste
EIA	Environmental Impact Assessment
GHG	Greenhouse Gas
IPP	Independent Power Producer
JCS I	Jamaica Country Strategy for the Adaptation of the Sugar Industry 2006-2015 <sup>1</sup>
JCS II	Jamaica Country Strategy for the Adaptation of the Sugar Industry 2006-2020 <sup>2</sup>
MTBE	Methyl Tertiary Butyl Ether
MJ	Megajoule
MSW	Municipal solid waste
MW	Megawatt
NEPA	National Environment and Planning Agency
NGO	Non-governmental Organization
NO <sub>x</sub>	Nitrogen Oxide
OPM	Office of the Prime Minister
OUR	Office of Utilities Regulation
PCJ	Petroleum Corporation of Jamaica
PWG	Policy Working Group
REP	Rural Electrification Programme
SRC	Scientific Research Council
SWOT	Strengths, Weaknesses, Opportunities, Threats
WTE	Waste-to-Energy
UNFCCC	UN Framework Convention on Climate Change

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<sup>1</sup> Developed in 2005

<sup>2</sup> A revision of JCS I, developed in 2009

## *Acknowledgements*

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The Ministry of Energy and Mining wishes to thank the members of the Biofuels Policy Working Group for providing technical support and guidance to the development of this policy. This policy required significant input from those agencies with responsibility for agriculture and we thank all those agencies for their inputs.

The National Energy Policy 2009 – 2030 provided the overarching framework for the development of the Biofuels policy. Of note, we also wish to thank the members of the Energy and Minerals Development Thematic Working Group of the Vision 2030 Jamaica – National Development Plan Monitoring and Evaluation Process as well as the various Ministries and Agencies that assisted the process by providing pertinent data and engaging in the consultative process that is so important in national policy development.

We also wish to thank International Development Partners who are currently providing extensive support in the development of Jamaica’s energy sector and in particular our efforts at achieving energy security, diversification of the country’s energy mix and reducing the cost of energy to Jamaicans. We especially thank the United Nations Development Programme (UNDP) for the support they have provided the Ministry to facilitate the development of five sub-policies under the National Energy Policy 2009 – 2030.

## *Message from the Minister of Energy and Mining*

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Following the promulgation of Jamaica's first long-term National Energy Policy 2009 – 2030 in December 2009, I am happy to present to the nation, Jamaica's National Biofuels Policy.

I believe that this Policy will help Jamaica meet its energy targets for renewable energy which will result in significant cost savings for the country and all Jamaicans as well as improved environmental conditions. Furthermore, this Policy will assist with the revitalization of our sugar industry – one that has been a staple of Jamaica's economy for over 300 years. Biofuels production will ensure that it remains viable well into the 21<sup>st</sup> century.

The Biofuels Policy will facilitate the development of new and innovative technologies that are currently being tested and employed in countries all over the world – both the developed countries and other developing states such as Jamaica. This enhanced technical capacity and knowledge base will spread to other areas, leading to an enhanced research and development environment in our country. This will help to move the country on its path towards sustainable development.

*James Robertson, M.P.*

# Executive Summary

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This document presents Jamaica's National Biofuels Policy which is designed to achieve:

***A modern, efficient, diversified and environmentally sustainable biofuels sector that contributes to Jamaica's long-term energy security and socio-economic development***

This policy supports the implementation of the National Energy Policy 2009-2030 which seeks to provide ***“affordable and accessible energy supplies with long-term energy security.”*** The creation of this policy was a specific response to the National Energy Policy which calls for the development of the energy sector especially in areas related to renewables, diversification fuels, biofuels and waste-to-energy. This policy also will support the attainment of the vision set out in the National Renewable Energy Policy 2009 – 2030, which is expected to create a ***“well developed, vibrant and diversified renewable energy sector that optimally utilizes indigenous renewable energy resources.”***

## Overview and Context

Biofuels present an emerging opportunity in the face of rising oil prices and the increased volatility in many of the regions of the world that provide oil. Jamaica is one of the largest oil importers in the Caribbean. The country relies on oil imports for about 91% of its total energy consumption. Jamaica is an energy intensive economy and its primary challenge is to reduce the overall cost of oil imports while increasing total export earnings, for increased economic stability and foreign exchange stability.

Biofuels are derived from renewable biomass resources and, therefore, provide a strategic advantage to promote sustainable development and to supplement conventional energy sources in meeting the rapidly increasing requirements for transportation fuels. Jamaica has had over three hundred (300) years of experience in the traditional sugar cane sector, which provides access to an excellent biofuel feedstock. Biofuels can increasingly satisfy these energy needs in an environmentally benign and cost-effective manner while reducing dependence on the import of fossil fuels and thereby providing a higher degree of national energy security.

This policy defines the framework for the exploration, development and expansion of biofuels options. Key institutions in both the energy and agriculture sectors will take leading roles in the implementation of this policy. Collaboration with other sectors such as environmental management, transport, and finance also will be necessary.

## Policy Framework

The policy framework is underpinned by a **Strategic Framework** which sets out the goals, strategies and actions necessary to facilitate the implementation of the policy; and the **Institutional Framework** describes the roles and responsibilities of the various stakeholders in the energy-from-waste sector.

The Strategic Framework underpinning this policy presents four (4) goals which will contribute to achieving the vision of: *A modern, efficient, diversified and environmentally sustainable biofuels sector that contributes to Jamaica's long-term energy security and socio-economic development.*

The four goals are:

- Goal 1:** The economic, infrastructural and planning conditions conducive to the sustainable development of the biofuels sector, supported by intersectoral collaboration
- Goal 2:** Innovative and clean technologies facilitating a secure supply of biofuels into local and national distribution systems
- Goal 3:** A well-defined governance, institutional, legal and regulatory framework for the development of the biofuels sector
- Goal 4:** Jamaicans have the technical capacity and knowledge for the development, deployment, management and use of biofuels

The strategic framework presents the desired outcomes related to achieving those goals, discusses key issues and includes the short- to medium-term as well as long-term strategic directions for the government, private sector and industry. The framework has been designed to be flexible and adaptable to meet new challenges and opportunities as they arise.



## Monitoring and Evaluation

A continuous programme of monitoring and evaluation, involving relevant stakeholders from public and private sectors, will be implemented and this will be aligned to the Monitoring and Evaluation Framework that is part of Vision 2030 Jamaica as well as the Whole of Government Business Planning Process. The Ministry responsible for energy in collaboration with the Ministry responsible for environment and waste management will use several indicators to assess the effectiveness of the National Biofuels Policy in achieving the outcomes, which will form the basis for reviewing the policy and recommending any changes to the policy framework.



*Biofuels can make a significant contribution to achieving renewable energy targets, ensuring security of energy supply.*

# Section 1

## Overview and Context

# Introduction

This document presents Jamaica's National Biofuels Policy 2010-2030. This policy is one of six (6) sub-policies under the National Energy Policy 2009 – 2030 which are intended to support the achievement of the goals of the National Energy Policy which seeks to provide “affordable and accessible energy supplies with long-term energy security.” The National Energy Policy calls for the development of the energy sector, with specific emphasis on renewables, new and alternative fuels, biofuels and energy-from-waste.

The National Biofuels Policy is being developed to enable **“a modern, efficient, diversified and environmentally sustainable biofuels sector that contributes to Jamaica's long-term energy security and socio-economic development.”**

## Sub-Policies under Jamaica's National Energy Policy 2009 – 2030

- Renewable Energy Policy
- Energy-from-Waste Policy
- Biofuels Policy
- Policy for Trading of Carbon Credits
- Energy Conservation and Efficiency Policy
- Electricity Policy

This Biofuels Policy will guide the operations and processes associated with the development of the biofuels sector with specific focus on bioethanol and biodiesel. This will involve partnerships among the energy and agriculture sectors as well as linkages with other sectors such as transport, finance and planning. The Policy establishes a strategic framework – goals and a mix of short- to medium-term as well as long-term strategies to support the development of the biofuels sector.

The development of this policy was guided by a Task Force comprising representatives of key government ministries and agencies (see Appendix II for the members of the task force). The Policy also benefitted from the input of key stakeholders in the agriculture sector. This policy working group is part of the Energy and Minerals Development Thematic Working Group under the monitoring and evaluation framework of Vision 2030 Jamaica. The development process included the inputs of various stakeholders in the public and private sectors as well as from non-governmental and civil society organizations.

## Structure of the Policy

The Biofuels Policy consists of the **Executive Summary**, followed by the sections described below.

**Section 1 – Overview and Context** provides the introduction to and rationale for the policy. This section also describes the main sectors with primary responsibility for this policy: energy and agriculture and discusses key global and local issues which must be addressed to realize a successful biofuels sector.

**Section 2 – Defining the Policy Framework** presents the vision for the biofuels sector in Jamaica and the strategic framework (goals and strategies) for this policy.

**Section 3 – Implementation, Monitoring and Evaluation Framework** describes the implementation, monitoring and evaluation framework for this policy. Section 3 also includes the institutional framework for biofuels development in Jamaica.

**Appendix I** is a glossary of terms used in this policy document.

**Appendix II** lists the members of the Task Force who developed this policy.



# Background

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Biofuels present an emerging opportunity in the face of rising oil prices and the increased volatility in many of the regions of the world that provide oil. Jamaica is one of the largest oil importers in the Caribbean. The country relies on oil imports for about 91% of its total energy consumption. Jamaica is an energy intensive economy and its primary challenge is to reduce the overall cost of oil imports while increasing total export earnings, for increased economic stability and foreign exchange stability.

