II. GLOBAL LANDSCAPE

1. SOUTH AMERICA

Source: World Factbook

A) INTRODUCTION

The opportunities presented by biofuels are commanding attention throughout the region. As in other parts of the world, a desire to ease dependence on petroleum-based energy sources and concern about environmental degradation are driving much of this interest. There is also a strong desire in South America to increase the economic returns of the basic agricultural commodities on which much of the region relies. These combined pressures have prompted various efforts to promote biofuels research and production.

Brazil clearly leads the field, and many of its neighbors look to the Brazilian model as a guide for their own development plans. In countries as diverse as Argentina, Colombia, and Peru, governments are seeking to create the infrastructure and regulatory and financial framework for the nascent industry. Private sector participation is uneven, with Argentina and Colombia leading the way.

B) GOVERNMENT POLICIES

Several common assumptions underlie official efforts to support the regional biofuels industry:

1. A recognition that a clear regulatory framework for the industry is essential to encouraging investment.

2. A desire to create a mix of incentives and mandates to support biofuels, including tax breaks, R&D support, and mandatory fuel blending standards.

3. An understanding that extensive agricultural reform will be necessary to increase feedstock availability, including improving productivity and extending acreage under cultivation.

4. A realization that private sector investment, including foreign investment, must provide the bulk of the capital for the industry's production, processing, and transport needs. A further realization that foreign capital will be critical in facilitating technology transfer.

The pace at which countries in the region are acting on these understandings varies depending on existing resources, the organization of the agricultural sector, R&D capacity, attractiveness to foreign investment, and perhaps most importantly, the political will of the government.

Argentina and Colombia are perhaps best placed to realize their biofuels production potential. Chile's program is in the early stages, but the country has the organizational capacity to move forward rapidly. Peru has taken important steps but has yet to put in place a comprehensive framework for development of the industry. Much work remains ahead for Bolivia and Ecuador, which have only embryonic biofuels efforts. Venezuela, with its huge oil reserves and deficit in sugar production has not made biofuels a priority.

Policy Implementation
In Colombia, the Uribe Administration has pushed for a more robust ethanol industry. Since 2001, a series of laws and regulations have established fuel blending mandates, regulatory standards, and incentives for biofuels production. Colombia's fuel oxygenation program now covers 57% of the country.

Argentina enacted a new biofuels law (informally known as SFL) in 2006. While similar to the Brazilian approach in terms of incentives, fuel blending requirements, and regulatory authority, it lacks purchase guarantees and provisions for the involvement of small-and-medium size enterprises. In addition, the requirement that fuel blending be performed at the petroleum refinery will entail major additional infrastructure expenditures for transport. Implementing regulations for the SFL, expected to emerge from the Congress in the coming months, will provide a clearer indication of the resources that will be available to this new sector.

Peru has established an initial legal framework for the promotion of biofuels and put in place a Program for Biofuels Promotion and a Technical Commission for Biofuels. The Amazon region is receiving particular attention as a source of biofuels production. However, implementing regulations are still needed to guide potential investors. For its part, Chile is just beginning to address biofuels. There is currently no production, and the Renewables Law passed in 2003 still awaits needed regulatory guidelines. With its significant production of wood chips, Chile's greatest potential likely will be in cellulosic biofuels research.

Ecuador has instituted policies to promote fuel diversification and has significant potential feedstock resources in sugar and palm oil. However, the absence of a clear regime for investment and agricultural expansion is a substantial obstacle to further development. Venezuela, as a major oil producer and net importer of sugar, has an

agreement with Brazil for ethanol, but has not acted to promote domestic production. Bolivia has established fuel blending mandates but has not drafted concrete plans for sugarcane-based biofuels production. With an appropriate regulatory and investment framework, significant potential exists in this sector, as well as for soy-based biodiesel.

Cooperation with Brazil
Brazil conducts a range of cooperative activities on biofuels with most of the countries in the region. Peru has a cooperative research program with Brazil on biotechnology and biofuels, and the two countries recently signed an agreement to jointly develop alternative crops for biofuels. The state oil companies of Brazil and Colombia have a technical cooperation agreement on information sharing and joint ventures in which biofuels figure prominently. Chile and Ecuador have not formalized relationships with Brazil on biofuels, but there are informal efforts to share information and develop a common agenda. Cooperation between Argentina and Brazil has occurred at the provincial level and through broader energy consultations in Mercosur. Biofuels cooperation between Venezuela and Brazil is conducted through the national oil companies, PDVSA and Petrobras.

C) CURRENT SITUATION

The overwhelming proportion of biofuels production in the region goes to domestic consumption, in many cases by same entities that produce the fuel. Only Brazil has measurable exports. It sent 340 million liters of ethanol to the United States in 2004, over 140 million liters in 2005 and a projected 1.2 billion liters in 2006. Tariff barriers are an important obstacle to expanding exports to the US market. Colombia and Peru, which have negotiated free trade agreements with the United States, have a potential advantage in this respect. Indeed, Colombia is planning a major expansion of its palm oil production as a biodiesel feedstock, with an eye to the export market.

D) PRIVATE SECTOR

Private-sector interest and activity tend to follow government engagement. In Colombia, where there are already five operational ethanol distilleries, a variety of investment projects have been announced, largely by Colombian groups but with some foreign involvement, including Svensk Etanol of Sweden. In Argentina, about 20 private companies currently produce biofuels, but principally for their own consumption. In the biodiesel sector, however, investors are pursuing commercial production, with the participation in one case of the Spanish firm Repsol. Japan's Mitsui is also studying the possibility of building an ethanol plant in the province of Santa Fe.

There is some minor local investment in Peru, and China has expressed interest in an ethanol investment in Ecuador. In Bolivia, limited production capacity exceeds even more limited demand, and in Venezuela, PDVSA, in cooperation with Petrobras, is the sole investment player in the sector.

E) RESEARCH & DEVELOPMENT

Regional R&D activity is unevenly distributed. A broad range of research activity exists in Colombia, including a public-private partnership, the Corporation for Industrial Development of Biotechnology and Clean Production; research sponsored by the state oil company, Ecopetrol; university research into palm oil based biodiesel; and work by the sugar and palm oil producers associations to improve yields and identify optimum varietals for feedstocks. In Argentina, where there is a long history of interest in biofuels, Repsol YPF has established a Biofuels Research Center, giving the private sector a leading role in the R&D effort. Government research remains limited in scope. However, several universities are promoting biofuels, and particularly biodiesel, through research and involvement in initiatives like the New Technologies for Biofuels Network. Elsewhere in the region, R&D efforts are much more limited.

Source: World Factbook

A) INTRODUCTION

Argentina has both the means and the motivation to pursue large-scale production of biofuels. The country is the world's largest exporter of soybeans, a primary biodiesel feedstock, and boasts a sophisticated agribusiness sector. Argentina is also heavily dependent on fossil fuels and is seeking ways to diversify its energy matrix. These conditions have already prompted soy farmers to produce biodiesel for their own use in a bid to reduce their exposure to volatile prices.

The Argentine government is taking the lead in creating the conditions for the development of a domestic biofuels market, both through production incentives and demand guarantees in the form of mandatory blends. Complementing the government's initiative, the academic and private sectors have engaged in research and development and invested in production facilities. As the biofuels industry expands, however, current infrastructure constraints might become a substantial obstacle.

B) GOVERNMENT POLICIES

Background

The Argentine government has a long history of promoting the biofuels industry, which began in 1922 with preliminary studies on the domestic use of ethanol as an engine fuel. In 1928, the first successful experiment was completed using a Ford Model T and an 80% ethanol mix. In 1979, several Argentine automakers helped create the country's first ethanol program (Programa Alconafta).

By 1985, the country's entire northwest region had become part of the program, and a second phase, to promote sugar exports, was about to begin. Then, a series of bad harvests, the high price of sugar in the international market, and unfavorable internal market conditions nearly drove the ethanol industry to extinction by the early 1990s.[1]

It was not until 2001 that the government reestablished the National Program for Biofuels (Resolution 1076/2001). Together with the Biodiesel Competitiveness Plan (Decree 1396/2001) it brought new light to the decaying industry.[2]

In 2004, the Secretary of Agriculture, Cattle, Fish and Food joined the renewed effort by issuing its own National Biofuels Program to promote the production and use of biofuels, support and advise the rural sector, collaborate with institutions dedicated to R&D, and advertise the use of biofuels as a way of promoting public and private investment.[3]

The New Biofuels Law

Most recently, the Argentine government provided a general legal framework for all these programs by approving the Ley de Biocombustibles.[4] Also known as Senator Falco's Law, or simply SFL, it establishes new rules to promote the biofuels industry and closely follows the Brazilian model.[5]

In particular, the SFL designed a combination of fiscal incentives and blending quotas to promote the industry. It also provides tax breaks for biodiesel and ethanol producers, including exemption from (a) the Value-added Tax (VAT) on capital goods and infrastructure projects related to these activities; (b) the income tax on goods affected by

production; (c) the Hydro-Infrastructure Tax (Tasa de Infraestructura Hidrica); and (d) the general fuels tax. On the mandates side, the SFL required a 5% blending of biodiesel into regular diesel and of ethanol into gasoline by 2010. Together, the provisions aimed to encourage investment and provide a consumer base for the biofuels industry. New investment is expected to stimulate the development of infrastructure and technological research.[6] The SFL made the executive branch responsible for regulating the biodiesel market and tasked the National Assistant Commission with supporting the executive and suggesting policy adjustments.[7]

In most respects, SFL mirrored Brazilian legislation. But the similarities end when it comes to offering benefits to biofuels producers. In particular, the Argentinean model does not (a) guarantee minimum biodiesel purchases; (b) establish future brackets for biofuels blends; or (c) require any sort of social engagement by biodiesel producers. Small-and-medium enterprises are likely to receive more benefits, but their participation is not currently a requirement under the legislation.

The SFL also creates a significant obstacle to efficient production through its requirement that the 5% blending take place at petroleum refineries. Experts have pointed out that in many cases pure biofuels will need to be transported hundreds of kilometers to reach the few existing large refineries that supply the country and the international market.[8]

The SFL was approved by both houses of congress on May 12, 2006, and President Kirchner signed the regulatory framework into law in February, 2007. The law creates the obligation to replace naphtha and diesel with a minimum 5% biofuels blend by 2010, which would equal 600 million liters of biodiesel and 250 million liters of ethanol. The government will provide direct subsidies to spur production and VAT refunds to attract investment.[9]

Local Government Involvement

The SFL does not mandate provincial involvement in biofuel development. Instead, it extends an invitation to all provinces that wish to join the central government's biofuels efforts.[10] Several provinces have accepted that invitation. Rio Negro recently signed an agreement with the Ministry of Production and the Biocoms Foundation to launch a program for the production and consumption of biofuels in the province. The Province of Entre Rios announced in July 2006 that it would begin 16 refining projects, several of which will be devoted to the production of biofuels. In addition, the Province of Buenos Aires has been researching the feasibility of constructing a processing plant, an inititiave known as the Biocom Project.[11] Neuquen Province is also promoting a study, called CODESU (Consortium for the Sustainable Development of Ucayali) to assess the feasibility of opening a biodiesel plant. In addition, Argentina's Santa Fe province recently created an energy department that will oversee all issues related to biofuels. The government will provide incentives, including the transfer of public land without charge, and hopes to attract biofuels experts able to provide technical support to the developing industry.[12]

Relations with Brazil and Regional Cooperation

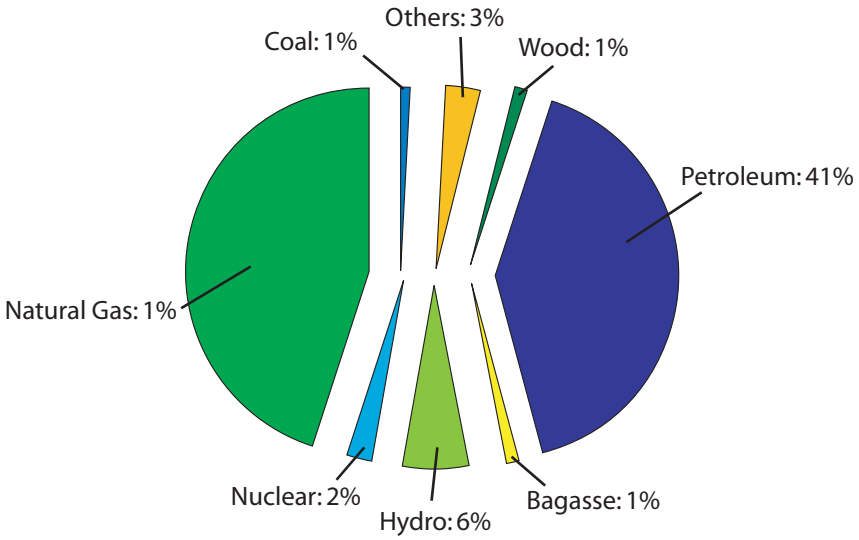
At the moment, there are no formal cooperation agreements between Brazil and Argentina on bioenergy issues. Neuquen province launched a research program in partnership with Petrobras to advance the production of biofuels in the province, but the program has not advanced significantly in the three years since it was signed. Argentina and Brazil have, however, engaged in extensive discussions on a unifying energy regulatory framework through the regional organization Mercosur.

