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Ecuador

Biofuels Annual

Ecuador Biofuel Industry, Bioethanol, Biodiesel, Production, Forecast 2012

Approved By: Emiko Purdy Prepared By: Henry Vega

Report Highlights:

Ecuador's executive branch of government, through President Rafael Correa, has been very keen on speaking up about the need for a biofuels policy and biofuels programs. However, despite the interest of the private sector as well, no biofuels policy exists at the moment. The Government of Ecuador is undertaking pilot projects to use bioethanol for the city of Guayaquil and jathropha biodiesel for the Galapagos Islands.

Post: Quito

EXECUTIVE SUMMARY

Thanks to its geographic location, Ecuador has an advantage in crops such as sugarcane, African palm, and jathropha that could be used for biofuels and renewable energy. Ecuador's private sector has shown a strong interest in investing in biofuels production, mainly in response to high petroleum prices in recent years, a new Ecuadorian Constitution that mandates a new energy structure, and environmental concerns associated with the use of fossil fuels. Ecuadorian companies have the raw materials and capacity to produce bioethanol and biodiesel. At the moment, although the private sector has continued to express interest, no significant investments have occurred because of an absent regulatory environment and the prospects of lower petroleum prices in the future.

U.S. government agencies have been working with the Government of Ecuador, as well as with private firms, in an assessment of the potential of Ecuador's biofuels sector. Ecuador is participating in the Energy and Climate Partnership of the Americas (ECPA), a U.S. Government imitative that aims at assisting countries in the Western Hemisphere to reduce their greenhouse gas emissions and improve economic growth.

POLICIES AND OVERVIEW OF THE SECTOR

Ecuador's geographic location and weather give it a natural advantage in agricultural production as crops can be grown throughout the year and luminosity is constant (12-hour days). Ecuador's executive branch of government, through President Rafael Correa, has been very keen on speaking up about the need of a biofuels policy and programs. However, despite the interest of the private sector as well, no biofuels policy exists at the moment and pilot projects undertaken by the Government of Ecuador (GOE) have not been properly executed. A wealth of information has been developed by the private sector that GOE initiatives could greatly benefit from. Projects undertaken by Ecuador's private sector using palm and jathropha oils appear to be promising. Because the development of a biofuels project requires heavy investments in research and development, some in the private sector have been willing to invest resources while the public sector has lacked the financial resources as well as the know-how to successfully produce biofuels.

Coordinating Ministry of Production is responsible for biofuels issues.

In January 2010, the Government of Ecuador launched a pilot program to mix 5 percent of bioethanol in a fuel blend to be marketed as E5 Ecopaís gasoline in several provinces. The pilot program ended in December 2011 and became a permanent initiative in January 2012. It was able to produce 160,000 liters per week through 2011 and it 2012 it aims at sourcing 500,000 liters of bioethanol per week.

Ecuador's biofuels policy fits into a larger policy framework designed to promote the development and use of renewable energies. For instance, Article 15 of Ecuador's Constitution says the State shall promote the use of clean alternative energy with low environmental impact and Article 413 indicates the State will promote the development and use of renewable energy without threatening food sovereignty.

Although Ecuador's Constitution encourages the development of renewable energy sources, in reality there is a lack of specific legislation and regulations for biofuels development and production. Authorities have focused their efforts on including the topic in several white papers. For example, Ecuador's National Energy policy addresses the need to diversify the national energy matrix, noting the GOE will encourage energy generation from renewable sources and promote research for the use of alternative renewable energy, especially from geothermal, biomass, wind, and solar sources. In addition, the National Plan of Good Living and the Agenda for Productivity, Diversification and Productive Transformation also provide economic incentives, such as tax benefits, to promote the creation of new firms in the bioenergy and biofuels sectors. The GOE has also identified biomass energy as an important component in its efforts to diversify Ecuador's agriculture/industrial base and to increase the country's generation of renewable energy.

ECUADOR'S POTENTIAL TO DEVELOP A BIOFUELS INDUSTRY

Due to Ecuador's natural advantage for agricultural production, both the public and private sectors have engaged in a series of pilot projects to develop a biofuels industry. In the private sector, a few projects

have culminated in domestically produced biodiesel that has been exported to foreign markets. According to a USAID study, Ecuador has the potential to dedicate 60.000 ha of sugarcane until the year 2025 for the production of bioethanol with an expected yield of 2 million liters per day. Regarding biodiesel, about 300,000 ha of African palm could be destined to the production of biodiesel until the year 2025 with an expected yield of 800,000 MT per year.