Jamaica has adopted a National Energy Policy 2009-2030 that calls for the reduction of energy costs to the citizens of Jamaica, to be achieved primarily through the diversification of energy supplies, increasing renewables in the energy mix, energy conservation and efficiency, modernization of the energy infrastructure, an updated regulatory framework and the overall development of the energy sector. The National Energy Policy forms an important pillar of the Vision 2030 Jamaica, which outlines the national development plans formulated by the Government of Jamaica to ensure that Jamaica chooses a sustainable development path to attain improved quality of life for all Jamaicans. The Vision 2030 states that Jamaica ***“will be the place of choice to live, work and raise families.”***

Biofuels have been given increasing importance because they form part of the multi-faceted approach that many countries are taking towards increasing energy security and reducing the use of fuel sources that pollute the natural environment. Locally, biofuels use will help mitigate against shocks as a result of persistent fuel price increases, potential disruption of fossil supplies, foreign exchange shortages, threat to energy security and a slowdown in the rate of economic development. The use of biofuels provides environmental benefits in terms of decreased greenhouse gas (GHG) emissions. The recent rapid increase in GHG emissions, due mainly to uncontrolled growth in the use of fossil fuels, and their impact on climate change have become issues of great concern locally and internationally, leading Jamaica to become a Party to a number of international agreements including the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

*The use of biofuels will help mitigate against shocks as a result of persistent fuel price increases, potential disruption of fossil supplies, foreign exchange shortages, threat to energy security and a slowdown in the rate of economic development.*

*The use of biofuels provides environmental benefits in terms of decreased greenhouse gas (GHG) emissions.*

Biofuels are derived from renewable biomass resources and, therefore, provide a strategic advantage to promote sustainable development and to supplement conventional energy sources in meeting the rapidly increasing requirements for transportation fuels. Jamaica has had over three hundred (300) years of experience in the traditional sugar cane sector, which provides access to an excellent biofuel feedstock. The sugar cane industry has a particular role to play both as a source of ethanol for use in vehicles and other fuel oil generators and through bagasse as a source of biomass for steam generation, whether as co-generation for the sugar mills or for provision to the national electric grid. The decline in sugar prices globally presents an opportunity for sugarcane diversification into a multi-product enterprise. Biofuels can increasingly satisfy these energy needs in an environmentally benign and cost-effective manner while reducing dependence on the import of fossil fuels and thereby providing a higher degree of national energy security.

As a means of climate change mitigation, biofuels present one of the few low-carbon options for the transport sector as it provides lower emissions of harmful pollutants. Along with the economic and environmental benefits, energy savings offer the potential for Jamaica to earn tradable carbon credits under the Clean Development Mechanism (CDM) and voluntary carbon markets.

The global economic recession, which began in 2008, has resulted in the closure of several of Jamaica's bauxite companies, and an increase in job losses as businesses downsize and restructure for survival. The biofuels industry provides Jamaica with a job creation alternative, at this crucial juncture, particularly aimed at rural employment and poverty alleviation. The production of biofuel feedstocks have the ability to create employment through the stimulation of the agricultural sector and the resultant fuels can be used in existing infrastructure with little or no modifications.

## Global Trends in Biofuels

Biofuels provided 1.8% of the world's transport fuel in 2008. Investment into biofuels production capacity exceeded \$4 billion worldwide in 2007 and is growing. The Global Biofuel Market Analysis projects that between 2010 and 2013, the global production of ethanol and biodiesel is projected to grow at a rate of 8 and 15.5 percent respectively. The US, Brazil and Canada have driven the ethanol industry providing 90% of the supply whereas the EU has dominated biodiesel accounting for 60%. The analysis identifies the Asia Pacific region as a major potential source of biofuels in the future given the availability of cheap feedstock.



# Rationale for Biofuels Policy

This Biofuels Policy responds to the directive within the National Energy Policy 2009-2030 and the National Development Plan Vision 2030 Jamaica to increase the percentage of renewables in the country's energy mix to reduce the nation's dependence on imported petroleum which meets approx 91% of the nation's energy needs.

The National Energy Policy has set targets for renewable energy and the percentage diversification of energy supply as presented in the table below.

Indicator	2009	2012	2015	2030
Percentage of renewables in energy mix	9%	11%	12.5%	20%
Percentage diversification of energy supply	9%	11%	33%	70%

These targets, therefore call for Jamaica to investigate various options for advancing the development of the energy sector. Increased development and use of biofuels – in conjunction with other renewable sources of energy such as wind, solar and hydro – become important considerations for the achievement of these targets and goals as set out in the National Energy Policy. Also, this Biofuels Policy will promote energy diversification which will help to enhance Jamaica's energy security.

The National Biofuels Policy provides the framework for the development of ethanol from sugar cane and further use of bagasse for cogeneration. Therefore, it provides guidance for the Jamaica Country Strategy for the Adaptation of the Sugar Industry 2006-2020, which addresses the "re-development" of the sugar industry and calls for reforms to facilitate access to new markets such as ethanol and power generation. The Country Strategy was developed in response to changes in international trading regimes that resulted in lowered prices for Jamaica's sugar exports, leading to reduced viability for that industry. Developing a biofuels focus will revitalize the 300-year-old sugar industry.

There are numerous benefits to the development of a biofuels sector in Jamaica. These benefits include:

- Generation of clean electric power
- Sustainable economic growth and development
- Job creation
- Reduced costs for users of electricity and bio-diesel



- Increased supply of biodiesel
- Increased independence and less reliance on imported petroleum
- Improved balance of payments
- Sustainable economic growth and development
- Stimulated industrial development
- Reduced greenhouse gas (GHG) emissions
- Reduced use of fossil fuels
- Ability to supply local demand for fuel grade ethanol from domestic production, since ethanol was mandated in 2009 and now replaces MTBE in gasoline
- Creation of opportunities for production of indigenous sources of energy
- Reduction of carbon emissions in line with national targets
- Improved use of land for balanced food/fodder/fuel/forestry production
- Reduced air pollution
- Promotion of rural development





# Defining the Scope for the Biofuels Sector in Jamaica

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The development of a successful biofuels sector in Jamaica will require the close collaboration of the energy and agriculture sectors. The main characteristics and management structures of these two sectors are described in this section.

## The Energy Sector in Jamaica

The development of Jamaica's energy sector shows much promise in reducing dependence on imported petroleum, lowering the cost of energy to consumers and creating a framework for better use of energy through energy conservation and efficiency by all Jamaicans, because of the promulgation of the country's first long-term National Energy Policy 2009-2030. The national policy was promulgated in 2009 to address the situation facing the energy sector of being "characterized by an almost complete dependence on imported petroleum; high rates of energy use; ... and an inadequate policy and regulatory framework."

The following provides a synopsis of the energy sector, identifying some key strengths and weaknesses. The National Energy Policy builds on the strengths and reduces many of these weaknesses.

### Strengths:

- Jamaica has a well developed power supply and distribution system with more than 90% of the population having access to electricity
- Jamaica is endowed with a very high potential for the use of renewables in the form of solar, wind hydro and biomass production
- There are diverse opportunities for co-generation

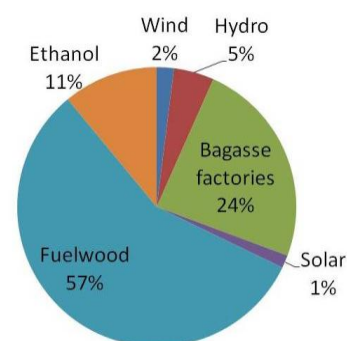
### Weaknesses:

- High dependence on imported petroleum
- High energy import bill
- High cost of electricity
- Lack of detailed and up-to-date data for determining projects for renewable energy, including biofuels
- Slow development of renewable energy resources
- Low levels of public action on energy conservation
- Weak enforcement by regulatory agencies

## Energy Use in Jamaica

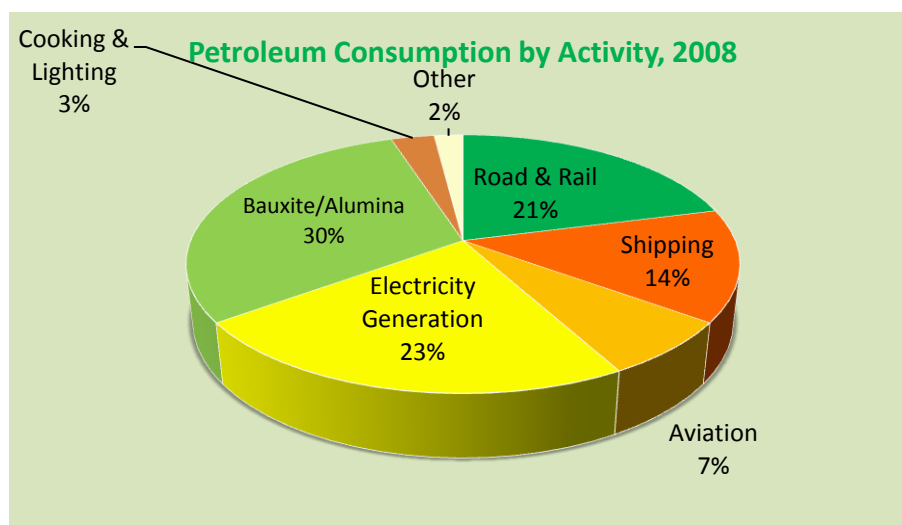
The energy sector in Jamaica is dominated by imported petroleum, which meets approx 91% of the nation's energy needs.