C) CURRENT SITUATION

Energy Matrix

A glance at Argentina's energy matrix shows how small a role bioenergy plays today. Combined, fossil fuels represent almost 88% of Argentina's energy use.

Chart 1.1.a: Argentina's Energy Matrix (2004)

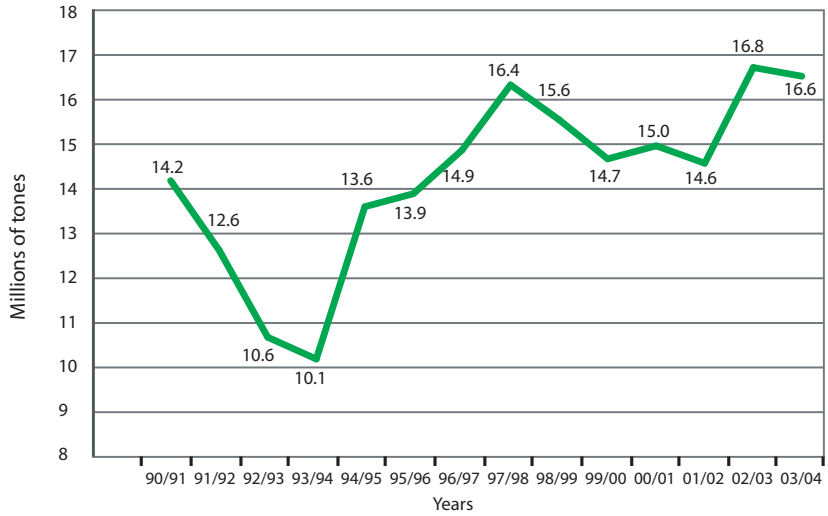


Source: Secretary of Energy

Ethanol Production

Once a growing industry, the ethanol sector today is largely dormant. In Argentina, as in Brazil, sugarcane is the main feedstock. For climate reasons, production of sugarcane is concentrated in the north of the country, called the NOA region, which accounts for 98% of domestic sugarcane production.[13]

Chart: 1.1b: Sugarcane Production in Northern Argentina (NOA)



There is not yet any significant production of sugarcane for ethanol. However, SFL's mandatory blending provisions will likely change that soon. Indeed, it is expected that demand for ethanol may reach 200 million liters by 2008.[14]

Biodiesel Production

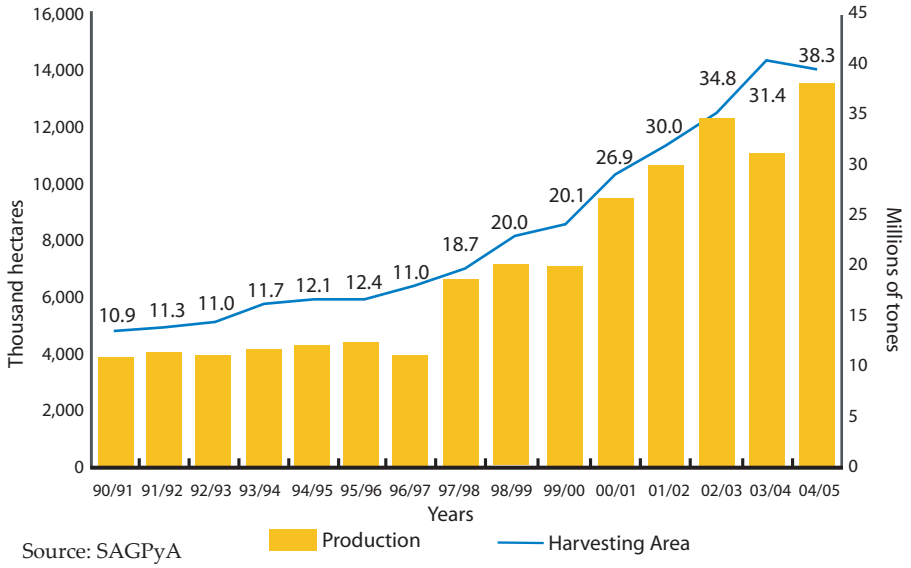
The production of biodiesel is relatively new and difficult to quantify. Most biodiesel is used by the same companies that produce it to fuel their own machinery and processing plants. Vegetable oils and a small portion of animal fat have supplied the necessary raw materials for existing biodiesel production.

Argentina produces a large amount of soy and sunflower seeds, and any expansion

in biodiesel production would likely rely on those crops.[15] During the last 15 harvest seasons (from 1990-91 to 2004-05), Argentina tripled its soy production, to 38.3 million tons. It is now the world's third largest soy producer and the largest soy oil exporter. Genetic upgrading of seeds and more advanced harvest management have ensured that production increases continue despite fluctuations in climatic factors.[16]

In 2003, there were 45 soy plants with a processing capacity of 98,000 tons per day, which increased to 100,000 tons per day in 2004. With a similar amount of land harvested, total production grew by 21.2% during 2004-05 and has increased slightly in 2006. Even this scale of growth is not enough to meet increasing demand, however, and processing companies have already announced major new investments.

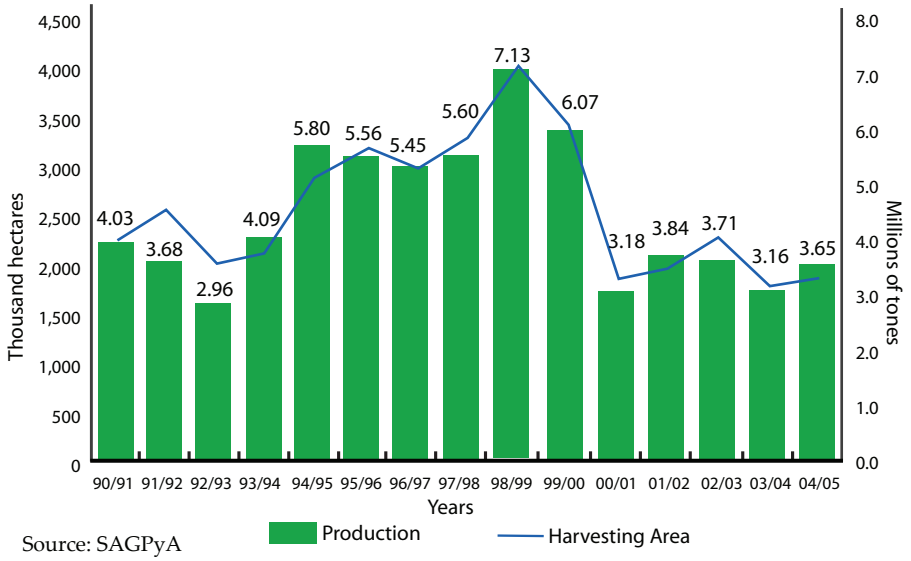
Chart 1.1c: Soy Production and Harvesting Area



Source: SAGPyA

Sunflower is a distant second to soy as a likely feedstock, though both crops may be needed to meet demand increases associated with blend requirements. The sunflower industry shows clear signs of expansion. Most factories are small and further investments to expand land and increase production are announced on a regular basis.

Chart 1.1d: Sunflower Production and Harvesting Area



Source: SAGPyA

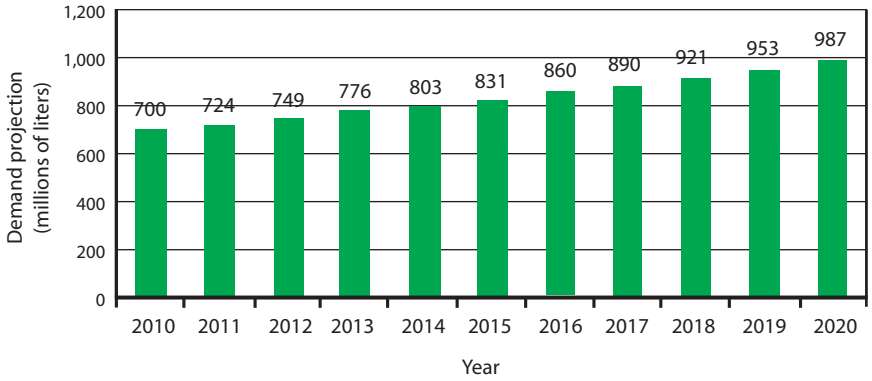
Table 1.1a: Cultivated Land Area for Soybeans Required to Substitute Current Diesel Consumption

Table 9. Cultivated land area for soybeans required to substitute 5 %, 10 %, 50 % and 100 % of current diesel consumption in Argentina

Fuel blend	Total consumption, 2004 (Mt/year)	Equivalent quantity of soybean (Mt)	Land required (Mha)	% of total cultivated area in 2004
Diesel	11.4			
B5	.57	3.167	1.435	8.9
B10	1.14	6.333	2.871	17.8
B50	5.7	31.667	14.353	89
B100 (pure biodiesel)	11.4	63.333	28.71	178

Source: Bakovich, 2005

Chart1.1e: Projection of Biodiesel Demand



Projection of biodiesel demand between 2010 and 2023 assuming a 5% blend in diesel, and a 3.5% annual growth in fuel demand. Source: IIR-INTA, 2005.

Demand for biodiesel should reach 650 million liters by 2008, and over one billion liters by 2023.[17]

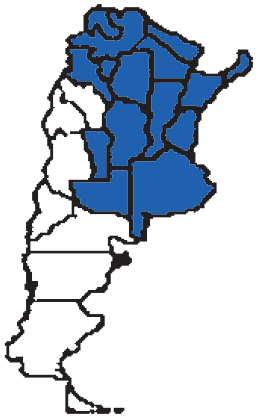
Production and Supply Chain Infrastructure

Because the biofuels industry is at an early stage of development, the necessary supply chain has not yet been established, and the future shape of the production chain remains unclear. Producers foresee that logistics (storage facilities, shipping procedures, etc.) will be a major obstacle as the industry grows. They insist that Argentina's biofuels infrastructure will need major improvement if the country is to meet the blending mandate established by the SFL. For example, there are still no storage tanks or prepared locations near ports for the processing plants. The government expects that the new legal framework will prompt the needed infrastructure, as the private and public sector combine resources through concessions and partnerships. To date, however, no biofuels infrastructure projects have begun, the new tax incentives notwithstanding.

Production Capacity and Land Availability

Argentina's climatic conditions, especially in the central and northern regions of the country, lend themselves to cultivation of feedstock, including sugar, soy, corn and sunflower. Argentina has 90.5 million hectares of arable land, only 30% of which (27.2 million hectares) is in use.

Map 1.1a Geographic Dispersion (Soy, Sunflower)



Source: SAGPyA

The possibility of expanded soy production has created concerns about the desertification that may accompany extensive harvesting. To address this concern, the Argentine Secretary of Agriculture is studying the potential of other crops, such as canola.[18]

D) PRIVATE SECTOR

As of May 2006, there were nearly twenty companies producing biofuels in Argentina. An estimate by the Argentine Secretary of Agriculture indicates that there is significant investment in the biodiesel industry, but almost none in ethanol. What interest there is in ethanol is in applying US technology for corn-based production, but no projects have been decided upon as of yet.

The main companies investing in biodiesel for commercial purposes, rather than for internal consumption, include:

OilFox has recently announced that it will build a plant to produce around 20-30 million liters per month. The company is promoting research into new technologies and has resources available for the development of a biodiesel processing facility that employs used oil as feedstock. In addition, the company has reached an agreement with the Argentine Air Force to conduct biodiesel tests on aircraft.[19]

Repsol-YPF will invest $30 million in a new biodiesel plant, scheduled to become operational in 2007, which will produce 120,000 tons per year.[20]

Grupo Vincentín, a major Argentinian vegetable oil producer, has announced a $25 million investment to build a biodiesel processing plant that will reach production levels of 300,000 tons annually. Grupo Vincentín is already planning further investments of approximately $75 million on a new plant that would export most of its production to Germany.[21]

BIOFE has a production plant in Santa Fe with capacity to produce 15,000-20,000 liters per day.