Government of Ecuador's Interest in Developing Biomass-based Energy

There are few projects that the Government of Ecuador has identified as potentially feasible. These projects are considerably ambitious and require technical expertise which is currently lacking in Ecuador's public sector. A summary of the most relevant ones is included below.

Project Name	Provinces	Estimated value (US\$)	Description
Bioethanol Ecuadorian Sovereignty Project	Several provinces. First stage: Guayaquil, Guayas	160 million	National project in cooperation with the Government of Brazil that seeks to install a plant for 150,000 liters of bioethanol per day
Zapotillo	Loja	140 million	Government-sponsored project in pre-feasibility stage for the production of 300,000 liters of bioethanol per day in an area of 7000 ha.
Provincial Government of Sucumbios	Sucumbíos	13 Million	Provincial government project that seeks to produce 40,000 liters of ethanol out of sugarcane planted in 2,500 ha.

There are many sources of biomass fuel available in Ecuador, including biomass derived from the production of rice, corn and sugarcane. The following table shows some examples of existing biomass that the GOE has been investigating how to use as fuel:

Product	Byproducts	Percent	МТ	
Rice	Husk	22.50	191.250	
	Broken rice	5	42,500	

Biomass Sources in Ecuador

	Rice flour	8	68,000
	Impurities	1.50	12,750
	Milled rice	63	535,500
	TOTAL		850,000
	Cane and cob	68	340,000
Com	Impurities	1	5,000
Com	Corn	31	155,000
	TOTAL		500,000
	Tops and leaves	32	176,000
	Bagasse	36	198,000
Sugarcane	Other residues	11	60,500
	Sugar and sugar products	21	115,500
	TOTAL		550,000

Note: Figures are annual as reported by Ecuador's Ministry of Agriculture

In addition, the Ecuadorian government through its Ministry of Agriculture (MAGAP) has determined volume, physical and chemical qualities of the following agricultural products:

Palm Kernel Shell: Palm oil processing plants are located in the area between Santo Domingo de los Tsáchilas and Quinindé.

Approximate annual volume: 50,000 MT

Physical-chemical properties:

- Calorific value: 16.8 GJ / kg $\,$
- Humidity 12%
- Ash 2%

Wood Chips: Sawmills are located in Quevedo, Los Rios in the coastal region and in the southern provinces.

Approximate annual volume: 20,000 MT

- Physical-chemical properties:
- Calorific value: 13.5 GJ / kg
- Humidity 20%
- Ash 0.5%

Rice husk: Rice mills are located in the coastal provinces of Guayas and Los Rios. Approximate annual volume: 20,000 MT Physical-chemical properties:

- Calorific value: 15.0 GJ / kg $\,$
- Humidity 20%
- Ash 20%

Sugarcane bagasse: Located in Guayas and Los Rios Approximate annual volume: 100,000 MT Physical-chemical properties: - Calorific value: 12.0 GJ / kg

- Humidity 10-60%

- Ash 10%

Ecuador's Private Sector Identified Initiatives to Develop Renewable Energy

Project Name	Provinces	Estimated value (US\$)	Description
ECUANOL (Ecuadorian Bioethanol) Production of bioethanol based on sugar cane and sweet sorghum	Azuay, Oro	63.3 million	Ecuanol promotes the planting of 17,000 ha of which 7000 would be sugarcane and sorghum the remaining 10,000. It aims to produce 250,000 liters a day in two distillation plants.
The alternative energy Yunguilla Valley Project	Azuay	7.1 million	Project for the production of bioethanol with 3,900 hectares of agricultural production and a daily production of 70,000 liters of bioethanol
Iancen, bioethanol	Imbabura	32 million	In the northern part of Ecuador, Iancen Sugar Mill seeks to produce 100,000 liters of ethanol per day and co- generate 6 MW. Sugarcane crops needed would be 3000 ha.
Zarate Garcia	Guayas	70 million	Proposed planting of 5,000 hectares in the area of El Empalme. The project could produce 150,000 to 200,000 liters of bioethanol per day.
Biodiesel from Castor oil plant, Torres Perez	Manabí	4.7 Million	Production of biodiesel made of castor oil plant. It would produce 6,000 liters per day in an area of 900 hectares.
BANAENERGY	Santa Elena	14.27 Million	Production of sweet sorghum as raw material for the production of ethanol, 30,000 liters per day in 1,200 ha
Asociación de Desarrollo Integral Integral	Imbabura	2.35 Million	Production of 12,000 liters of bioethanol per day from 450 ha of sugarcane.
Biodiesel Ecuador	Loja	4.9 Million	Production of 5,000,000 gallons per year of biodiesel from castor oil plant and jathropha.