Approximately 9% of the energy supply mix comes from renewable sources such as wind, hydro, fuelwood, bagasse, solar and ethanol (processed from sugar cane and used as a component of E10 – a liquid fuel composed of 10% ethanol and 90% gasoline – now widely used in the transportation sector).



**Figure 1. Composition of renewable energy sources in Jamaica - 2009**

The bauxite and alumina industry accounts for 34 per cent of national petroleum consumption, while electricity generation accounts for 23 per cent. Transport is the largest consumer of petroleum in our economy, accounting for 37 percent of total petroleum consumption in 2008. The Jamaican vehicle stock currently exceeds 541,000 vehicles with over 90% using gasoline. The stock is expected to increase by 135,000 vehicles over the next ten years based on vehicle import trends. The demand for automotive fuels (gasoline and diesel oil) is growing at a rate of 4.3% per annum.



**Figure 2: Petroleum Consumption by Activity, 2008**

## The National Energy Policy 2009-2030

The National Energy Policy 2009-2030 is designed to ensure that by 2030 Jamaica achieves: **“A modern, efficient, diversified and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security and supported by informed public behaviour on energy issues and an appropriate policy, regulatory and institutional framework.”**

The Strategic Framework – the goals and strategies underpinning the National Energy Policy – addresses both supply and demand energy issues the country faces and places priority attention on seven key areas:

1. Security of energy supply through diversification of fuels as well as development of renewables
2. Modernizing the country's energy infrastructure
3. Development of renewable energy sources such as solar and hydro
4. Energy conservation and efficiency
5. Development of a comprehensive governance/regulatory framework
6. Enabling government ministries, departments and agencies to be model/leader for the rest of society in terms of energy management
7. Eco-efficiency in industries

The National Energy Policy will support the implementation of Vision 2030 Jamaica – National Development Plan, particularly National Outcome #10 – Energy Security and Efficiency and is therefore consistent with, and part of the overarching vision for achieving developed country status by 2030.

### **Management of the Energy Sector**

The Ministry of Energy and Mining has overarching responsibility for the development of the energy sector in Jamaica. The Ministry's Energy Division facilitates the development of strategies, programmes and projects to ensure the successful implementation of the National Energy Policy with a focus on the identification of new, renewable and alternative energy sources and the promotion of energy conservation and efficiency.

The Petroleum Corporation of Jamaica (PCJ) is the main implementing agency of the Ministry and focuses on implementing the energy security and fuel diversification strategies and the cost-effective availability of petroleum products.

The Jamaica Public Service Company Limited (JPSCo) is the National Electric Grid Operator and, along with several Independent Power Producers (IPPs), satisfies the electricity generation needs of the country.

The Rural Electrification Programme (REP) has responsibility for providing electricity to non-urban areas. Under the REP, 7,000 km of low voltage distribution lines were constructed and approximately 70,000 rural homes electrified. In excess of 90% of households island-wide now have access to electricity.

Currently, the Government of Jamaica owns 20% of the Jamaica Public Service Company (JPSCo) Limited. The Government has taken the decision to privatize and liberalize the electricity sector, and as a first step, all new generating capacity is being undertaken by the private sector through independent power producers (IPPs) which generate electricity for their own use (self

producers) and/or for sale to the national grid. While JPSCo retains a monopoly on the transmission and distribution of electricity, independent power providers now account for over 25% of electricity generation capacity. In 2008, total generating capacity in Jamaica was approximately 818 megawatts (MW), which included 217 MW capacity provided by IPPs.

## The Agriculture Sector in Jamaica

Jamaica's agriculture sector accounts for approximately 6% of GDP (which increases to almost 12% when the value of agriculture in ward and backward linkages is taken into account) and employs almost 20% of the country's labour force. In 2009, there were approximately 200,900 two hundred and thirty thousand farmers producing crops and livestock for domestic use and for export. Significantly, the agricultural sector plays an important role in alleviating rural poverty by transferring money from urban to rural areas.

### The Sugar Cane Industry

The sugar industry is the oldest segment of the agricultural sector, and currently engages over 35,000 employees directly, as well as another 100,000 indirectly, inclusive of approximately 9,000 independent cane farmers. In the 2008/2009 crop year, the gross value of sugar production was J\$5.56B with the export value of sugar, US\$72M, and rum US\$48.6M.

The sugar cane industry has a critical role to play in indigenous production of ethanol to meet national E10 requirements and through bagasse as a source of biomass for electrical power generation. The production of the Jamaican publicly owned sugar industry has been in a state of decline and uncertainty for the last three decades. Indigenous production of ethanol and efficient cogeneration that can provide power to the grid cannot be achieved without a viable sugar cane industry.

The sugar industry consists of two main groups of producers. One group consists of seven large estates (see Table 1) each with a mill, five of which are government-owned while two are owned and operated by local private sector interests. These estates account for 60% of the total land area in cane cultivation. As of August 2010, two (2) estates - St. Thomas and Trelawny – have been sold to private interests, and the process of divesting the remaining three (3) continues. The other group of sugar cane producers consists of over 9,600 cane farmers that represent 40% of the total land area in cane cultivation. This



grouping includes farms up to 300 hectares in size with over 60% of these being less than 2 hectares.

**Table 1: Lands in Sugar Cane**

Location	Lands in Sugar Production (hectares)	Ownership
Long Pond, St. Thomas	1,341	Sugar Company of Jamaica
Bernard Lodge, St. Catherine	6,000	Sugar Company of Jamaica
Frome, Westmoreland	5,294	Sugar Company of Jamaica
Monymusk, Clarendon	7,900	Sugar Company of Jamaica
Trelawny	5,300	Sugar Company of Jamaica
Appleton	11,400	Private Owners
Worthy Park	3,600	Private Owners
St. Thomas	1,744	Private Farmers
St. Catherine	4,000	Private Farmers
Westmoreland	8,000	Private Farmers
Clarendon	3,260	Private Farmers
Trelawny	1,900	Private Farmers
<b>Total</b>	<b>59,739</b>	

*Source: J.P. Mukherji Sugar Industry Ethanol Study, October 2006 (Volume 2)*

### **The Jamaica Country Strategy for the Adaptation of the Sugar Industry**

Recent impetus for comprehensive re-examination of the sugar industry came from two changes in international trading regimes – the reform of the EU Sugar Regime which commenced in 2006 with a 36 percent reduction in the price for our sugar exports to the EU and the termination of the Sugar Protocol under the Cotonou Agreement, with effect from September 2009. This led to the development of the Government of Jamaica’s Sugar Adaptation Strategy, which was developed in October 2005.

The ***Jamaica Country Strategy for the Adaptation of the Sugar Industry 2006-2015*** (JCS I ) calls for the reduction in the role of Government in production and operations, re-tooling of factories and improvements in cane yields, as well as full utilization of all the possible bi-products from sugar cane. This strategy (JCS I) was subsequently revised in 2009 with the development of the ***Jamaica Country Strategy for the Adaptation of the Sugar Industry 2006-2020*** (JCS II). The revision builds upon the success of the first strategy, taking account of progress in its implementation and changing circumstances in the international and domestic environment. JCS II takes the reform of the Sugar Cane sector through to 2020 in line with the perspective of other major policy initiatives in Jamaica, continuing, on the one hand, the transformation of the industry into a fully private internationally competitive sector and, on the

other, the development of the sugar dependent areas into economically and socially vibrant and less vulnerable communities.

## Management of the Agricultural Sector

The Ministry of Agriculture has overarching responsibility for the development of the agriculture sector in Jamaica. The Ministry oversees Commodity Boards established to manage the regulation and control of specific commodity industries such as bananas, cocoa, coffee, coconut, dairy and sugar.

The Sugar Industry Authority is responsible for regulation, monitoring, arbitration, research and development and technical assistance to the sugar industry. The Sugar Industry Research Institute (SIRI) is its technical arm and has responsibility for sugar research, assessment of factories, extension services and training. SIRI's vision includes serving "a modern sugarcane industry ... and providing a secure source of renewable energy for the country's needs."

The Ministry also has oversight responsibility for statutory bodies such as the Agri Business Council of Jamaica which supports community development through improved, profitable agri-business and the Rural Agricultural Development Authority which builds the capacity of farmers throughout the country to implement better farming practices.

While the Ministry of Agriculture is responsible for livestock farms and the waste generated by these farms, the Scientific Research Centre works with the Ministry and other government agencies as well as the private sector to provide solutions for handling animal wastes using biogas technologies.

The Centre of Excellence for Advanced Technology in Agriculture (CEATA) was established in early 2010 to advance research within the agriculture sector. The principal objectives of the Centre are to: define the agricultural research agenda; to link the critical entities engaged in agricultural research; and to develop a practical model in order to provide efficient training for Extension Officers to ensure the transfer of the research findings to farmers in the field. The Centre will serve not only Jamaica, but also the Caribbean Region as a whole, in order to increase the Region's agricultural productivity international competitiveness.

# Prospects for Development of the Biofuels Sector in Jamaica

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By definition, “biofuels” describes any fuel that is derived from biomass - organic material - that is used to generate heat or electricity or exists as a liquid or gaseous fuel. Biofuels include the following:

- Bioethanol
- Biodiesel
- Biogas
- Syngas
- Wood, sawdust, grass cuttings,
- Domestic and agricultural wastes
- Charcoal
- Dried manure

The best options for biofuels development in Jamaica – based on the country’s size, economic activities, and natural environment as well as the current and anticipated development environment – are described below.