Horreos de Argentina Project, through an alliance with West Central Iowa, will produce soy flour specialized for the production of biodiesel.

In the ethanol industry, there appears to be only one relevant private-sector player:

Mitsui Argentina, a subsidiary of the Japanese Mitsui Co., is studying the possibility of opening an ethanol plant in the city of Rosario, in the province of Santa Fe.

E) RESEARCH & DEVELOPMENT

Research and development has grown significantly in the past few years with the involvement of the private, public, and academic sectors.

A highlight in the private sector is Repsol-YPF's project to study the potential of biodiesel production in Argentina. The company announced the creation of a Biofuels Research Center (Centro de Investigaciones de Biocombustibles) to be opened in the city of La Plata. As one of ten major private oil companies in the world, the largest private energy company in Latin America, and the largest refiner of petroleum in Argentina, Repsol-YPF's engagement suggests a favorable trend in the local biofuels industry.[22] OilFox's agreement with the Argentine Air Force to test biodiesel is a further sign of private-sector activism.

The Academic community has also become involved with the growing biofuels industry. The Buenos Aires Engineering University (FIUBA), for instance, recently established a dedicated Renewable Energies Department. The initiative is helping design pilot-projects for biodiesel production in the laboratory, studying the physical and chemical properties of biodiesel, and conducting engine tests with biofuels. In addition, the university is part of a "New Technologies for Biofuels Network", which helps coordinate a wide range of researchers from across Latin America.[23]

Another significant initiative comes from the National Technology University (UTN)'s Córdoba campus, which hosts a Technology Research Center (Citelac). The center has been conducting a series of lab tests to obtain biodiesel from animal fat. Cintec has successfully transformed pig fat into biodiesel and is encouraging local meat plants to supply the necessary raw material, which is currently wasted. On its Buenos Aires campus, UNT is developing another series of experiments, in partnership with the Universidad Nacional del Litoral and the Institute for Rural Engineering, to improve the energy efficiency of biodiesel with different types of engines and crop yields.[24]

Federal and local governments now provide direct support to some research projects. The Argentine Secretary of Science and Technology, for example, recently approved a $35,468 grant for a feasibility study on extracting pure hydrogen from ethanol and using it for car fuel.[25] The government of Buenos Aires province has been researching biofuels since 2000 through the Biocom Project.[26]

F) CONCLUSION

Argentina has a decades-long, but fitful experience with biofuels. Its vast agricultural resource base (including sugar, soy, corn, and oilseeds), relatively sophisticated economy, and educated populace make it a potentially significant producer. Although various initiatives have been launched in the past few years, including a newly enacted federal biofuels law that offers tax breaks and mandates fuel blending, considerable work remains to provide adequate incentives and establish a workable framework for infrastructure development. Transportation and storage capacities are limited, and national and local government roles have to be better defined. R&D activities have been expanding and several new private initiatives are underway in the biodiesel sector (although none in ethanol). Technical cooperation with Brazil, which is now rudimentary, could help remove obstacles to increased production. With the right combination of regulatory measures, infrastructure financing, and efforts to attract foreign investment, the biofuels sector could become significant.

Endnotes

[1] SAGPyA & IICA Argentina, Perspectivas de los Biocombustibles en la Argentina y en Brasil (Buenos Aires: SAGPyA & IICA Argentina, Oct. 2005), 41.

[2] The National Program for Biofuels passed formally as Resolution 1076/2001 along with the Biodiesel Competitiveness Plan as Decree 1396/2001. In that same year, Resolution 1076/2001 addressed eventual environmental concerns and problems related to the industry, and the Secretary

of Energy and Mining issued the Resolution 129/2001, which determined quality requirements for pure biodiesel (B100).

[3] SAGPyA, 23.

[4] Argentina, Ley de Biocombustibles 26-093/2006 (Buenos Aires: Republic Argenitna, 2006).

[5] Shafik Asal, Rémi Marcus and Jorge A. Hilbert, "Opportunities for and Obstacles to Sustainable Biodiesel Production in Argentina," Energy for Sustainable Development X.2 (2006), 49.

[6] Ibid, 51, 55.

[7] Argentina, article 2-4, Ley de Biocombustibles 26-093/2006 (Buenos Aires: Republica Argenitna, 2006).

[8] Ibid.

[9] "Kirchner Signs Biofuels Law Regulatory Framework – Argentina," Business News Americas, 12 Feb. 2007 <http://www.bnamericas.com/story.jsp?sector=9&idoma=I&noticia=382080>.

[10] Argentina, article 20, Ley de Biocombustibles 26-093/2006 (Buenos Aires: Republica Argenitna, 2006).

[11] SAGPyA, 49.

[12] "Santa Fe Creates Energy Department with Biofuels Focus – Argentina," Business News Americas, 2 Feb. 2007 <http://www.bnamericas.com/story.jsp?sector=9&idioma=I&noticia=381005>.

[13] SAGPyA, 43.

[14] Ibid, 48.

[15] Ibid.

[16] Ibid.

[17] Argentina, Secretary of Agriculture, Cattle, Fishing and Food, 12 Oct. 2006 <www.sagpya.gov.ar>.

[18] La Nacion, 30 May 2006, Oct. 2006 <http://www.lanacion.com.ar/>.

[19] Ibid.

[20] Ibid.

[21] "Construirán una planta de biodiésel en San Lorenzo," Diario La Nacion, 6 May 2006, 30 May 2006 <http://www.nuestromar.org/noticia.php?tp=28&nt=7101>.

[22] Diario La Nacion, 7 June 2005, 12 Oct. 2006 <http://www.lanacion.com.ar/>; Diario El Cronista 12 Dec. 2005, 12 Oct. 2006 <http://www.cronista.com/.>

[23] Silvia Daniela Romano, "Cultivos no tradicionales y su Impacto en las Economías Regionales," Jornadas sobre Biocombustibles, Mendoza, 3-4 April 2006.

[24] "Una Nueva Aplicación: Buscan Hacer Biodiesel con Grasa Vacuna," AgroDiario, 1 Aug. 2006, Oct. 2006 <http://www.agrodiario.com.ar/despachos.asp?cod_des=1845&id_seccion=33>; Diario La Nacion, 29 July 2006; SAGPyA, 25.

[25] SAGPyA, 2005.

[26] Ibid.

Source: World Factbook

A) INTRODUCTION

The private sector is leading efforts to develop a biofuels industry in Bolivia. The government has not yet shown a serious commitment to include biofuels in its energy matrix, and has thus far established only rudimentary policies to support the sector. Research and development is almost nonexistent. Still, the country does have significant potential to produce biofuels given its established production of sugarcane and soy. Yet new regulations and stronger government commitment would be needed to support the industry.

B) GOVERNMENT POLICIES

So far, few regulations have been approved in Congress to promote a sustainable biofuels industry. In July 2005, the Executive created a very basic law that established two simple rules: First, Bolivia was to prepare itself for 10%-25% ethanol blends with gasoline, also known as "alconafta", by 2010.[1] Second, the Executive would be in charge of planning the incentives and projects for the development of a domestic industry capable of meeting those blending quotas.[2] The law states explicitly that Bolivia's chosen crop for biofuels will be sugarcane and that ethanol will be blended into gasoline at 25%, a level that does not require engine modifications.[3]

No concrete executive plan for the sugarcane industry has been established by the government, and the consequences are apparent in the industry's slow development.

Relations with Brazil

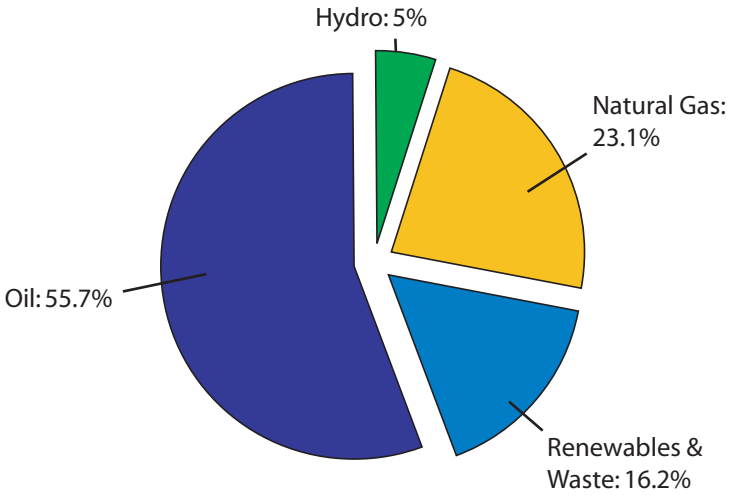
In 2003, Bolivia entered talks with Brazil regarding the transfer of sugarcane-based ethanol technology. However, negotiations have been suspended due to increasing tension since Bolivia nationalized its natural gas industries in May 2006 (Brazil imports more than 50% of its natural gas from Bolivia).[4] It is unclear how this move will affect interest and domestic demand in the biofuels sector. In addition, Bolivia has excluded sugarcane from a trade deal with Brazil and other Mercosur countries.[5]

C) CURRENT SITUATION

Energy Matrix

The country's reticence with respect to biofuels can be explained in part by its strong preference for oil and natural gas, which are entirely domestically produced.

Chart 1.2a: Bolivia's Energy Matrix (2003)



Source: IEA

As noted, natural gas and oil are major industries in Bolivia. As shown in the following table, annual production has grown steadily.

Table 1.2a: Natural Gas and Petroleum Production (1995-2004)

	NATURAL GAS		PETROLEUM	
	(MMPC)	(MMPCD)	(bbl)	(bpd)
1995	188,809	517.3	10,347,385	28,349
1996	186,397	510.7	10,653,255	29,187
1997	188,662	516.9	10,214,047	27,984
1998	189,623	519.5	13,793,472	37,790
1999	176,613	483.9	11,850,425	32,467
2000	200,729	549.9	11,463,859	31,408
2001	252,671	692	13,064,935	35,794
2002	314,537	862	13,245,316	36,289
2001	252,671	692.2	13,064,935	35,794
2002	314,537	861.7	13,245,316	36,289
2001	252,671	692.2	13,064,935	35,794
2002	314,537	861.7	13,245,316	36,289
2003	361,007	989.1	14,434,607	39,547
2004	446,997	2,469.6	16,953,699	46,448

MMPC: million cubic feet bbl: Barrels
MMPCD: million cubic feet / day bpd: Barrels / day

Source: Ministerio de Hydrocarburos & Energia

The steady increase in investments in both industries reinforces the view that the government's priority is keeping these domestic commodities as major components of the matrix.

Table 1.2b: Investments in Natural Gas

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Exploration	69.81	130.38	374.56	372.20	256.79	168.99	113.47	108.58	86.66	86.61
Production	29.22	140.42	230.25	208.55	185.33	237.38	231.31	171.96	149.26	241.89
TOTAL	99.03	270.80	604.81	580.75	442.12	406.37	344.78	280.54	235.92	328.50
Pipeline: Yacuiba - Río Grande							283.00			
TOTAL							627.78	280.54	235.92	328.50

Source: Ministerio de Hydrocarburos & Energia

Nevertheless, experts have noted that it is precisely because of this reliance that Bolivia should diversify its matrix. In addition, there are opportunities in biofuels that might prove attractive investments in Bolivia.

Capacity Expansion
Currently, Bolivia has robust sugarcane production, which could help meet the demand that will be generated by the 10% mandatory blend. The nation produces more than 4.8 million tons of sugarcane each year, with 105,000 hectares under cultivation.

Almost all sugarcane production goes to the production of refined sugar, which greatly exceeds domestic demand.[6] At least some of this excess, which is currently being exported, could be used for ethanol production, thereby decreasing Bolivia's exposure to global sugar price volatility.

To that end, Bolivia is in the process of constructing 15 distilleries for the production of ethanol.[7] Officials from the largest distilleries, Unagro S.A. and Guabirá Distillery, claim that major government investments are still necessary to implement the law and begin production. The supply necessary to meet the mandatory quota established in July 2005 is 90 million liters annually.[8]

According to business representatives, investments of up to $70 million and an additional 50,000 hectares of cultivation are necessary to meet this initial demand. This investment would have a significant social impact by creating 60,000 jobs directly linked to the ethanol industry.[9]

When it comes to biodiesel, the potential capacity expansion seems even greater, a dynamic similar to that in Brazil. While Bolivia does not produce one single ton of oilseed, the country has significant soybean production: 1.7 million tons in 2004 alone.[10] Possible incentives for the biofuels industry could create new options for soy producers to diversify their business.