BIOETHANOL AND BIODIESEL

BIOETHANOL

Production

According to MAGAP, in 2011 there were about 78,000 ha planted with sugarcane. Most of the crop is used for sugar for human consumption. There is an installed capacity to distill 185,000 liters of alcohol per day, of which slightly more than 20,000 liters per day are used for bioethanol fuel. High sugar prices are the reason low amounts of sugarcane have been used for bioethanol production.



Ecuador's Area Planted with Sugarcane

Source: MAGAP's database and FENAZUCAR

Consumption

Except for small amounts used by the Government of Ecuador's pilot project in the city of Guayaquil, ethanol consumption is negligible.

In January 2010, the Government of Ecuador launched a pilot program to mix 5 percent of bioethanol in a fuel blend to be marketed as E5 Ecopaís gasoline in several provinces. This would require approximately 500,000 liters of bioethanol per week. Currently, only about 160,000 liters per week are being supplied.

The first stage of the pilot project was started in the city of Guayaquil, Guayas province. The goal was to replace all gasoline sold in Guayaquil with Ecopaís in a period of two years, requiring a supply up to 50,000 liters of anhydrous ethanol per day by 2014 and 1.5 million liters by 2025. The pilot program ended in December 2011. The program became permanent in January 2012 with the same goals as the pilot project as the pilot program's goals were not met. The GOE has, however, come up with a price formula that seems to be more attractive to distilleries judging by their interest in selling bioethanol to the GOE in 2012. MAGAP, working with Ecuador's National Planning Secretariat (SENPLADES), has a project aimed at increasing the area planted with sugarcane to 6,000 ha until 2015. A second project involves government purchases of artisan-produced alcohol for small producers that would be commercialized through Ecuador's national oil company Petrocomercial.

BIODIESEL

Production: African Palm

The total area planted with African palm in Ecuador is 240,000 hectares, with about 200,000 ha currently being harvested. Ecuador could potentially plant up to 628,000 ha of African palm, according to MAGAP. Ecuador's private sector has the capacity to refine palm oil into biodiesel. This has been done in the past few years when oil prices reached record highs.

Based on projections from the sector in terms of production, domestic consumption and export surplus of red oil, the surplus could grow significantly and reach more than 850,000 tons of red oil in 2025. No biodiesel was produced in Ecuador in 2011.



Ecuador's Production and Consumption of Palm Oil

Source: U.S. Agency for International Development, Ecuador

Production: Jathropha

Jatropha's yields are lower than those of African palm, although it is considered an alternative to African palm due to the large amount of unused arid land where it can grow. Ecuador's private sector has identified the most suitable areas to plant this crop; however current profit estimates are not optimal yet. Research is ongoing to utilize all sub-products of converting jathropha oil into biodiesel to increase profitability. There are currently about 700 ha planted with jathropha for commercial use.

La Fabril is the only group in Ecuador producing biodiesel out of palm oil and jatropha. This group could potentially process up to 50,000 hectares planted with African palm and jathropha.

Consumption

Local biodiesel consumption is taking place only in the Galapagos Islands. Targets have been set to blend biodiesel and introduce it to the market progressively from a 3 percent mix requirement in 2014 to 17 percent by 2024. It is not clear at this time where the raw oil to produce the biodiesel will come from.

Government-owned companies such as Hidronacion are exploring the possibility of using jathropha. These targets could be fulfilled only if a feasible source of oil is identified.

U.S. GOVERNMENT AGENCIES ACTIVITIES

U.S. Agency for International Development

In 2009 USAID began a project with the Coordinating Ministry of Production to elaborate a comprehensive biofuels policy for Ecuador. This initiative did not progress and the new authorities at this Ministry are exploring alternative policies. The final proposal was presented to the Production Minister Nathalie Cely in 2011 at about the same time she was leaving the Ministry to become Ecuadorian Ambassador to the United States.