## Production of Bioethanol from Sugar Cane

Bioethanol (hereafter referred to as ethanol) is made by fermenting the sugar components of plant materials such as sugar cane. Ethanol can be used as a fuel for vehicles in its pure form, but in Jamaica it is used as a gasoline additive to increase octane and improve vehicle emissions resulting in E10 – a fuel mixture consisting of 10% ethanol and 90% gasoline. The rollout of E10 by the Government of Jamaica in November 2009 mandated the use of ethanol blended fuel for motor engines throughout the island, phasing out the use of the environmentally harmful petroleum-based Methyl Tertiary Butyl Ether (MTBE). This has created a guaranteed national market for ethanol of 70 million litres annually and provides a powerful incentive for the production of ethanol from local sugar cane.

Jamaica has nearly 30 years of experience in the production of fuel grade ethanol from imported feedstock. In recent years, feedstock has been imported from Brazil. In 2008, there were three local plants producing ethanol for the export market. Two of these were privately

owned and one is a state owned facility. The combined export capacity of the three plants was 830 million litres per annum.<sup>3</sup>

Jamaica's sugar industry is well-suited to accommodate the cultivation of "energy cane" to produce ethanol for both the domestic and export markets.

The Jamaica Country Strategy for the Adaptation of the Sugar Industry 2006-2020 outlines 2010 targets for sugar cane industry targets for raw sugar, molasses, rum and ethanol as shown in Table 2. The table reflects the cane and land requirements to produce 70 million litres of ethanol and to provide 100 percent of the molasses required for rum at the current rum production levels. Currently, approximately 50% of the molasses for rum is imported. Rum is Jamaica's highest value-added product from sugar cane and international standards of labeling require a minimum of 50% of the molasses come from indigenous sources to maintain country of origin labeling. Labeling is the most important factor in marketing and sales for spirits.

**Table 2. Summary of Sugar Cane Industry Targets for 2010**

Product	2010 Target	Cane required (tonnes)	Land required (reaped Ha)
Raw Sugar	200,000 tonnes	1,900,000	25,000
Molasses (co-product)	67,000 tonnes		
Additional molasses for rum	67,000 tonnes	400,000	5,000
Ethanol	70,000,000 litres	1,000,000	13,000
Total		3,300,000	43,000

Source: JCS I, SIA, SIRI

The sugar industry has the opportunity to conduct research and development of cane varieties that are resistant to pests, drought and other conditions. A successful example is Monymusk Public Estate, where saline tolerant varieties were grown, resulting in fields abandoned for 20 years producing more than 70 tonnes of cane per hectare.

### Production of Biodiesel

Biodiesel is made from vegetable oils, animal fats or recycled greases. Biodiesel can be used as a fuel for vehicles in its pure form, but it is usually used as a diesel additive to reduce levels of particulates, carbon monoxide, and hydrocarbons from diesel-powered vehicles. Biodiesel is produced from oils or fats using trans-esterification.

Development of biodiesel in Jamaica is in its infancy. The Centre of Excellence for Renewable Energy (CERE) is providing leadership in research and development. Castor beans and Jatropa

<sup>3</sup> Petrojam Ethanol Ltd.



have been selected for field trials due to their high oil content and production potential. The research will consider the harvest potential under prevailing climatic condition and will seek to determine the productivity of feedstock varieties on marginal lands.

Other crops Jamaica may consider for production of biodiesel include coconut (which would complement the country's existing coconut industry), sunflower (which has benefits and a rotational crop in sugar plantations) or oil palm (which has oil yields of over 5 tonne/ha and has been grown very successfully in Costa Rica for at least 20 years).

Biodiesel can be used in several different ways where 1% to 2% biodiesel can be used as a lubricity additive, which could be especially important for ultra low sulfur diesel fuels, that may have poor lubricating properties. In addition, 20% biodiesel can be blended with 80% diesel

fuel (to produce B20) for use in most applications that use diesel fuel.

Biodiesel can also be used in its pure form (B100) with proper precautions. The unqualified term “biodiesel” refers to the pure fuel – B100 – that meets the specific biodiesel definition and standards approved by ASTM International. The Bureau of Standards Jamaica is in the process of developing standards for B100 and blends B6 to B20. The existing standards for petroleum-based diesel apply for the B1 to B5 biodiesel blends.

Biodiesel can be produced economically on a small scale, obviating the need for financing multi-million dollar facilities and for organizing large numbers of farmers quickly in a common venture, and processing requires limited technical sophistication. At the same time, the market is much larger than for domestic ethanol-gasoline blending. While esterified plant oils can be blended with petroleum diesel fuel to form B5, it can also be used directly in local stationary engines and fleet vehicles, and as a refinery feedstock, without depending on a nationwide blending program, which would take time and resources to implement. Therefore, the biodiesel industry has the potential of a biodiesel industry to grow gradually, with limited capital and technology at each stage.

While the focus on biodiesel development is focused on the cultivation of feedstock crops, the potential exists to incorporate waste cooking oils in the system to generate biodiesel. The unsafe practices of cooking oil disposal pose an environmental hazard. Currently, while there are some small operations in existence, there is no national system in place for collecting used cooking oil which is usually thrown away, or poured down the drain.



**Jatropha and castor bean plants**

## Sugar Cane Cogeneration

Electricity generation from cogeneration facilities depend very much on the choices of process and technology characteristics. Bagasse output was an estimated 402,376 tonnes in 2009 which is equivalent to about 741,630 barrels of oil. Studies developed in Jamaica indicate that for different scenarios, the potential interconnection of sugar cane cogeneration to the grid could be in the range of 220-300 GWh per year including projects to be developed in all factories in the country. A study developed by Gibson Energy indicates that Sugar Company of Jamaica mills could produce up to 94 MW and 266 GWh of electricity to the grid during the harvest season. This in turn could mitigate up to 221,844 tonnes of CO<sub>2</sub> per year.

## Production of Biogas using Animal Wastes

The Scientific Research Council has been involved in the development of biogas plants using animal wastes in the agricultural, small manufacturing, educational and residential sectors. A total of 250 of these plants are in operation across the island, though cultural barriers are still to be broken in order to gain full acceptance of biogas as a fuel for cooking. The National Energy-from-Waste Policy governs the production of biogas from animal wastes.

## Advanced Biofuels Production

Although still in the early stages of research and development, the climatic conditions of Jamaica for biomass production has potential for advanced technologies to use other hydrocarbons providing a wide range of fuels and co-products. For example, with advanced technology being developed, cellulosic biomass, such as trees and grasses, can be used as feedstocks for ethanol production. Also, as microbial technologies for cellulosic conversion develop, direct conversion of bagasse to ethanol will most likely become economically viable. Additionally, options can be pursued for creating biodiesel from oils produced from algae, fungi, bacteria, moulds, and yeast.

# SWOT Analysis of Biofuels Sector

For the biofuels sector in Jamaica, the identification of strengths and weaknesses represents the internal assessment of the sector while the consideration of opportunities and threats represents the analysis of the impact of the external environment on the sector. The SWOT analysis, along with the issues and challenges and the profile of the agriculture and energy sectors presented above, form the basis for identifying goals and strategies that will be employed to apply the strengths and address the weaknesses of the sector, and capitalize on the opportunities and mitigate the threats for the long-term development and sustainability of the sector. The SWOT analysis for Jamaica's biofuels sector is presented in the matrix below.

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>E10 mandate in November 2009</li> <li>The existence of three well-established firms in ethanol dehydration along with ethanol production capacity and experience</li> <li>The proximity to US market and the current trade relations that exist with the CBI</li> <li>The access provided under EPA for incentives for the external market</li> <li>Land availability</li> <li>Technical assistance from regional institutions (ECLAC, CARICOM, OAS, Republic of Brazil and the U.S. Embassy)</li> <li>Bi-products – pharmaceuticals, fertilizers, cosmetics and health products</li> <li>Feedstock options would not impact greatly on food supply</li> <li>National Energy Policy 2009 – 2030 provides focus</li> <li>Resources and climate</li> <li>Over 300 years of know-how on sugar cultivation</li> <li>Existing institutions and agencies</li> </ul>	<ul style="list-style-type: none"> <li>Depletion of soil due to cultivation practices.</li> <li>Deficient land use policy</li> <li>Lack of adequate infrastructure and efficient sugar production facilities</li> <li>Shortage of skilled labour</li> <li>Lack of infrastructure and inadequate financing</li> <li>Resistance from large marketing (oil) companies make business more difficult</li> <li>Limited local specialized expertise and knowledge (biodiesel production)</li> <li>Low public awareness of biofuels as compared with traditional fuels</li> <li>Increasing cost of irrigation water</li> <li>Inadequate policy and regulatory framework</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>Idle lands and the changing sugar market</li> <li>Availability of new technologies and developments</li> <li>Local availability of raw materials for biodiesel</li> <li>Potential to produce and sell excess electricity to the grid</li> <li>Volatility in energy costs</li> <li>Potential financial resources via Clean Development Mechanism along with carbon trading incentives to boost infrastructure /plant construction. Environmental benefits linked to the reduction in carbon emissions and surface covering</li> <li>Potential for improved pricing regime for biofuels industry</li> <li>Diversification of agricultural and process skills base</li> <li>Diversification of sugar-cane industry and the fuel mix</li> <li>Increased employment opportunities</li> <li>Increased private sector participation</li> <li>CBI and tri-lateral agreement</li> </ul>	<ul style="list-style-type: none"> <li>Potential loss of unskilled jobs because of mechanization</li> <li>The existence of possible antagonists – Lobby groups.</li> <li>The food security challenge</li> <li>Climate change and associated floods, hurricanes, droughts etc.</li> <li>The potential to meet market demand</li> <li>Competing national priorities, for example housing, health, education roads etc.</li> <li>Inadequate marketing arrangement for raw material</li> </ul>

# Key Issues in the Biofuels Sector

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The National Biofuels Policy addresses a number of key global and local issues that are related to the development of a successful biofuels sector. These issues are described below and are addressed by strategies associated with each goal of this policy.