D) PRIVATE SECTOR

Despite the significant potential for biofuels in Bolivia, it is still not clear where expansion will occur. A closer look at the trends in the private sector can help to clarify this issue.

Bolivia's two largest sugarcane refineries are Unagro S.A. and Guabirá Distillery. Unagro S.A. is a union of sugarcane producers in the eastern region of Santa Cruz. Unagro's only sugarcane plant, Ingenio Azucarero "Roberto Barbery Paz", has an annual processing capacity of 115,000 metric tons of sugar and 12,000 metric tons of ethanol.

Guabirá Distillery is one of Bolivia's oldest sugar companies and it is also located in the eastern region of Santa Cruz. In addition to ethanol, Guabirá processes refined sugar, alcohol, and fertilizers. The company has almost 28,000 hectares of sugarcane and is planning to expand. In 2006, Guabirá launched a $6.5 million subsidiary, Guabirá Energía S.A., devoted entirely to producing clean energy from sugarcane derivatives.[11] Today the company has a production capacity of 300,000 liters a day, but since there is not enough demand, the distillery currently produces around 30,000 liters of ethanol per day.[12] Most recently, Guabirá S.A. annouced a second phase of expansion during which $11 million will be invested by 2008.[13]

E) RESEARCH & DEVELOPMENT

Bolivia conducts little research on biofuels. University departments related to energy tend to focus their studies on natural gas and petroleum. This focus reflects the relative underdevelopment of the industry and the lack of government leadership, including initiatives and financing to promote research in the field.

F) CONCLUSION

With Bolivia's attention focused on the most effective utilization of its vast natural gas reserves, biofuels development unsurprisingly has a lower priority. Land reform issues and the government's perceived hostility to at least certain forms of private foreign investment further complicate the picture. The absence of technical cooperation with Brazil, partly a result of gas industry tensions, limits progress, especially without significant domestic R&D. While the necessary agricultural resources are apparently available, regulatory, infrastructure, and financing issues will likely restrain active biofuels development.

Endnotes

[1] Ley 3086/05, article 1o.
[2] Ley 3086/05, article 2o.
[3] Ley 3086/05, article 1o.
[4] "Gov't announces measures to guarantee natgas supply to consumers," Financial Times 19 May 2006.
[5] American Sugar Alliance, 31 Oct. 2006 <http://www.sugaralliance.org/desktopdefault.aspx?page_id=136&resource_id=661>.
[6] FAO Stats, 10 Oct 2006 <http://faostat.fao.org>; American Sugar Alliance, 31 Oct. 2006 <http://www.sugaralliance.org/desktopdefault.aspx?page_id=136&resource_id=661>.
[7] GTZ (German Technical Cooperation), Conference Handout for Biofuels for Transportation: Global Potential and Implications for Sustainable Agriculture and Energy in the 21st Century (Berlin: GTZ, May 2006).
[8] "Una ley autoriza la producción de alcohol carburante en Bolivia," 14 Aug. 2006 <http://www.fedebiocombustibles.com/bolivia-alcohol-carburante.html>.
[9] Ibid.
[10] FAO Stats, 10 Oct. 2006 <http://faostat.fao.org>.
[11] "Guabirá anuncia proyecto para generar electricidad," Los Tiempos 14 Feb. 2006, 31 Oct. 2006 <http://www.lostiempos.com/noticias/14-02-06/14_02_06_eco5.php>.
[12] National Federation of Biofuels, 14 Aug. 2006 <http://www.fedebiocombustibles.com/guabira-unagro.html>.
[13] "Guabirá anuncia proyecto para generar electricidad," Los Tiempos 14 Feb. 2006, 31 Oct. 2006 <http://www.lostiempos.com/noticias/14-02-06/14_02_06_eco5.php>.

Source: World Factbook

A) INTRODUCTION

While currently nonexistent, the biofuels industry in Chile has been gaining increasing attention as the government pushes for a more diversified energy matrix. Reducing dependence on foreign energy is unquestionably the strongest incentive for the biofuels market in Chile.[1] As of 2004, 72% of Chile's domestic energy consumption came from foreign sources (an 18% increase since 1995).

Chile is also interested in finding other uses for its agricultural production, which could reduce its exposure to unstable prices, and which might produce higher profits and accelerated industrial and agrarian development. Environmental concerns constitute a further incentive for development of the biofuels industry.

Studies have highlighted the potential for promoting agricultural development through bioenergy incentives, and the government has sponsored an initial assessment on how to promote the industry.

B) GOVERNMENT POLICIES

To face the immediate challenge of diversifying its energy matrix, the Chilean government has employed two simultaneous strategies: (a) the development of a biofuels industry; and (b) a policy of incentives for renewable generation of electric energy.

The Ministry of Agriculture recently devoted $1 million to study the optimal feedstock for a biofuels industry.[2] This effort has not yet yielded definitive conclusions, but it is the first significant sign of government interest. The Ministry of Agriculture and the Ministry of Mines and Energy have joined forces to assess the potential for a sustainable industry.[3]

In March 2003, the government issued a Renewables Law (Law 19.940/2003) that made several modifications to the energy operation and transmission system and created mechanisms to promote the use of Non-Conventional Renewable Energies (NCRE) for power generation, such as hydroelectric, geothermal, and solar power. The goal is to achieve a 15% NCRE level, or 320 MW, by 2010. Thus far, the law mandates that 5% of the energy applied to the transmission system come from renewable sources, which in the long run could include cogeneration from biofuels plants.[4]

The Renewables Law includes a number of additional incentives. For instance, it ensures that small generators (up to 9 MW) can make sales to the spot market without discrimination, offering them simplified commercial treatment and greater price stability. In addition, the law guarantees the right to access the main distribution networks in order to transmit generated energy and removes toll charges for access to the main transmission system for non-conventional sources of less than 20 MW.[5]

However, the Renewables Law is still a "short law" (Ley Corta), meaning that it is awaiting regulatory guidelines. These are expected to include guidelines for fiscal incentives, regional integration of the energy grid, and specific quotas for each renewable source.[6]

Most recently, the Bachelet Government organized a public-private advisory commis-

sion to make recommendations regarding the development of the biofuel industry. The commission recommended the exemption of biofuels from specific taxes and encouraged a government mandate to ensure demand.[7] The report did acknowledge that it may be more economically prudent to import biofuels from more competitive producers such as Brazil, Argentina, Bolivia or Peru.[8] According to Odepa, a division of the agriculture ministry, biodiesel will only be competitive with diesel in Chile if oil prices reach $72 per barrel.[9]

Relations with Brazil

According to the Chilean Institute for Agrarian Development (INDAP), the two governments have been in continuous contact to develop a partnership. In July 2006, a meeting took place between the Brazilian Agriculture Minister and a working group from Chile's Agricultural Ministry. On that occasion, Brazilian representatives highlighted Chile's potential in biofuels and stressed that Brazil is willing to help Chile diversify its energy matrix.

The development of a common agenda on tax, technology transfer, logistics, and legal aspects, is still pending. Brazilian officials have suggested that Chile begin by adding 5%-10% of corn or wheat-based ethanol fuel to its cars, which would not require any changes in car engines.[10]

C) CURRENT SITUATION

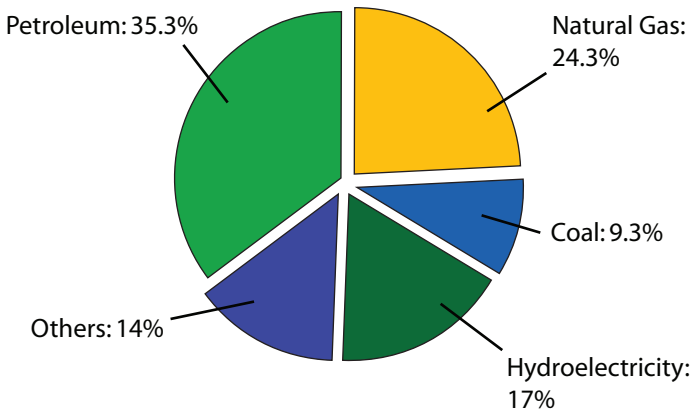
The Chilean power sector has been under-funded for many years. Hydroelectric (which is 100% domestic) has lost 2% of its share of the energy matrix to natural gas (which is 80% imported). Indeed, natural gas grew 16% from 1996 to 2004.[11] The goal of the Renewables Law is to reverse this trend.

Biofuels are still a secondary option for diversifying Chile's energy matrix. Nevertheless, experts from the Ministry of Mines and Energy and other agencies insist that a comprehensive strategy combined with fiscal incentives will permit the Chilean biofuels industry to grow exponentially in the coming years.[12]

Energy Matrix

A closer look at the country's energy matrix shows that 68.9% of Chile's energy supply comes from non-renewable fossil fuels. 99% of the petroleum, 80% of the natural gas, and 96% of the coal consumed by Chile are imported, which leaves the country vulnerable both in terms of supply and price.

Chart 1.3a Chile's Energy Matrix (2004)



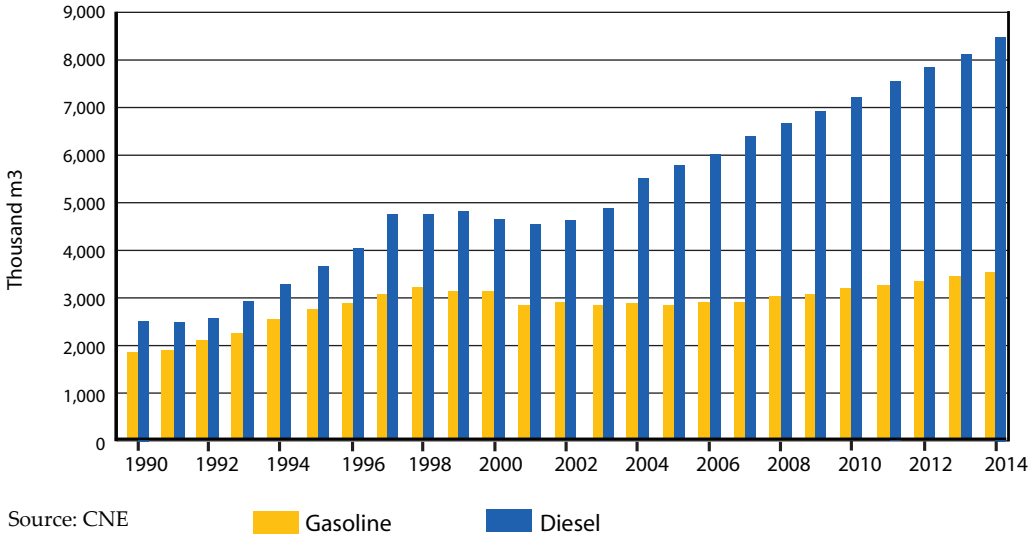
Source: National Energy Commission (CNE)

The diversification of the matrix to include renewable sources of energy is essential. The Chilean Minister of Mines and Energy, Karen Poniachik, has stated on several occasions that Chile could begin producing agro-fuels by 2008 with the proper strategy.

Chile needs to first decide on the best crop (or crops) for biofuels production and then to establish a regulatory framework of incentives for production and quality control.[13]

Production and Consumption Capacity
Because there is no established biofuels industry in Chile, there are no current consumption levels to report. Several studies, however, have assessed potential demand given the government's plan to include biofuels into the country's energy matrix (see Government Policies). In the last decade, for instance, Chile has significantly increased its consumption of regular diesel, which has surpassed gasoline. In 2005, road transportation alone consumed 3.6 billion liters of diesel.

Chart 1.3b: Chile's Fuel Consumption (1990-2014)



Source: CNE

An eventual introduction of a 5% biodiesel blend (B5) would produce demand of 250 million liters by 2010, and 289 million liters by 2014. Thus far, rapeseed has been the most studied crop for future biodiesel production in Chile. Today, domestic production occurs on approximately 37,000 acres and is mainly used for salmon feed.

In terms of ethanol demand, the introduction of a mandatory 5% blend with gasoline (E5) would create estimated demand of 157 million liters of ethanol by 2010, and 176 million liters by 2014. Corn has been identified as the most probable crop for ethanol production in Chile. In 2004, domestic production was around 1.3 million tons from 119,000 acres and is used for both human consumption and animal feed.

D) PRIVATE SECTOR

Investments are limited, although several projects have recently been finalized and should be initiated in the coming months.