U.S. Department of Agriculture (USDA) and U.S. Department of State

Energy and Climate Partnership for the Americas (ECPA)

USDA, with funding of the Department of State has worked with the GOE and the private sector in the identification of agricultural biomass as a sustainable source of renewable energy. This program has provided countries such as Ecuador an opportunity to reduce greenhouse gas emissions and improve their economic growth, two key goals of the ECPA. Ecuador was seen as a strong candidate for USDA's ECPA biomass initiative because of its existing biomass resources, geographical advantage, its evolving policy framework, and its high level of interest.

Ecuador's ECPA Activities

DEMONSTRATION PROJECT THEME	SCIENTIFIC EXCHANGE SUBJECT AREAS OF INTEREST	U.S. STUDY TOUR SUBJECT AREAS OF INTEREST
Increasing the economic feasibility of biodiesel production from Jatropha by producing ethanol and identifying the economic benefits of Jatropha co-products	Economic and technical feasibility of water hyacinth as a biomass to be used for power generation. Exchange took place at Texas	Use of sugar cane bagasse and other biomass for electric power generation.
	A&M.	

Demonstration Project

FAS has worked with an Ecuadorian company to develop co-products from the jatropha plant in order to improve the viability and profitability of using the jatropha plant as a feedstock for biofuels. Without the additional co-products, the price of biodiesel is too low for the jathropha crop to be profitable. The Ecuadorian company has aimed to develop a process for synthesizing cellulosic ethanol from the jatropha shell which could then be used as a substitute for methanol for detoxifying the jatropha paste. After detoxifying the jatropha paste, it could be used as an alternative protein for chicken feed.

As a result of USDA/FAS coordination, scientists at the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) have proposed a methodology for supporting the company's efforts to increase their yields of cellulosic ethanol. The company is also exploring the possibility of using the jatropha plant for other co-products such as bio-insecticide, engine/machine lubricant, and biological catalysts that can be used as inputs in industrial chemical processes. At the same time, agronomists are doing field trails to improve the yields from the jatropha plant.

Scientific Exchange

In late 2011, an Ecuadorian technician participated in a 3 month scientific exchange at Texas A&M University. The research objective was to expand production and usage of water hyacinth (Eichornia crassipes), an aquatic weed, for energy. The training provided (1) information on how to operate a mixed-culture fermentation process, (2) know-how to handle laboratory equipment, (3) up-to-date scientific literature, and (4) an initial assessment of the technical and economic potential for using water hyacinth for energy and biofuels. In most trials, methane content greater than 65 percent with a maximum of 71.36 percent was reached. This project is aligned to one of the 12 National Objectives of the National Development Plan of Ecuador –National Plan for Good Living. The results of this research have the potential of being used by generator units near the reservoirs of Ecuador's largest hydroelectric plant.

U.S. Study Tour

In late 2011, a group of Ecuadorians including delegates from the GOE and the sugarcane industry traveled to Florida. They visited the facilities of the University of South Florida Polytechnic in Lakeland, Florida. They looked at the research facilities for chemical and microbiological analysis of biomass to produce ethanol. The delegation also visited the USDA ARS research facility at Canal Point. In this research center there are trial plantations with varieties of sugar cane for ethanol. The delegation also visited the IFAS station at Belle Glade where

research on different biomass, among which are elephant grass, sugarcane and miscantthus, is being carried out. The visit ended with visits to the companies Climaco (biogas digesters) and sugarcane mill Florida Crystals.

PROSPECTS

At the moment biofuels and agro-energy continue to be an issue of national interest because of Ecuador's new constitutional mandate to replace Ecuador's current energy matrix with energy produced from renewable resources.

Most key players would seem to have the intention to bring this sub-sector to the next level. However, while the rules of the game remain unclear, considerable private long-term investments are not likely to occur. Ecuador's private sector is concerned about policies that support prices not set in the marketplace, export bans, or requirements to sell locally at preferential prices. Another concern of the private sector

has to do with the policies that will benefit the inefficient production of some biofuels: the government picking winners and losers.

Some have suggested the creation of special regimes and incentives that could target the use of biofuels in niche markets when either the consumer or the government is willing to pay the right price, which would be a higher price for them when fossil fuels are less expensive. For example, blended gasoline or diesel with biofuels could be marketed separately at gas stations where the consumer will have the choice to pay the real price of the product. Similarly, biofuels could be used in sensitive locations such as ecologically-sensitive tourist destinations, hospitals, or government facilities.