## Land and Water Use

A critical part of sustainable agriculture is to ensure that we have a clear policy on arable land usage. For too long our most arable lands have been unaccounted for and subject to inactivity due to lack of information or delinquent leases. The current system of leasing arable lands tends to be ad hoc and leaves too much to the discretion of the lessee.

In addition, while it is estimated there are approximately 200,000 ha of agricultural lands, there are many competing interests for these lands, resulting in significant amounts being converted to non-agricultural use. The most fertile level lands are also the most desired by developers. Preserving agricultural lands for food and bio-energy production will benefit Jamaicans for generations to come. Also, there are large amounts of agricultural lands are marginal for food crops, but could be utilized for biofuel feedstock production.

Water availability is an issue in many areas where sugar cane is grown using irrigation sources from aquifers. The degradation of upland watershed continues to reduce availability of irrigation water. The Ministry of Energy and Mining (MEM), Ministry of Agriculture (MOA) and National Environment and Planning Agency (NEPA) have a common interest in preserving agricultural lands and ensuring the best sustainable use of resources.

## Food Security

“First-generation” biofuels are made from sugar, starch, vegetable oil or animal fats using conventional technology such as fermentation. The basic feedstocks for the production of first generation biofuels are often crops such as corn or wheat which could instead enter the animal or human food chain. On a global level, as the population has risen, their use in producing biofuels has been criticised for diverting food away from the human food chain, leading to food shortages and price rises. Jamaica’s use of sugar cane and other crops such as jatropha does not raise the same issue of diverting vital foodstuffs from human consumption. However, use of valuable agricultural land to produce biofuel feedstocks could divert land away from growing food crops for the national and export markets which would contribute to reduced food security.

## **Deforestation and Biodiversity**

Any land use policy that advocates increased use of land for production of a select type of crop must be cognizant of the possible effects on biodiversity. It will be important to ensure that forested areas are not cleared to provide space for agricultural development.

## **Current and Future Technology**

Climate and experience with sugar cane production give Jamaica unique opportunities for primary ethanol production. However due to limitation in the availability of good crop lands resulting in small-scale feedstock production, ethanol production will have to be produced in a cogeneration system to be viable. In the long term, advanced microbial technologies for cellulosic conversion which effects direct conversion of bagasse to ethanol will most likely become economically viable. Although still in the early stages of research and development, the climatic conditions of Jamaica for biomass production has potential for advanced generation hydrocarbons providing a wide range of fuels and co-products produced from a wide range of feedstock grown on different type of soil and under different rainfall regimes.

## **Processing Plant and Independent Power**

Sugar cane mills in Jamaica date from the early 20<sup>th</sup> century and consequently, their energy efficiencies are low. Plants in the public sector also have very low operating availability. Many other sugar cane growing countries have modern sugar mills that produce and sell excess electricity both during the sugar cane milling season and outside of this season. The great dependence of Jamaica on imported petroleum results in high cost of electricity. Jamaica could benefit from the lower or equal cost excess electricity that upgraded sugar mills could produce and sell to the national grid.

## **Incentives and Requirements for Privatization for Ethanol**

The Jamaica Country Strategy for the Adaptation of the Sugar Industry 2006-2020 (JCS II) anticipates privatization of the five publicly held estates will provide the financial resources and management needed to increase cane yields and rehabilitate the factories. However, the tenders for the bidding firms place no requirements on development of ethanol or cogeneration capacity for the grid. The evaluation team should consider the national interests of bio-fuels and cogeneration from an indigenous renewable source (bagasse) in reviewing the proposed business plans of this divestiture. The Ministry of Energy and Mining needs to be proactive in working with the new estate owners in discussing their business plans for providing electricity to the grid from cogeneration from bagasse and supplemental fuels (e.g. cane trash or energy crops) and construction of ethanol production facilities. Furthermore, it must be

ensured that the new owner will indeed operate an efficient, successful plant. As a part of the divestment strategy, viable production enterprises need to be established showing financial indicators such as IRR, NPV and ROI for the various entities.

## Pricing Regimes

The pricing structure for cane has not been reviewed since 1987. The current structure is based on sugar. Revenues for sugar and molasses between field and factory is currently split 62:38 respectively. A government Commission of Inquiry is reviewing the current pricing formula. Consideration needs to be given to an equitable revenue sharing that takes into consideration the multiple co-products and promotes national interest of a stable sugar cane industry and promotion of renewable energy resources. Preliminary recommendations from the Commission indicate that it agrees that issues related to ethanol and cogeneration need to be reflected in the pricing regime. However, as stated in its draft report, the Commission is of the view “that these matters of refining the formulae for payment of cane ... are not properly matters to be handled by a Commission of Enquiry. This Commission ... [believes] that the SIA, as regulator, ... ought properly to be spearheading the process of continuous review of the cane payment formulae. ... This Commission recommends that the SIA use its regulatory authority to adjudicate on cane pricing matters on an on-going basis, whether through a rejuvenated Cane Prices Committee or other appropriate structure determined by the Authority.”

While OUR encourages production of renewable energy that includes some certainty of a market for electricity and price certainty, there is no equivalent regulatory arrangement that provides certainty of market or price predictability to a domestic producer of ethanol. Jamaica currently requires the national petroleum company to acquire ethanol to meet the E10 requirement competitively on the open world market. The implication is that Jamaican producers, with no special access to the national market, will also sell into the international ethanol market, with only a logistical advantage at home. Since ethanol may enjoy subsidies in other countries, overseas sales could be an advantage to the country. On the other hand, investors in ethanol production will need adequate assurance that their product can be sold over an extended period of time at an acceptable price, assurance that may not be possible to obtain from foreign buyers.

## Increasing Cane Production and Replanting Cane Fields

The thrust of the Jamaica Country Strategy is to introduce private capital to address the technical inefficiencies and lack of market responsiveness of the existing industry. Key statistics in Table 3 indicate average cane yields for key years ranging from 38.3 to 67.85 tonnes/ha. Private estates such as New Yarmouth achieve yields of 100 to 115 tonnes/ha. Impressive

results have also been achieved at Monymusk on cane lands that had previously been abandoned due to salinity issues. Through improved irrigation management and variety selection these previously abandoned lands have yielded in excess of 70 tonnes/ha.

**Table 3: Key Statistics in Key Years 1994 - 2008**

		1994	1996	1999	2005	2008
<b>Cane production</b>	(tonnes)	2,449,865	2,623,915	2,306,835	1,368,730	1,652,048
<b>Sugar</b>	(tonnes)	220,350	237,943	204,200	124,570	140,872
<b>- TC/TS</b>		11.12	11.03	11.30	10.99	11.73
<b>Area Reaped</b>	(hectares)	39,158	38,672	37,646	35,739	29,890
<b>- Cane/ha.</b>	(tonnes)	62.56	67.85	61.28	38.30	55.27

Notes: significance of years:

1994 - year of previous privatisation of the industry;

1996 - progress under private ownership;

1999 - year of return to state ownership of SCJ estates;

2005 - formulation of JCS (I), figures affected by impact of Hurricane Ivan in 2004 followed by a drought over the 2004/5 growing season;

2008 - last full year of data.

Source: SIA website

Cane fields have not been replanted when needed to maintain yields. Less than 5% of the fields are replanted annually on the public estates. Replanting the majority of land is the first priority to improve yields. The Sugar Industry Research Institute is developing multipurpose cane and high fiber varieties for Jamaica's current and anticipated industry needs.

## Environmental Considerations

Sugar cane is recognized as having the highest energy balance of any crop used for ethanol production. The ratio of energy produced to fossil fuel used as an input to the supply chain is 8.3 compared to corn ethanol at 1.4. Jamaica is fortunate to have a sugar cane industry but needs to be diligent in addressing environmental concerns in the production and processing operations. Efforts to increase irrigation and fertilizer efficiency, disease and pest resistant varieties and mulching are all best management practices that will conserve water, reduce chemical applications, and reduce soil erosion.

Cane leaves and cane tops are a valuable source of renewable energy and, subject to correct preparation, use and boiler design, can be used to extend the quantity of bagasse available for energy production. When a portion is left in the fields, this residue provides a good mulch which improves soil fibre content and reduces loss of moisture – which will not happen when the current practice of burning cane fields occurs. This practice needs to be phased out. This practice also reduces the biomass available for energy generation and produces airborne



pollution in the form of fine particulate matter as well as releasing nitrous oxide and carbon dioxide both of which are greenhouse gases. Education on this issue needs to be supported by regulatory enforcement and penalties for violation. Moves towards green cane harvesting will eliminate this problem.