ENAP, the National Oil Company of Chile, and IANSA, a multinational group of agribusiness companies, announced a joint study to produce fuels from vegetable oils. The parties signed an agreement in March 2006 to carry out a six-month feasibility study.[14]

Petrobras, the Brazilian state-owned oil company, has announced its interest in investing in an ethanol plant in Chile. According to several newspapers, the company is in the process of finalizing investment plans. After the July 2006 International Seminar on Agroenergy and Biofuels in Santiago, a Petrobras official confirmed the company's interest in developing the Chilean biofuels industry.[15]

The lack of more extensive private-sector involvement in Chile reflects the country's very recent engagement with the industry.

The Cellulosic Opportunity
In addition to the current opportunities for private-sector investment in biofuels, advances in cellulosic research might open new paths. Currently, wood chips are Chile's third-largest export (11.8% of total exports) and are shipped to 86 countries. The leading destinations are Japan, the United States, South Korea, and Western Europe. It is estimated that wood chip exports will reach $3 billion by 2010.

While the majority of Chile's pulp and plantation industry is domestically owned and operated, major foreign investors include New Zealand's Carter Holt Harvey and Fletcher Challenge, Shell of the Netherlands, and from the United States, Simpson Timber, International Paper, Scott Paper, CitiBank, and two pension funds, RII-UBS and Xyem. Japan's Mitsubishi, Sumitomo, and Daio Paper each have eucalyptus plantations as well as joint ventures with various Chilean companies in the wood chip export business. Direct multinational logging in native forests includes Cranefield of Canada and the US-based Trillium company/Savia investment group, which has a large-scale project covering 250,000 hectares in Tierra del Fuego.

A breakthrough in cellulosic technologies for ethanol could turn what is already a commercially viable industry into a remarkable opportunity for Chile.

E) RESEARCH & DEVELOPMENT

As Chile is just beginning to assess its potential for biofuels, there has been relatively little R&D. However, as discussed, the Ministry of Agriculture designated $1 million to promote agroenergy R&D through the Agricultural Innovation Foundation (FIA).

FIA is responsible for promoting innovation related to domestic agricultural production in Chile. The institution is also in charge of significant financing mechanisms for private projects and government programs related to agriculture. Its studies will focus on the possibilities of using corn and sugarcane based ethanol for an initial 10% blend (E10) with gasoline and the use of edible oils, mainly soy and rapeseed, for an initial 20% blend (B20) with regular diesel.

The R&D environment is likely to improve if FIA's current studies endorse a government decision to offer incentives to the biofuels industry.

F) CONCLUSION

Chile is still in the starting blocks on biofuels development, despite its clear need for energy diversification. The country currently has no biofuels production. Some initial indications of interest have come from the Chilean national oil company and Petrobras. Research has not yet identified the optimal crop for biofuels development, although corn seems to be favored. The government has passed a Renewables Law, but it will require considerable elaboration before it can become a viable blueprint for development of the industry. Chile's long-term opportunity would appear to rest on advances in cellulosic research. Wood chips are the country's third-largest export, projected to increase to $3 billion in 2010. A breakthrough in cellulose technology could open the door to significant biofuels production.

Endnotes

[1] Chile is currently in a dispute with Argentina and Bolivia over the price and supply of gas, which could be economically disruptive.

[2] The resources are being operated by the Foundation for Agrarian Innovation (Fundacion para Innovacion Agrária - FIA), linked to the Ministry of Agriculture of Chile.

[3] Fernando Flores, "El agro aprieta el acelerador," FernandoFlores.cl, 31 Jul. 2006 <http://www.fernandoflores.cl/node/1536>; "Diputados proponen cambios a Ley Corta II," Diario Pyme, 19 Jul. 2006 <http://www.diariopyme.cl/newtenberg/1845/article-73222.html>.

[4] Ley 19.940/2003.

[5] Ley 19.940/2003, Articles 71-7 and 91.
[6] Ley 19.940/2003
[7] "Chile's Biofuels Discussions Show Diversity of Stakeholders' Perspectives," Biopact, 6 Feb .2007 <http://biopact.com/2007/02/chiles-biofuels-discussions-show.html>.
[8] Ibid.
[9] "Govt: Biodiesel Competitive if Oil Hits US $72/b – Chile," Business News Americas, 23 Jan. 2007 <http://www.bnamericas.com/story.jsp?idioma=I&sector=9&noticia=379901>.
[10] INDAP, 29 Sept. 2006, 12 Nov. 2006 <http://www.indap.cl>.
[11] Chile, Ministry of Mines and Energy, National Energy Commission (CNE), Seguridad Energética: Escenarios y Estrategias (Santiago: Ministry of Mines and Energy, National Energy Commission, May 2006).
[12] Fernando Flores, 2006; "Diputados proponen cambios a Ley Corta II,"Diario Pyme, 19 Jul. 2006 <http://www.diariopyme.cl/newtenberg/1845/article-73222.html>.
[13] Fernando Flores, "El agro aprieta el acelerador", 31 Jul. 2006 <http://www.fernandoflores.cl/node/1536>; "Diputados proponen cambios a Ley Corta II," Diario Pyme, 19 Jul. 2006 <http://www.diariopyme.cl/newtenberg/1845/article-73222.html>.
[14] House of Representatives, 10 Sept. 2006 <http://www.camara.cl/diario/noticia.asp?vid=18547>.
[15] "Petrobras interesado en biocombustibles en Chile," 29 Jul. 2006 <http://www.chilepotenciaalimentaria.cl/?p=1146>.

Source: World Factbook

A) INTRODUCTION

Colombia is second only to Brazil in the Americas for biodiversity and is positioning itself to be a hemispheric leader in the production of clean fuels. Biofuels could help Colombia diversify its fuel consumption and agricultural production, create jobs in the agriculture sector, and provide an alternative to the production of illicit substances. The transport sector will be critical. According to the Ministry of Mines and Energy, transport accounts for 30% of total energy consumption, in part due to subsidies that encourage inefficient use. The government is addressing this issue by gradually decreasing subsidies, launching a public awareness campaign, and promoting alternatives like natural gas and biofuels.[1]

B) GOVERNMENT POLICIES

As in most countries, biofuels production in Colombia has been spurred by government policy, namely mandatory blend targets that create a guaranteed domestic market for early production. With the exception of Brazil, Colombia has the most developed regulatory framework in the region.

The Colombian government has promoted ethanol much more actively than biodiesel. In 2001, the Colombian government passed Law 693, which outlines several expected benefits of fuel standards, including reductions in hydrocarbon and carbon monoxide

emissions, maintenance and generation of jobs in the agricultural sector, and agro-industrial development. The law also stated that fuel used in metropolitan areas with more than 500,000 habitants should, by no later than 2002, have oxygenated components such as carburant alcohols, including ethanol and other oxygenating alcohols (the law states that private parties can participate in the production, distribution and commercialization of these alcohols.) Although not clearly defined in the legislation, the law also grants ethanol special privileges in energy self-sufficiency policies.[2]

In 2002, legislation was enhanced by Law 788, which exempts fuel alcohol from the Value Added Tax (VAT), as well as others. A 2005 regulation set the price for a gallon of carburant alcohol as $3,906.89 at the door of the refinery (roughly equivalent to $1.70 per gallon). It also guaranteed purchases by bulk distributors. 2005 also saw the introduction of a desired 10% ethanol blend that the government hopes to increase to 25% within 20 years. (There are reports that the government is considering a near-term increase of the ethanol blend to 20%.) A February 2006 regulation included the international price of sugar in the calculation of ethanol price. Recent regulations have also addressed the production, handling, and storage of ethanol and other additives.[3]

The government began to develop a biodiesel framework in 2004. Law 939 creates incentives and tax exemptions for the production and commercialization of biodiesel for use in diesel engines, and a Ministry of Mining and Energy resolution extends incentives for a 5% biodiesel blend.

Income generated by crops used as biodiesel feedstock (including cocoa, rubber, palm oil, citric acid, and fruits) is tax-exempt. The law also delineated the oils that can be blended with regular fuels, including ethanol, biodiesel, biometanol, biodimetileter (biomass), synthetic biofuels, biohydrogen, and pure vegetable oils. Quality standards provide that diesel fuel for use in engines can contain biofuels of vegetable or animal origin.

Relations with Brazil

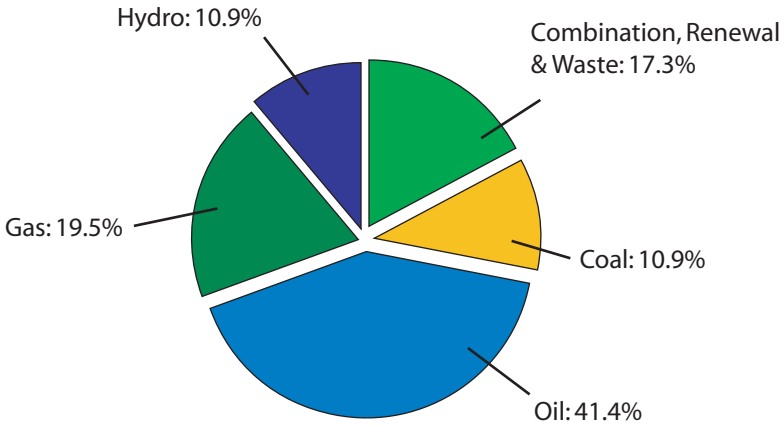
In October 2006, Ecopetrol, Colombia's state-owned energy company, signed an accord with Petrobras, its Brazilian counterpart, for the joint development of biofuels and distribution systems for petroleum byproducts. The companies agreed to sponsor studies on new production ventures, transportation and infrastructure, and technological support.[4] The agreement marks the first substantial cooperation between the two countries on biofuels.

C) CURRENT SITUATION

Colombia is heavily dependent on oil. In 2005, Colombia produced approximately 526,000 barrels of oil a day, exporting about half of that production, the majority of which is bound for the United States.[5] Oil accounts for 41.4% of domestic energy consumption, significantly higher than the global average of approximately 35%. The dependency owes much to inefficient consumption facilitated by subsidies, a problem the government is seeking to address.

Energy Matrix

Chart 1.4a: Colombia's Energy Matrix (2003)



Source: IEA

Current Production
Colombia produces both ethanol from sugarcane, cassava, and maize, and biodiesel primarily from palm oil.

Table 1.4a: Biofuels Feedstock Production (tons)

Crop	Type of energy	2003 production	2004 production	2005 production	%change 04-05
Sugar	Ethanol	16.574.312	16.961.864	7.717.120	4,5
Cassava	Ethanol	1.840.717	1.943.098	2.059.683,9	6,0
Maize	Ethanol	1.208.595	1.398.724	1.556.222	11,3
Palm Oil	Biodiesel	526.610	630.388	654.555	3,8

Source: Sociedad Colombiana de Agricultores

Ethanol Production
2005 has been labeled the beginning of the ethanol era in Colombia. Ethanol has created a promising new outlet for the country's agriculture sector, and particularly for sugarcane producers, who have been vulnerable to price volatility in the international sugar market. Of the approximately 200,000 hectares planted with sugarcane, 50,000 is now going to ethanol production, taking an estimated 15%-25% of surplus sugar off the market, according to the Agriculture Ministry.[6]

Colombia is a highly efficient producer of sugarcane. In 2004, it ranked 7th in the world for total quantity produced and did so with a yield of 93 tons per hectare, compared to 74 tons per hectare in Brazil, but unlike Brazil, Colombia depends on irrigation, which drives up costs. Thirteen of the country's fourteen refineries are located in the fertile Cauca Valley. They produce more than 99% of Colombia's sugar thanks to a climate that permits year-round production.[7] The first stage of ethanol production in Colombia relies on this existing industry. Already five of these refineries have added distilleries to their plants and are producing together more than one million liters of ethanol daily. These facilities are capable of meeting demand in the areas participating in the first phase of the ethanol program.