Water pollution is also an issue. The effluent from sugar mills and alcohol/ethanol distilleries has high BOD/COD and should not be released to streams. When stored in open lagoons it releases methane, a GHG that is 21 times more potent than carbon dioxide. Even when used as a raw source of nutrients, its use is limited and during heavy rainfall can create pollution in water bodies. Pretreatment using either covered lagoons or large tanks has been found in many countries to be a cost-effective way to both treat the raw effluent and produce and capture methane rich biogas. The biogas can be used as a supplemental fuel in the plant boilers or, more efficiently in reciprocating engines to produce electricity.

In order to contribute to Jamaica's environmental goals, the sugar cane industry has developed an Environmental Code of Practice in collaboration with the National Environment and Planning Agency that covers all areas of its operation which have potential negative impacts on the environment, including field and factory operations, product handling and storage, and support services.

### **Efficient Irrigation Drainage and Fertilizer Application**

Measures to improve yields of biofuels feedstock crops will likely increase the amount of land under irrigation. Replacement of furrow irrigation systems with efficient center pivot and drip irrigation technologies combined with best management practices for fertilization and irrigation scheduling can maximize yields while reducing per hectare water and fertilizer inputs. Vinasse from ethanol facilities can reduce fertilizer costs, but needs to be administered carefully to prevent groundwater contamination. Preferably it will be treated by anaerobic digestion to obtain biogas while reducing BOD by 90%. A cost benefit analysis should be conducted on an individual irrigation system basis. Analyses will be required for all phases of production from land clearance and/or preparation through to delivery and processing at the factory. The cost effectiveness including efficiencies of each operation/input should be clearly established.

### **Increased Mechanization and Cane Transportation Logistics**

As yields increase and availability of hand labor continues to decline, mechanization becomes essential. Mechanization has been constrained by farmers' small land holdings and estate fields configured in small blocks. Small-scale inexpensive cane mowing machines can speed up harvesting and semi-mechanize harvesting. Due to the place of sugar farming in Jamaica's



economic and social landscape, actions to address displaced workers are critical. These are identified in the Jamaica Country Strategy.

Cane cannot be efficiently transported to mills without adequate roads and infrastructure. Cane roads have been neglected and are in serious need of repair. Road repairs will reduce transportation maintenance costs, reduce fuel costs, and improve road safety. Cane Enhancement Funds are available for road improvements, cane replanting and efficient irrigation technology.

## **Climate Change and Greenhouse Gas Emissions**

Climate change is caused by the emission of greenhouse gases (GHGs) such as water vapour, carbon dioxide and methane into the atmosphere and the removal of carbon-sequestering trees and other plants. The combustion of fossil fuels and production of methane from landfills and agricultural activities cause the highest levels of greenhouse gas emissions. Methane has a heat-trapping effect in the atmosphere that is 21 times stronger than that of carbon dioxide emitted from fossil fuel combustion. Besides the reduction in CO<sub>2</sub> emissions from avoided use of fossil fuels, the biofuels sector also offers substantial advantages to Jamaica in terms of reducing GHG emissions since the areas of land kept under vegetation act as carbon sinks, removing CO<sub>2</sub> from the atmosphere.

## **Carbon Credit Trading**

Jamaica is a Party to the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol that set the overall framework for intergovernmental efforts to stabilize the concentrations of greenhouse gases (carbon dioxide and methane in particular) in the atmosphere. As a non-Annex 1 (developing country) party to the Protocol, Jamaica is not bound by specific targets for reductions in greenhouse gas emissions.

The Kyoto Protocol introduced the Clean Development Mechanism (CDM) as a trading regime that would allow Annex 1 Parties to implement project activities to reduce GHG emissions (or GHG removal by sinks) in non-Annex 1 Parties. Eligible projects under the CDM fall under several categories including renewable energy, diversification of fuel sources in areas such as transportation. There are specific biofuels CDM project opportunities for Jamaica in the areas of bagasse co-generation and the development of bioethanol and biodiesel. Jamaica's Policy for the Trading of Carbon Credits addresses this issue in detail.

## Section 2

# Defining the Policy Framework

# Strategic Framework for the Biofuels Sector in Jamaica

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## The Vision for the Biofuels Sector in Jamaica

This Strategic Framework underpinning the National Biofuels Policy 2010-2030 is designed to accomplish the vision of:

*A modern, efficient, diversified and environmentally sustainable biofuels sector that contributes to Jamaica's long-term energy security and socio-economic development*

This vision guides the creation of a biofuels sector that will provide long-term local ethanol and biodiesel supplies, electricity capacity from cogeneration and energy from other biofuels to meet the country's energy demands, strongly supported by public participation and an appropriate policy, regulatory and institutional framework.

## The Strategic Framework

The Biofuels Policy addresses three goals of the National Energy Policy 2009-2030:

- **Goal 3:** Jamaica realizes its energy resource potential through the development of renewable energy sources and enhances its international competitiveness and energy security whilst reducing its carbon footprint
- **Goal 4:** Jamaica's energy supply is secure and sufficient to support long-term economic and social development and environmental sustainability
- **Goal 5:** Jamaica has a well-defined and established governance, institutional, legal and regulatory framework for the energy sector that facilitates stakeholder involvement and engagement

Also, the Biofuels Policy falls within the framework of the National Renewable Energy Policy and has links to the National Energy-from-Waste Policy and the National Policy for the Trading of Carbon Credits.

The Biofuels Policy is consistent with *Vision 2030 Jamaica: National Development Plan* and directly supports the achievement of the following National Outcomes:

- **National Outcome 10: Energy Security and Efficiency** through the implementation of the national energy strategy: to diversify the energy supply

- **National Outcome 14: Hazard Risk Reduction and Adaptation to Climate Change** through the national strategy to contribute to the effort to reduce the global rate of climate change
- **National Outcome 12: Internationally Competitive Industry Structures** through the transformation of the Agricultural sector to focus on high value production and contribute to national food security.

The strategies identified in the Biofuels Policy are consistent with those presented in the Sector Plans for Energy and Agriculture under Vision 2030 Jamaica as well as the Jamaica Country Strategy for the Adaptation of the Sugar Industry 2006-2020. Also, this Policy will be linked to the National Transport Policy which is currently under revision.

The Strategic Framework will be sustained to 2030 and beyond yet be flexible and adaptable to meet new challenges and opportunities as they arise. The framework specifies short- to medium-term as well as long-term strategic directions for the government, private sector and industry as well as civil society. The strategies take advantage of the strengths and opportunities and seek to overcome the weaknesses and threats for the biofuels sector as presented in the SWOT analysis in Section 1. Also, the strategies address the local and global issues described in Section 1.

The vision and strategic framework of the Biofuels Policy reflect the input of the Biofuels Task Force charged with the responsibility of developing this policy. Appendix II lists the members of this task force.

## Goals of the National Biofuels Policy

There are four (4) goals in this policy which, when achieved together, will realize the vision of providing ***a modern, efficient, diversified and environmentally sustainable biofuels sector that contributes to Jamaica's long-term energy security and socio-economic development.***

- Goal 1:** The economic, infrastructural and planning conditions conducive to the sustainable development of the biofuels sector, supported by intersectoral collaboration
- Goal 2:** Innovative and clean technologies facilitating a secure supply of biofuels into local and national distribution systems
- Goal 3:** A well-defined governance, institutional, legal and regulatory framework for the development of the biofuels sector
- Goal 4:** Jamaicans have the technical capacity and knowledge for the development, deployment, management and use of biofuels

## Goal 1

### **The economic, infrastructural and planning conditions conducive to the sustainable development of the biofuels sector, supported by intersectoral collaboration**

The further introduction of biofuels will depend on the existence and availability of appropriate infrastructure. Achieving this goal will ensure that existing infrastructure is retrofitted or refurbished, new infrastructure is built to facilitate and expand capacity in line with renewable target, and our systems can handle the physical transportation and possible environmental and human health hazards that may be associated with more widespread use of biofuels across the island.

This goal involves the establishment of a national enabling environment for the development of the biofuels sector. The focus will be on establishing the national and sectoral systems within which biofuels developers and implementers will function and the incorporation of biofuels initiatives within the relevant components of the national energy system such as the electricity grid and transportation fuel distribution. This will include creating opportunities for private sector investment as well as public-private sector partnerships.

### **Strategies and Actions for Goal 1**

- Create an enabling environment for private sector investment for the biofuels sector
- Develop government industry partnerships that consider tax incentives, net metering and power wheeling, carbon trade policy, and low interest loans to create a viable business platform for sustainable indigenous biofuels production
- Explore the implementation of tax credits tied to efficiency targets for biofuels production plants
- Provide incentives that encourage the parallel development of sugar, molasses, ethanol and cogeneration for own use and to supply excess electricity to the grid in the sugar cane industry
- Leverage diplomatic relations with trading partners to ensure that the existing trade agreements are maintained or improved to our benefit
- Align biofuels initiatives with the Clean Development Mechanism (CDM) to facilitate the sale of carbon credits
- Finalize and adopt standards for the formulation of B100 and pursue development of standards for other biodiesel combinations such as B5

- Establish national and local systems to facilitate the sale of liquid fuel generated from biofuels
- Retrofit service stations to facilitate the dispensing of biodiesel
- Create a framework for net metering that allows electricity produced from biofuels facilities to be sold to the national grid
- Assess the infrastructural requirements for the transportation of biofuels across the island
- Develop port and land-based storage facilities at strategic locations across the island to reduce the frequency of transporting biofuels across the island
- In order to reduce harvesting and cultivation costs of sugar cane lands used for biofuels production, promote the development of alternatives for sugar cane farmers with farms below a certain size to be helped to find alternative crops that are economically more attractive. To determine the size below which alternative crops should be encouraged, undertake a full country assessment of land use combined with land ownership. This will allow a better estimate of the total land suitable for sugar cane and the selection of viable block sizes.
- Develop protocols for handling local spills, leakages and other hazards associated with biofuels that are consistent with those developed for renewable energy as a whole
- In the process of divesting government-owned sugar estates, include stipulations in the estate sales agreements binding the new owners to production of ethanol and power
- Meet with new factory owners and estate management to assess business plans for ethanol production, power generation for sale to the grid and timelines. Evaluate national indigenous production goals and revise as needed.
- Determine appropriate pricing regime for sugarcane to act as an incentive for increased production and a multi-product industry

### Key Implementing Agencies and Partners

- Ministry of Energy and Mining
- Ministry of Agriculture
- Ministry of Transport and Works
- Petroleum Corporation of Jamaica
- Office of Utilities Regulation
- Office of the Prime Minister

- Ministry of Finance and the Public Service
- Jamaica Public Service Company Ltd.
- JAMPRO (Jamaica Trade & Invest)
- Bureau of Standards, Jamaica

## Goal 2

### Innovative and clean technologies facilitating a secure supply of biofuels into local and national distribution systems

Under this goal, Jamaica will be able to implement a key aspect of its renewable energy policy by ensuring that it has identified high quality biofuels feedstock. The country will have to ensure that biofuels sources are adequate to provide stable energy supplies that are consistent with end-user demand and that do not jeopardize local food security or human and environmental health. Increasing the portion of energy obtained from biofuels will contribute to the achievement of Jamaica's targets of renewables in the total energy mix of 11% by 2012, 12.5% by 2015 and 20% by 2030.

Over the medium to long term, biofuels development is expected to ensure reduced dependence on fossil fuels for energy consistent with available commercially viable technological advances that are affordable to the end-user.

### Strategies and Actions for Goal 2

- Utilize a systems approach to feedstock production that addresses:
  - Feedstock development and production
  - Logistics/material handling
  - Infrastructure
  - Processing- products and co-products
  - End-use
  - Waste management
- Introduce and enforce effluent discharge standards at sugar mills and distilleries and biogas facilities
- Manage final waste generated in the production of biofuels to minimize potential adverse impacts on health and the environment
- Adopt precision agriculture and real-time yield monitoring on mechanical sugar cane harvesters
- Facilitate the production of E10 towards meeting local demand and for export from locally grown feedstock through the production of ethanol from locally grown sugarcane and the modernization of the sugarcane agro-industry
- Satisfy the demand in the transport sector for the biodiesel mixture B5 through the production of locally grown feedstock and recycled vegetable oil



- Develop biofuel "packages" - including the use of biodigesters that can provide energy in the medium term - that can be implemented at the household level using biomass that avoid pollution concerns
- Promote power cogeneration from generated biomass in conjunction with bagasse cogeneration operations
- Continue assessment of extent and effectiveness of domestically and internationally produced biofuels in the Jamaican energy sector and determine the best biofuel sources for Jamaica
- Continuously review options for biofuel use that may have improved based on technological advances and integrate new advances into the public's awareness
- Facilitate the expansion of current agricultural producers to convert their biowaste/biomass into biofuels either for cogeneration or for on-selling to the grid
- Support the Government of Jamaica Country Strategy (JCS) and the Sugar Industry Research Institute in implementing strategies to increase sugar cane production while minimizing the environmental impact
- Develop partnerships in research and development for development of biofuels, including biodiesel crops and technologies, new cane varieties and production systems and cogeneration options
- Implement variety and field trials of potential crops to validate potential yields for biodiesel production under Jamaica's growing conditions, avoiding the introduction of invasive species. Crops with potential for biodiesel production other than castor and jatropha include coconut (which would tie in with Jamaica's existing well-established coconut industry), sunflower (which has benefits and a rotational crop in sugar plantations) and oil palm
- Develop demonstration pilot programs for small scale biodiesel production, trans-esterification, marketing and distribution
- Promote best agricultural practices in growing biofuels feedstock crops to:
  - Optimize the use of all available water resources between competing interests and minimize water use through more efficient irrigation/drainage systems
  - Increase yields
  - Optimize use of fertilizers
  - Minimize use of pesticides and biocides and use organic methods where feasible and cost-effective
- Promote green cane harvesting

- Conduct water and energy audits of existing sugar estates to determine the most effective way to conserve water and energy and increase efficiency
- Design and assist with development of sugar mills and ethanol plants to provide electricity to the grid year round. This will generally require some additional energy to that of the bagasse. The additional energy can come from a combination of sources including biogas from effluent treatment, cane trash, energy crops and other residues

### **Key Implementing Agencies and Partners**

- Ministry of Energy and Mining
- Ministry of Agriculture
- Sugar Industry Research Institute
- Petroleum Corporation of Jamaica / Centre of Excellence for Renewable Energy
- Environmental Management Division
- National Environment and Planning Agency
- Scientific Research Centre
- Bodles Research Station / Centre of Excellence for Advanced Technology in Agriculture
- Caribbean Agriculture Research and Development Institute

## Goal 3

### A well-defined governance, institutional, legal and regulatory framework for the development of the biofuels sector

Achievement of this goal will result in a coherent policy and regulatory framework that will enable the development of a successful biofuels sector. This will require collaboration among institutions and systems related to energy, agriculture, transport, finance, environmental management and planning, among others to remove inconsistencies and create mutually beneficial policies, goals and strategies. This goal will focus also on ensuring that the institutions with responsibility for guiding this sector have the requisite capacity and protocols.

#### Strategies and Actions for Goal 3

- Develop a coordinated, integrated approach to the use of land to generate biofuel feedstocks in the context of the broader energy policy and other national plans relating to agriculture and food security
- Ensure that biofuels development is included in the formalization of the Agricultural Land Use Policy that is being developed. The policy will specify how agricultural lands are to be utilized
- Review the National Land Policy to be aligned with the Biofuels Policy to ensure that biofuels development is included in the directives for deciding optimum use of marginal or idle lands and that lands used for biofuels production do not disrupt the functioning of the local ecosystems or impact negatively on the availability of lands for food production
- Align proposed national spatial plan with biofuels policy to address issues related to land use for the development of biofuels.
- Ensure that the transportation policy facilitates the continued introduction and sustainability of biofuels in the transportation sector
- Ensure that the motor vehicle policy sufficiently incentivizes and prescribes an increased ratio of flexible fuel automobiles to regular petroleum using vehicles
- Reconcile issues related to the railways in regard to the Highway 2000 Programme to ensure access by biofuels producers to rail transport

#### Key Implementing Agencies and Partners

- Ministry of Energy and Mining
- Ministry of Agriculture
- Ministry of Transport and Works

- Office of the Prime Minister
- National Land Agency
- Office of Utilities Regulation

## Goal 4

### Jamaicans have the technical capacity and knowledge for the development, deployment, management and use of biofuels

Achievement of this goal will ensure that the country is well aware of biofuels options as alternatives to their traditional forms of energy and will require continuous demonstration of the viability and stability of the various alternatives that are being promoted to end-users as contributing to diversification of the energy mix. This goal also addresses the building of capacity among professionals in the energy and agriculture sectors regarding the development and implementation of new and existing biofuels technologies. This goal supports the enhancement of the Sugar Industry Research Institute (SIRI) as a national asset in supporting scientific input to sugar cane potential for renewable energy and the Jamaica sugar industry development and viability.

#### Strategies and Actions for Goal 4

- Support the development of early action first generation biofuels plants by setting-up a group of biofuels experts who are available to provide information about feedstock production practices, process options to maximize overall returns and related issues and to facilitate the transfer of lessons learned in other countries to help entrepreneurs in Jamaica make informed choices
- Implement a comprehensive education and outreach programme to raise awareness of biofuels among key stakeholders and to garnish support and overcome key technical and social barriers to biofuels development
- Build the capacity of the Rural Agriculture Development Agency to enable the organization to raise awareness among farmers regarding biofuels
- Provide education and technical support on following ISO 14000 Environmental Management in biofuels plants
- Increase visibility of the Sugar Industry Research Institute to potential investors and enable it to become an integral part of the national effort to develop the biofuels sector by providing guidance to farmers, supplying cultivars, and disseminating information on “best practices” from other countries
- Develop a biofuels resource registry to capture information on usable biofuels
- Seek opportunities to develop local expertise and knowledge of emerging biofuels technologies through scientific exchange, international industry and government internships, sabbaticals, and professional seminars and conferences

- Promote international and multidisciplinary research into agricultural practices and advanced biofuels production

### **Key Implementing Agencies and Partners**

- Ministry of Energy and Mining
- Petroleum Corporation of Jamaica / Centre of Excellence for Renewable Energy
- Sugar Industry Research Institute
- Rural Agriculture Development Agency
- Bodles Research Station / Centre of Excellence for Advanced Technology in Agriculture

# Section 3

## Implementation, Monitoring and Evaluation Framework



# Policy Implementation

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The Ministry of Energy and Mining will lead and facilitate the implementation of the Biofuels Policy, in collaboration with the Ministry of Agriculture and other Government Departments and Agencies, the private sector and NGOs. The successful implementation of this policy will require that linkages be made between the energy and agriculture sectors as well as other aspects of the economy and society including, but not limited to, transport, environment, finance and education.