Table 1.4b: Sugar Industry Moves Into Ethanol

Refinery / Distillery	Commenced Operation
Ingenio Incauca	October 2005
Ingenio Providencia	October 2005
Ingenio Risaralda	January 2006
Ingenio Mayagüez	March 2006
Ingenio Manuelita	March 2006

Source: Asocaña

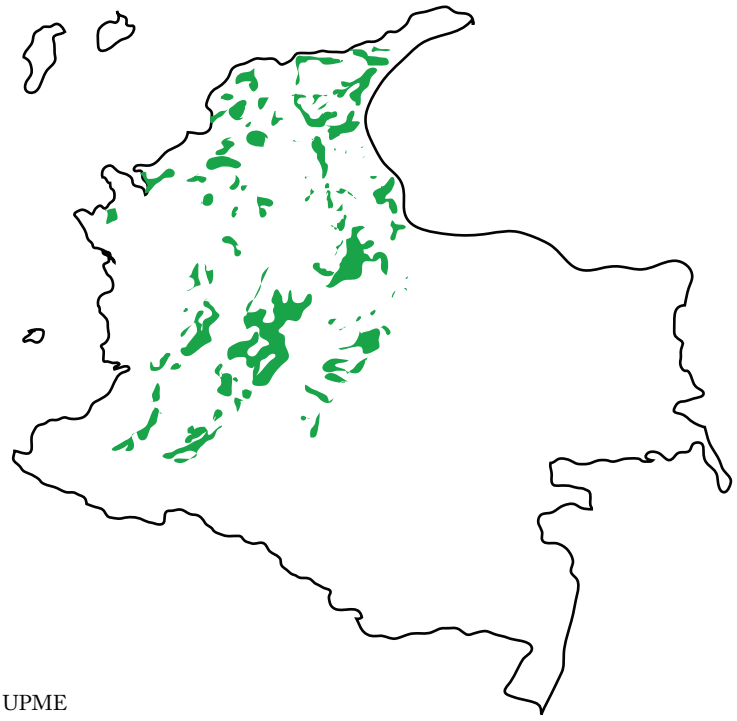
Further expansion may spread production beyond just this most productive region. The distribution system will involve truck transport from distilleries to local supply centers near major cities run by the country's three major distributors: ExxonMobil, Terpel and Texaco. There, the distributor blends the ethanol into the oil, and the fuel is then moved by tanker truck to local service stations. The chart below shows projected future capacity of projects throughout the country.

Table 1.4c: Capacity Potential of Identified Ethanol Projects

Location	Capacity (l/day)	Feedstock
Hoya del Río Suarez	300.000	Sugar Cane
Vegachí (Antioquia)	350.000	Sugar Cane
Valle del Cauca	300.000	Sugar Cane
Costa Norte	300.000	Sugar Cane- Yuca
Cundinamarca	150.000	Sugar Cane
Llanos Orientales	100.000	Yuca- Sugar Cane
Eje Cafetero	250.000	Sugar Cane
Huila	200.000	Sugar Cane
Nariño	150.000	Sugar Cane

Source: Asocaña

Map 1.4a: Zones for Potential Cane Expansion



Source: UPME

Colombia is also pioneering the use of cassava for ethanol production. There are already 128,000 hectares planted with cassava, and cultivation is rapidly growing. One plant using cassava is already operational and produces 20,000 liters a day. Two more plants, with a capacity of 75,000 liters a day, are under construction, and work on a project twice that capacity began recently in the state of Cordoba.[8]

The production of ethanol is expected to more than triple by 2020, thanks to both increased land dedicated to cassava farming, and what one can assume is production efficiencies in molasses and sugarcane based ethanol.

Table 1.4d: Ethanol Area by Feedstock (ha)

Area	2006	2010	2015	2020	2020/2006
Sugar Cane	37,000	72,000	72,000	72,000	35,000
Molasses	0	43,000	43,000	43,000	43,000
Cassava	3,000	34,000	70,000	100,000	97,000
Total	40,000	149,000	185,000	215,000	175,000

Source: UPME

Table 1.4e: Ethanol Production by Feedstock (1,000 liters)

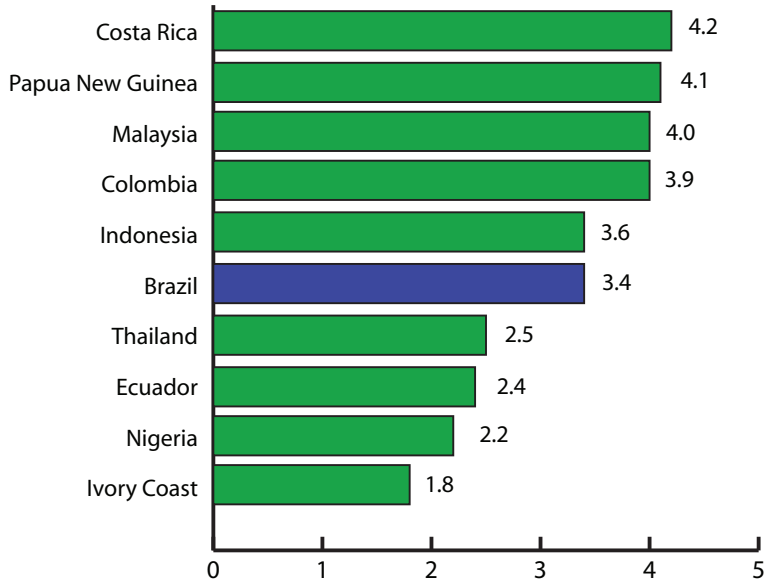
Production	2006	2010	2015	2020	2020/2006
Sugar Cane	858,082	1,469,863	1,469,863	1,469,863	611,781
Molasses	0	733,300	733,300	733,300	733,300
Cassava	20,000	632,500	907,500	1,595,000	1,575,000
Total	878,082	2,835,663	3,110,663	3,798,163	2,920,081

Source: UPME

Biodiesel

Biodiesel activity, both in terms of projects and research, is focusing on the African Palm. While Colombia produces large quantities of soy and other oilseeds, these commodities are not particularly competitive and production is declining. Colombia leads the Americas in palm production, and is the fifth-largest producer and exporter of palm oil in the world (fourth in terms of yield per hectare).

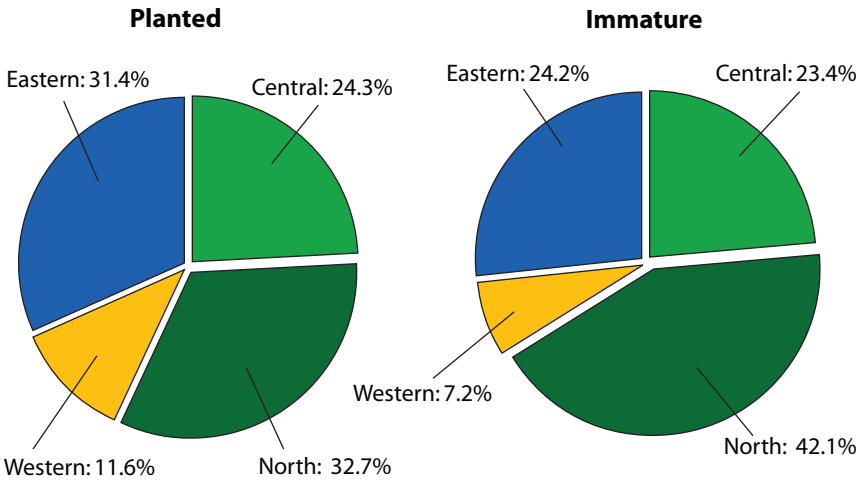
Chart 1.4b: Top Global Palm Oil Producers (2004) (billion liters)



Source: Fedepalma

A national plan for the development of the palm oil agroindustry calls for an additional 640,000 hectares by 2020, an expansion that is expected to create 100,000 new jobs and 300,000 indirect jobs, with the added benefit of offering an alternative to drug cultivation.[9] Palm grows throughout the country, but rapid expansion is occurring in the north, according to Fedepalma, the industry association.[10] The Colombian government is supporting this expansion through Finagro, a group extending credit to integrate producers, commercial and industrial, public and private entities in support of industrial agriculture.[11]

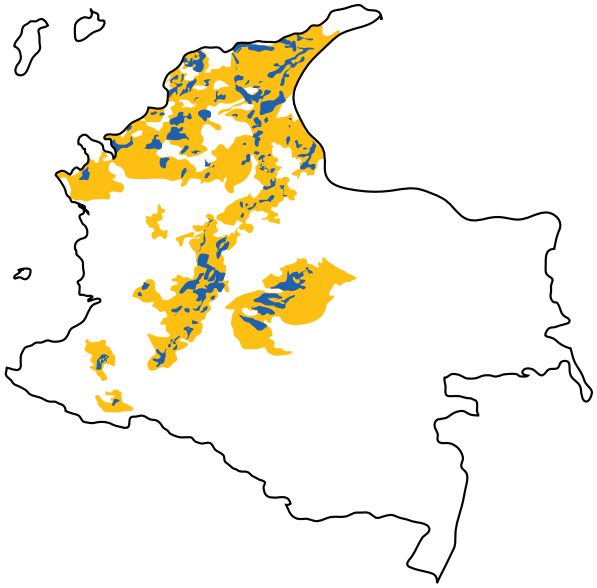
Chart 1.4c: Planted and Immature Palm Oil by Region



Source: Fedepalma

Interest in biodiesel is increasing in all four productive regions of the country. Producers in the country's banana industry in Urabá are reportedly exploring the palm-based biodiesel industry in an effort to diversify the region's agriculture sector, which produces an excess of bananas. The region would like to use more of its billion plus hectares of arable land, only 30% of which is under cultivation.[12] Fedepalma claims that, with expanded cultivation along these lines, producers could meet the demands of a 15% blend requirement. The association contends, however, that producers are waiting for clear signals that the government will help create a market for the product.[13] The map below shows areas determined to be suitable for palm cultivation.

Map 1.4b: Areas of Potential for African Palm



Source: UPME

Domestic consumption

The Government's national ethanol plan has now created a base level of demand. The 10% blend requirement in Bogota, Valle del Cauca, and the coffee-producing areas, regions which represent 57% of Colombian transport oil consumption, now requires nearly all current ethanol production.[14] Expanding the 10% blend to the rest of the Colombian market, planned for 2007, is expected to increase consumption to 700 million liters a year and require a trebling of land dedicated to feedstock cultivation.[15]

Biodiesel consumption in Colombia is still small-scale, although some local communities have made it a primary fuel. The town of Gaviotas, for example, has a plant sponsored by the University of Colorado in Boulder which produces biodiesel for use by the community.

Export

There are currently no exports of ethanol or biodiesel. Ethanol producers plan to meet domestic demand before considering the export market, but they are keenly aware of its potential, particularly in the US market. Should a recently negotiated free trade agreement gain Congressional approval, Colombia would enjoy tariff free access to that rapidly growing market. The US market is all the more appealing because supply shortages and high-cost production have driven up prices, which are 30% higher than in Colombia. The free trade agreement may affect Colombian ethanol in another way: unrestricted trade with the US means that high fructose corn syrup will enter the market and threaten the sugar industry. Ethanol provides an alternative outlet for sugarcane that may help offset this impact.[16]

D) PRIVATE SECTOR

The biofuels sector has grown up from almost nothing in the past two years, but major investments are needed for its continued expansion. To meet domestic demand, the industry will require an estimated $400 million in investment over the next five years and $100 million in new infrastructure for distribution. The five existing ethanol distilleries in the Cuaca Valley alone required at least $80 million and benefited from existing infrastructure and proximity to Colombia's most efficient sugarcane production.[17] The industry could technically remain concentrated in the Cuaca Valley, but with no available land for expansion, any increase in ethanol production there will come at the expense of sugar production. Moreover, transporting the ethanol to more distant markets adds an estimated 7-8% to the cost.

To effectively service local markets then, ethanol production facilities will need to be constructed as greenfield projects,[18] a requirement that makes finding investors more challenging. While Colombia is one of the most attractive regional markets for international investors, "green" investors have not flocked to these new projects. Absent major new investment, it is unlikely that there will be sufficient productive capacity to meet the 2007 target of a 10% ethanol blend throughout the country.[19]

A number of factors limit investor enthusiasm. Many of the new projects needed to ensure countrywide distribution are located in areas less suited to sugarcane production due to climate, topography, and a lack of transport infrastructure. Still, some projects are moving forward, including a $7 million investment by local company Petrotesting in an ethanol facility in Llanos Orientales with production capacity of 20,000 liters a day.[20]

Another area of potential private sector investment is electrical and steam cogeneration. Bagasse, a sugar byproduct, is burned by many sugar mills to produce electricity and steam. Usually, the primary purpose is to dispose of the bagasse and to produce enough energy to meet the needs of the sugar mill. However, advanced technology has been developed to produce energy in excess of sugar mill needs which can be sold on the market. Colombia's sugarcane industry association, Asocaña, estimates that with investments in high-pressure boilers and increased utilization of cane waste, plants could generate 200 MW of excess electricity for sale to the national grid. This generation could help address the estimated 660MW and 1,160MW of additional power capacity that will be needed in 2009-2013. According to the group's annual report, however, investments of this kind will require additional economic incentives.[21]

There is a great deal of enthusiasm surrounding biodiesel production, both for the domestic market and for export. Most areas with productive potential are concentrated near the coast, making exports viable. Unlike with ethanol, there is ample room for expansion. According to industry association Fedepalma, there are already 8 biodiesel plants with an installed capacity of 685,000 tons each year. As the mandated 5% blend will require just 200,000 tons, producers are looking to export markets. To date, investment in the sector has come exclusively from local actors, largely from companies already in the palm-oil business.

E) RESEARCH & DEVELOPMENT

For a relative newcomer, the biofuels industry in Colombia has sparked a considerable amount of research interest and activity.

The Corporation for Industrial Development of Biotechnology and Clean Production (Corpodib), a public-private institution affiliated with the National University, has taken the lead in the research effort behind Colombia's national biofuels plan, including zoning the country for the production of biofuels feedstocks. Corpodib has conducted studies of ethanol plant design, fermentation, energy consumption, and solid and liquid disposal.[22] On biodiesel, it conducted studies of new technology, the national market, and raw material costs. It also established a pilot plant for biodiesel production in cooperation with Transmilenio, the public transportation system of Bogota, which

tested and used the biodiesel in its buses.[23] Corpodib has continued to study how to optimize biofuels production processes.[24]

The government is also promoting biofuels R&D through the state energy company Ecopetrol and the National Institute for Science and Technology, Colciencias, which in January 2006 sought proposals for the establishment of "centers of excellence" – including one on biomass and biofuels.[25]

The Colombian Sugarcane Research Center (CENICAÑA) is financed by the sugar mills and individual sugar producers who comprise the Colombian Association of Sugar Producers (ASOCAÑA), much like the CTC in Brazil. Its research agenda is established by a board representing the financing institutions and has historically focused on developing improved varieties with higher sugar content, earlier maturity, resistance to disease, and susceptibility to mechanized harvest.[26] These developments have contributed to the productivity of the industry, which has grown more than 50% since 1980.[27]

The holding company Petrotesting, which owns the only cassava-based ethanol refinery, has partnered with the Cali-based International Centre for Tropical Agriculture (CIAT) to study the optimal cassava plant for ethanol production. CIAT is the global leader in cassava studies and has 6,000 varieties in its gene bank.[28]

The Universidad Nacional de Colombia and the University of Antioquia are studying the optimization of biodiesel production through transesterification with methanol from Tenera, a hybrid of the African palm grown in the country. A public-private collaboration, the research is being done by Interquim S.A. with financing from Colciencias, the national institute for science and technology. The project is advocating a mandatory national 30% biodiesel blend, which would require an additional 270,000 hectares of palm cultivation and create an estimated 70,000 jobs.[29]

Cenipalma, a private institution jointly funded by the federal government and palm oil producers, is also researching biodiesel production. In January 2005, it opened an experimental farm to identify the optimal varieties of palm. Cenipalma has long been engaged in developing high-yield varietals for the country's palm oil industry and is hoping to raise oil yields to 12 tons per hectare from a current average of four.[30] The organization has since partnered with the palm oil union Fedepalma and Pro-Palma to conduct a nationwide viability study for palm-oil biodiesel production.

F) CONCLUSION

After Brazil, Colombia is one of the leading countries in the region in all aspects of biofuels development, from the strong foundation of appropriate natural resources and government regulations to research & development initiatives and the pace of private sector investment. While the further expansion of sugarcane-based ethanol production faces hurdles, the country's biodiesel industry shows incredible promise, both for the domestic market and as a major export industry.

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A) INTRODUCTION

A slow shift is underway in Ecuador toward the production of ethanol and biodiesel. Private investment and research are showing interest in the industry, and there is strong potential for a domestic market. Yet, the government has yet to play the major role it must—particularly with respect to budgets and land use—to capitalize on these trends.

B) GOVERNMENT POLICIES

Subsidies and Inefficiency

In recent years, the government has attempted to solve some of its pressing energy security issues. Ecuador's energy sector has long been heavily subsidized, inefficient, poorly managed, and almost entirely dependent on petroleum [Chart 1.5a]. For instance, in 2005, total subsidies totaled $718 million: $281 million for liquid petroleum gas (LPG), $357 million for diesel, and $80 million for electric energy. The general use of electricity for commercial, industrial, and domestic purposes is highly inefficient, and there is no legal framework for managing consumption or promoting efficiency.[1]

Experts have pointed out that the current state of Ecuador's energy sector is the result of a decade of government policies that divorced the power sector from the oil sector and obstructed an integrated energy policy. This bifurcation left the country heavily dependent on oil and hugely inefficient in its use. The government has now initiated

reforms to address the issue.[2]

Diversifying the Matrix
The National Council for Electricity, which has demonstrated a growing commitment to energy security in the past few years, has designed a threefold strategy to improve energy consumption efficiency, reduce subsidies for the power sector, and diversify the country's energy matrix. Accordingly, the government has been working to create a Clean Energy Fund that will increase the use of renewable sources for power generation, such as solar, wind, hydro, biomass and residues. The goal is to make the electrical sector more efficient and less dependent on government subsidies.[3]

On energy diversification, the government has two major policy initiatives. The National Program for Biofuels (Programa de Biocombustibles), established through Executive Decree 2332, declares the production, commercialization and use of biofuels to be in the national interest. It creates a Consultative Council for Biofuels with direct access to the President's Office. The Environmental Regulation for the Operation of Hydrocarbon Industries, passed in 2001, promotes the production of oxygenated additives, such as ethanol, for blending with gasoline.[4]

Following on these initiatives, the government launched an Ethanol Program in 2004 to promote the cultivation of sugarcane for ethanol production. The program seeks to achieve a 5% ethanol blend by the end of 2006 in the city of Guayaquil. If successful there, the plan would be extended to the rest of the country.[5] The government's strategy for biodiesel is very similar, though it seeks a 10% blend of palm-based biodiesel into regular diesel. No city has been chosen yet for the biodiesel pilot project.[6]

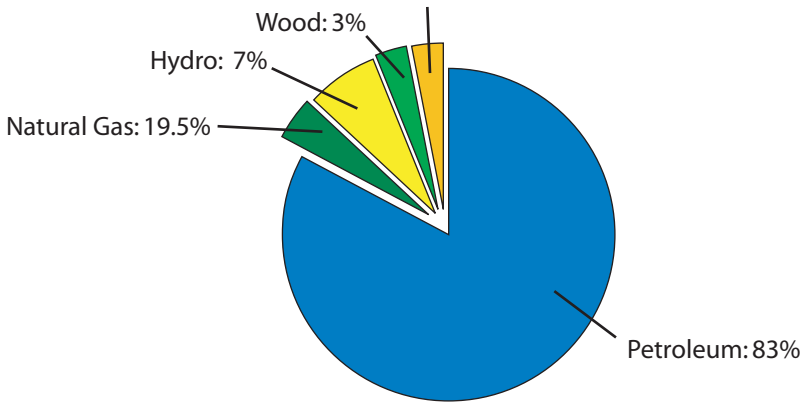
Despite having passed key legislation in 2004, the government has only recently announced its intention to designate funding and specific land for production expansion. Detailed plans for the implementation of biofuels projects are still lacking.[7]

Relations with Brazil
In 2004, Ecuador and Brazil signed a memorandum of understanding on energy, but the document did not include biofuels.[8] In July 2006, the countries held a joint symposium to explore possibilities for cooperation on the biofuels industry in Ecuador. This symposium was a result of contacts between President Alfredo Palacio and President Lula da Silva at the Summit of the Americas in November 2005.[9]

C) CURRENT SITUATION

Energy Matrix
As discussed, Ecuador's energy sector has been heavily subsidized, inefficient, and dependent on oil and natural gas.

Chart 1.5a: Ecuador's Energy Matrix



Source: OLADE

Production Capacity and Land Availability
Ecuador has great potential to expand ethanol production. The country has a variety of microclimates optimal for sugarcane, high quality soil, and a large supply of available labor. Approximately 76,000 hectares are already dedicated to sugarcane cultivation, and current ethanol production is approximately 60,000 liters per day. [10]

The Ethanol Program seeks to achieve augmented production by diverting most existing sugarcane production to ethanol from sugar. The plan envisions the possibility of expanding sugarcane production by 50,000 hectares, which would allow for a 10% blend with gasoline, instead of the initial 5%. Given projected annual gasoline consumption of 2.38 billion liters by 2008, the expected demand for ethanol, at a 10% blend, would be nearly 651,000 liters per day, or 237.6 million liters a year, more than 10 times today's production.[11]

Ecuador has a robust palm oil industry, which could provide feedstock for biodiesel. Approximately 207,000 hectares are dedicated to palm, which yield 350,000 metric tons of palm oil. 57% of this palm oil is consumed domestically and the rest is available for export.[12] With consumption of diesel expected to reach 3.74 billion liters by 2008, the expected annual demand for biodiesel, at a 5% blend, is around 512,000 liters per day or 186.5 million liters annually. The government plans to rededicate most of its exports of palm oil to biodiesel for domestic consumption.[13]

D) PRIVATE SECTOR

Thus far, Ecuador's private sector has been reluctant to invest significantly in the biofuels industry. A major concern is the lack of a clear plan for expanding the land available for sugarcane production. Despite the establishment of a legal framework for the biofuels industry, the government's ethanol and biodiesel projects still exist on paper only, and no implementing regulation has been signed.[14]

The Etanolsa Guayas, a union of 4,000 sugarcane producers from the Simón Bolívar region, has repeatedly complained that the government has failed to authorize funds for a refinery to support its 30,350-hectare expansion, which was approved by the legislature in 2000. Similarly, the National Ecuadorian Union of Sugarcane Producers (UNCE) has pressured the government to expand sugarcane production. Both groups are hopeful that government support will be forthcoming soon.[15]

The private sector has also been disappointed with the government's pace on biodiesel. The National Association of Producers of African Palm (ANCUPA) has proposed a series of projects for the government's consideration, but no final decision has been made.[16]

Most sources agree that the government's initiative in Guayaquil is closest to becoming operational. However, investment of $30 million is still required.[17] The Bejar Trading Company, an Ecuadorian subsidiary of China Dalian International Cooperation Holdings has discussed investing in the project, but little information about the negotiations has been made public.[18]

E) RESEARCH & DEVELOPMENT

Research and development on biofuels in Ecuador has been moving slowly. One significant initiative is the Network for Biotechnology Cooperation for Agriculture (Red de Cooperación Técnica en Biotecnología Agropecuaria). The Network is a project of the Food and Agriculture Organization, which has operated in Ecuador since 1991. It aims to facilitate technology transfers between institutions enaged in biotechnology for agricultural applications.[19] The network has supported several studies of sugarcane applications, including ethanol. One key goal is to improve the production yield per hectare. Current production is 74 tons per hectare for irrigated land, similar to Brazil's yield without irrigation. Sucrose levels, however, are below 10%.[20]

The Escuela Politécnica Nacional (EPN)'s science department has also been active in

research. In recent studies, EPN has been able to produce small quantities of ethanol from wood residues and paper trash, such as newspapers. Trajano Ramírez, a chemical engineer who also works with the Network, coordinates the project, which aims to expand wood-based ethanol production through governmental support and private investments.

F) CONCLUSION

As in most countries, implementation is the key to biofuels development in Ecuador. The absence of an integrated energy policy, continued subsidies for petroleum-based products, limited R&D, and poor sugarcane yields all impede the country's biofuels effort. Exploratory discussions are underway on cooperation with Brazil, but no substantive work has begun. The private sector is interested in biofuels but is unwilling to commit until the government elaborates its legal framework and actively supports land expansion for sugarcane production. Until the government becomes more active, progress will be slow.

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A) INTRODUCTION

Paraguay ranks 106th out of 120 countries in economic competitiveness, according to the World Economic Forum's Global Competitiveness Report.[1] Like many of its neighbors, Paraguay suffers from a variety of maladies, including official inefficiency, corruption, and crime, which continue to obstruct Paraguay's industrial development and integration into the global economy. Despite these challenges, Paraguay's economic growth averaged 3.5% between 2003 and 2005, and the national poverty rate has declined in recent years.[2]

Paraguay is a borrowing member of the Inter-American Development Bank and has been a member of Mercosur since 1991. Trade with Brazil forms a large part of its GDP.