## Institutional Framework

The key players in the implementation of the National Biofuels Policy and their roles and responsibilities are described below.

The **Ministry of Energy and Mining** will be responsible for the overall implementation of the Energy-from-Waste Policy and will provide expert advice and guidance with respect to all energy-from-waste initiatives. The **Petroleum Corporation of Jamaica**, which is an agency of the Ministry, and its **Centre of Excellence for Renewable Energy** (CERE) will be involved in facilitating the implementation of energy-from-waste initiatives.

The **Ministry of Agriculture** is responsible for the management of agricultural and will have significant responsibility for the implementation of this policy. The **Sugar Industry Research Institute** will be responsible for overseeing the ethanol development initiatives.

The **Environmental Management Division** within the Ministry with portfolio responsibility for the environment will provide expert advice and guidance on the environmental impacts of all biofuels production programmes. The Department will facilitate proposals for consideration of projects to benefit from the Clean Development Mechanism.

The **National Environment and Planning Agency** (NEPA) will have the responsibility of ensuring that biofuels production facilities operate in such a way that human health and the environment are protected from harmful emissions.

The **Office of Utilities Regulation** (OUR) will have oversight responsibility for the regulatory framework guiding biofuels initiatives. That office will protect the interest of both the consumer and investor in the provision and utilization of public utility services. The OUR will work with the **Jamaica Public Service Company** (JPSCo) to create net metering arrangements with biofuels facilities to sell electricity to the national grid.

The **Ministry of Finance and Planning** will be responsible for establishing any financial or tax incentives or disincentives for the development of the EFW sector.

**Local universities** will play a key role in keeping abreast of research in energy-from-waste technologies and the linkages between EFW facilities and impact on human health and the environment, and thus ensuring environmental sustainability.

## Implementation Framework

The strategies identified in the Strategic Framework will be operationalized by the associated implementing agencies and partners through the incorporation of specific actions in the Strategic and Operational Plans of these entities. These plans will provide detailed information on specific actions to be undertaken, the implementing agencies and partners, timelines and costs.

## Critical Pathway for Ethanol Development

To achieve the objectives for ethanol development, there is a critical pathway of actions and strategies that must occur in a specific sequence or in parallel. This proposed pathway, shown below, needs to be considered in conjunction with the action plan in the Jamaica Country Strategy.

### Critical Path Analysis of all the major tasks has to be undertaken for ethanol development

Activity	Time frame
The public sugar estate divestiture negotiating team needs to consider the national interests of bio-fuels and cogeneration from an indigenous renewable source (bagasse) in reviewing the proposed business plans of this divestiture.	Requires immediate action. Proposals were due April 2010 for the remaining three public estates.
Assess new estate owner business plans for ethanol production and power generation for sale to the grid. Meet with new estate owners and estate management to discuss construction and production timelines. Evaluate national indigenous production goals and revise as needed	2010 or within 3 months of sale of estates
Replant cane fields and install more efficient irrigation harvesting and soil replenishing systems. MOA and MEM will jointly develop a five year plan in 2010 with targets for completion	2010-2015
Improve cane roads. MOA and MEM will jointly develop a five year plan in 2010 with targets for completion.	2010-2015
Review Pricing Regime for sugar cane	2010
Environmental considerations.	2010

Address cane burning as a first priority

Institute best management practices and ISO 14000

2010-2015

## Monitoring and Evaluation Framework

The Ministry of Energy and Mining will be accountable for monitoring and evaluating the implementation of this Policy. The proposed indicators outlined in this policy represent the foundation of a results-based monitoring and evaluation system to ensure that the four goals of this policy are achieved which will, in turn, contribute to the achievement of the related goals as set out in the National Energy Policy 2009-2030 and Vision 2030 Jamaica, National Development Plan.

A continuous programme for monitoring and evaluation, conducted by relevant stakeholders from public and private sectors, will be implemented. The Ministry of Energy and Mining will conduct broad stakeholder consultations periodically to review and assess the effectiveness of the Policy using the indicators identified below as a guide. The results of the assessment including recommendations will be published in an annual report for submission to the Cabinet.

### Proposed Indicators

The proposed indicators for the National Biofuels Policy over the period 2010-2030 are presented in Table 4 below. These indicators are the building blocks of the Monitoring and Evaluation programme. Targets will be set in collaboration with the key implementation partners.

**Table 4. Biofuels Indicators and Targets**

Indicator	Baseline	Targets		
	2010	2012	2015	2030
Percentage of energy from renewable energy sources generated from biofuels				
GWh of electricity generated from co-generation and other biofuels facilities				
Volume of ethanol produced (litres)				
Volume of biodiesel produced (litres)				
Number of farmers/employees involved in biofuels production				
Land utilized for ethanol production (ha / % total agricultural land)				
Land utilized for biodiesel production (ha / % total agricultural land)				
Average biofuels feedstock yield for each				

crop (tonnes/ha)				
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# Appendices

# Appendix I

## Glossary

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### *Annex I, or Annex B*

The signatory nations to the Kyoto Protocol that are subject to caps on their emissions of greenhouse gases and committed to reduction targets – countries with developed economies. Annex I refers to the 36 countries identified for reduction in the UNFCCC while the Annex B is an adjusted list of 39 countries identified under the more recent Kyoto Protocol. Annex B countries have their reduction targets formally stated.

### *Biodiesel*

A diesel replacement fuel that is manufactured from vegetable oils, recycled cooking greases or oils, or animal fats.

### *Bioethanol*

### *Biofuels*

Biofuels are renewable fuels made from plants that can be used to supplement or replace the fossil fuels petroleum and diesel used for transport. The two main biofuels are ethanol and biodiesel. Ethanol is produced from the fermentation of sugar or starch in crops such as corn and sugar cane. Biodiesel is made from vegetable oils in crops such as soybean, recycled cooking greases/oils or from animal fats. Depending on the processes used to make biofuels, greenhouse emissions from cars and fuel-powered machinery can be substantially reduced by their use.

### *Carbon footprint*

The global warming impact of human activities in terms of the amount of greenhouse gases they produce. The emissions associated with the use of power, transport, food and other consumption for an individual, family or organisation are added up to give one comparable measure in units of carbon dioxide equivalent.

### *Clean Development Mechanism (CDM)*

A Kyoto Protocol initiative under which projects set up in developing countries to reduce greenhouse gas emissions generate tradable credits called CERs, the first step towards a global carbon market. These credits can be used by industrialized nations to offset carbon emissions at home and meet their Kyoto reduction targets. The projects include renewable energy generation, reforestation and clean fuels switching.

### *Cogeneration*

The use of a heat engine or a power station to simultaneously generate both electricity and useful heat

*Greenhouse Gas (GHG)*

Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include, but are not limited to, water vapor, carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), hydrochlorofluorocarbons (HCFCs), ozone (O<sub>3</sub>), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>).

*Kyoto Protocol*

The agreement reached in Kyoto in 1997 committing developed countries and countries making the transition to a market economy (Annex I countries) to achieve quantified targets for decreasing their emissions of greenhouse gases.

*UNFCCC*

United Nations Framework Convention on Climate Change. Also referred to informally as the UN climate change convention. It is the international agreement for action on climate change and was drawn up in 1992. A framework was agreed for action aimed at stabilizing atmospheric concentrations of greenhouse gases. The UNFCCC entered into force on March 1994 and currently has 192 signatory parties. The UNFCCC in turn agreed the Kyoto Protocol in 1997 to implement emission reductions in industrialized countries up to 2012 and is currently seeking the negotiation of a new treaty to extend commitments beyond 2012.

## Appendix II

### Members of the Biofuels Task Force

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<b>Dr. Betsy Bandy (chair)</b>	Ministry of Energy & Mining
<b>Mrs. Yvonne Barrett-Edwards</b>	Ministry of Energy & Mining
<b>Mr. Adrian-Charles Stewart</b>	Ministry of Agriculture
<b>Mr. George Callaghan</b>	Ministry of Agriculture
<b>Ms Shernette Sampson</b>	Ministry of Transport & Works
<b>Ms Monifa Blake</b>	Ministry of Transport & Works
<b>Mr. Vivian Blake</b>	National Environment & Planning Agency
<b>Mr. Anthony McKenzie</b>	National Environment & Planning Agency
<b>Mr. Jerome Smith</b>	Office of the Prime Minister (Environmental Management Division)
<b>Mr. Niconor Reece</b>	Petroleum Corporation of Jamaica – Centre of Excellence for Renewable Energy
<b>Mrs. Denise Tulloch</b>	Petroleum Corporation of Jamaica – Centre of Excellence for Renewable Energy
<b>Miss Felicia Whyte</b>	Petroleum Corporation of Jamaica – Centre of Excellence for Renewable Energy
<b>Mrs. Seveline Clarke-King</b>	Planning Institute of Jamaica
<b>Mr. Richard Kelly</b>	Planning Institute of Jamaica
<b>Ms Elaine Manning</b>	Sugar Industry Research Institute
<b>Mr. Lancelot White</b>	Sugar Industry Research Institute
<b>Dr. Nilza Justiz-Smith</b>	University of Technology, Jamaica
<b>Prof. Ralph Robinson</b>	University of the West Indies
<b>Mr. Richard Walker</b>	
<b>Mr. William Saunders</b>	
<b>Mr. Brad Rein</b>	US Department of Agriculture