B) GOVERNMENT POLICIES

Following the oil shock of 1973, Paraguay followed the lead of Brazil and the United States and launched a national ethanol program. However, government support for the program declined with the fall of oil prices and by the early 1980s, it had dissolved completely.[3]

In a second attempt at biofuels production, Paraguay launched its Ethanol Program in

1999. The program mandates a blend of up to 20% with most gasolines, although it is estimated that the country's ethanol production capacity can only support a blend of 18%. The Ethanol Program also provides a tax incentive for ethanol use, by reducing the standard fuel tax of 50% to just 10%.[4]

In 2001, the Paraguayan government issued Decree No. 12.111, which created a working group to study the technical and economic feasibility of biodiesel. The group found that, given the high and volatile price of oil, the substitution of a reasonable percentage of biofuels was economically viable and would help limit the economic impact of fluctuating fuel prices.[5]

A Biofuels Law, enacted in 2005, supported the findings of the working group and declared the development of biofuels, including biodiesel, a matter of national interest. It mandated the use of local resources as feedstock for ethanol and biodiesel, provided market support in the form of incentives, and reduced licensing requirements for biofuels-related activities.[6]

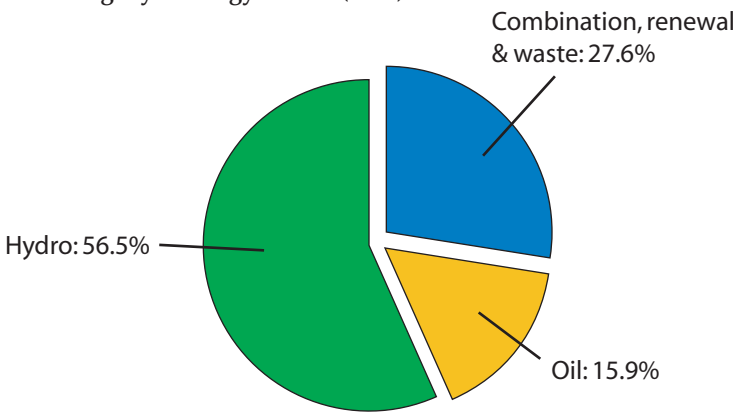
Most recently, a program enacted in 2006 called Ethanol 85 raised the required percentage blend of ethanol to 24%, greatly increasing demand for the fuel. According to Paraguay's Ministry of Industry and Commerce, the nation's ethanol demand has reached 465,000 liters per day.[7] As of October 2006, regulations on biofuels quality standards and other matters were still pending.[8]

Relations with Brazil
Paraguay has several bilateral agreements with Brazil, including for technical cooperation on agrarian development and for training and professional capacity-building. The countries have reached an agreement to cooperate on the development of biofuels technology.[9] Recently, ministers from the two countries agreed to support an initiative set forth by the Paraguayan Ministry of Industry and Commerce for a business seminar on Investments and Integration of Production Chains for Biofuels. The conference is scheduled to take place in early 2007.[10]

C) CURRENT SITUATION

Energy Matrix
The majority of Paraguay's energy comes from hydropower, with less than 16% of its energy derived from oil [Chart 1.6a].

Chart 1.6a: Paraguay'a Energy Matrix (2003)



Source: International Energy Agency[11]

Paraguay's electricity sector is controlled by its state-owned utility, the National Electricity Administration (ANDE), which operates the Acaray hydroelectric dam, six thermal power plants, and shares responsibility for two hydroelectric dams with Argentina. With Brazil, ANDE jointly manages the Itaipu dam, currently the world's largest.

Paraguay uses 16% of its electricity yield from Itaipu and exports the rest to Brazil. The country consumes only 1% of the power derived from the 3,500-megawatt capacity Yacyreta dam and exports the remainder to Argentina.[12]

Paraguay consumed 4.5 million liters (28,000 barrels) per day of oil in 2006, all of it imported (the country does not produce any oil). The state-owned petroleum company, Petroleos Paraguayos (Petropar), has a monopoly on the import and sale of petroleum products and operates the country's only refinery, the Villa Elisa facility, which has a capacity of 1.2 million liters (7,500 barrels) per day.[13] In 2005, Petropar signed a deal with Venezuela that grants the company preferential terms for crude oil imports.[14]

Biofuels Production

Paraguay has 39.73 million hectares of land, 67,000 of which is irrigated. 7.47%, or nearly 3 million hectares, is considered arable and 0.94%, or 373,462 hectares, is used for permanent crops. The Paraguayan economy is largely based on small farms, with sugarcane, corn, wheat, cassava, and soybeans as the major agricultural products.[15] Given this agricultural strength, Paraguay has good potential to become a large-scale producer and net-exporter of biofuels.

Ethanol

Cereal grains and other starch crops account for a large part of Paraguay's agricultural cultivation, and could be used to produce ethanol. The country annually produces 1.1 million tons of maize (corn), 5.5 million tons of cassava, 3.6 million tons of sugar cane, and 715,000 tons of wheat. Based on net exports, maize, sugar cane, and wheat have the greatest potential to serve as feedstock for ethanol production.[16]

Biodiesel

Of the nation's agricultural products, soybeans are the most promising resource for large-scale production of biodiesel. Paraguay is expected to produce 3.6 million tons of soybeans in 2006 and is consistently a net exporter.[17] Additionally, the country produced 125,660 tons of palm kernel equivalents, 27,660 tons of rapeseed and mustard seed, and 440 tons of oilseed in 2004.[18]

Studies show that Paraguay is currently using only 10% of its arable land. An estimated 20,000 acres of arable land could be used to cultivate biofuels crops, especially soybeans, without diverting farmland from food crops.[19]

D) PRIVATE SECTOR

Soybean production has expanded dramatically in Paraguay in recent years: soy accounted for 10% of the country's economy and 50% of its exports in 2005. Large multinational agribusinesses like Cargill, a U.S. grains conglomerate, have been the prime drivers of this expansion and will play a large part in the future development of a domestic biodiesel program.[20]

E) RESEARCH & DEVELOPMENT

Paraguay currently has agreements with the United States to facilitate the transfer of technology and research related to biofuels production. Paraguay has also increasingly looked to Brazil for expertise, and the two nations have an accord to cooperate in the development of biofuels technology.[21]

F) CONCLUSION

Paraguay's total dependence on imported oil and its robust agricultural economy make it a strong candidate for a domestic biofuels industry. The country grows a number of feedstock crops suitable for both ethanol and biodiesel production, and studies show that there is potential to expand the cultivation of these crops to underutilized land without diverting land from food crop cultivation. The passage of pending legislation and continued technical cooperation with the Brazilian government would help the country realize its biofuels potential.

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A) INTRODUCTION

Peru has taken a number of important steps to promote its domestic biofuels industry. As with many other countries in the region, Peru began by establishing a regulatory framework and mandated blends of biofuels, which should soon be followed by investments and R&D incentives.

The need to decrease reliance on traditional sources of energy is a strategic requirement for Peru and the strongest motivation to develop biofuels. In addition, the use of ethanol has been promoted as an instrument to reduce pollution, foster development in rural areas, and create jobs across the country. Finally, it is anticipated that the ethanol industry may serve as an alternative to narcotics and assist Peru's fight against illegal drugs.

Peru's established sugarcane production and the work the government has done to lay a legal and regulatory foundation are positive, but further budget and tax incentives will be necessary to develop the nascent industry.

B) GOVERNMENT POLICIES

In recent years, Peru has worked to establish an initial legal framework for the promotion of biofuels through two main instruments, the 2003 Biofuels Market Law (Ley de Promocion del Mercado de Biocombustíbiles), also known as PMB Law, and the 2005

Supreme Decree 03.
The PMB Law established a series of guidelines for promoting biofuels and created a Program for Biofuels Promotion (PROBIOCOM) and a Technical Commission for Biofuels (TCB).[1] The two bodies will promote production and trade of biofuels, strengthen R&D initiatives, invest in human resources, and create incentives for commercialization. A particular focus of both institutions will be fostering the production of biofuels in the Amazon region as an alternative to drug cultivation.[2] The TCB will also work in cooperation with the National Environment Council in order to ensure that expansion in the Amazon region is pursued responsibly.[3]

In 2005, a Supreme Decree required blends of 7.8% ethanol with gasoline and 5% biodiesel with diesel. It also called for ethanol production to begin in the regions of La Libertad, Lambayeque, Ancash, Piura, Barranca and Huaura by July 2006; in the regions of Loreto, Ucayali, Amazonas, San Martín, and Huánuco by January 2008; and in the rest of the country by January 2010. The Decree also envisions biodiesel commercialization in the regions of Loreto, Ucayali, Amazonas, San Martín, and Huánuco by January 2008; and in the entire country by January 2010.[4]

As of late January 2007, ProInversion, Peru's private investment promotion agency, will coordinate a subcommittee tasked with outlining technical standards for ethanol and biodiesel as part of Probiocom. Representatives of Industrias del Espino, Peruana de Combustibles, Heaven Petroleum, Biodiesel Perú, Repsol, automobile manufacturers association Araper, and local universities will participate in the subcommittee.[5]

Both the PMB law and the Decree insist that biofuels crop projects comply with national environmental laws and reinforce anti-narcotics initiatives.[6]

Challenges to the Framework
An initial legal framework is in place, but recent analyses have highlighted the need for implementing regulations. The Center of Rural Promotion, a Lima-based research center linked to the Peruvian Ministry of Agriculture, has recommended a number of changes to the current framework. For instance, the center points out that ethanol may not be competitive with regular fuels if taxes and incentives are not structured appropriately, especially given future fluctuations in the relative prices of sugar and oil. According to the study, the production of palm oil-biodiesel would cost approximately $0.50 per liter, a level that may be too high to be viable without state intervention in the form of tax incentives or price subsidies. The study also recommends increasing gasoline blends to 10% ethanol and diesel mixes to 20% biodiesel.[7]

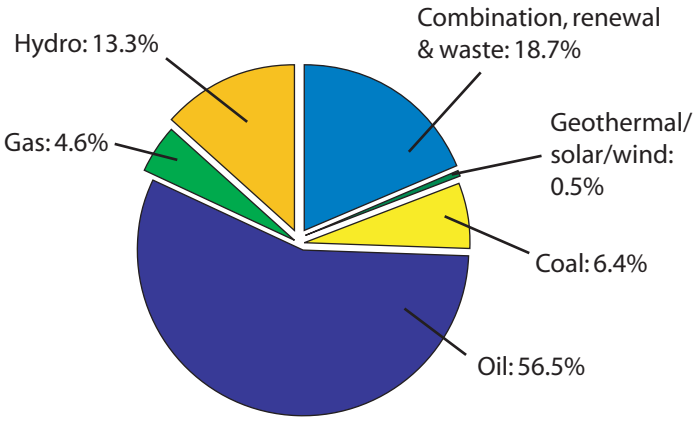
Relations with Brazil and Regional Cooperation
In February 2006, Peru's National Counsel of Science, Technology and Technological Innovation (CONCYTEC) renewed a program on biotechnology and biofuels with Brazil's Agricultural Research Corporation.[8] The governments of Brazil and Peru also signed an agreement in June 2006 to work together on projects related to the development of alternative crops for biofuels.[9]

The Free Trade Agreement (FTA) Peru signed with the US allows it to export biofuels into the US market and creates an opportunity for ethanol and sugar producers. However, there is some concern in Peru that recent agreements signed with Mercosur could threaten the domestic biofuels industry by allowing lower-cost Brazilian product access to the market before Peru's industry reaches cost efficiency.[10]

C) CURRENT SITUATION

Energy Matrix
Peru is heavily dependent on non-renewable sources of energy, which account for almost 70% of consumption.

Chart 1.7a: Peru's Energy Matrix (2003)



Source: International Energy Agency

Production Capacity

Peru has a number of crops that can be used for biofuels production, including sugarcane, sorghum, corn, yucca, potatoes, and rice. Peru is particularly competitive in sugarcane, boasting the highest yield per hectare in the world.[11] According to the Food and Agriculture Organization, the Peruvian sugarcane industry in 2004 produced 120 tons per hectare compared to just 73 tons per hectare in Brazil. The industry is also growing; production in 2004 increased 5%.[12]

80% of Peru's sugarcane goes to sugar production, and ethanol production is consequently quite low; in 2003, the country produced just 30.4 million liters. Using 2004 gasoline sales figures, it is estimated that 102 million liters of ethanol will be needed to reach the PMB's planned 7.8% blend standard by 2010.[13]

One of the strategies for expanding production is to increase cultivation in the Amazon region, which may have as much as 2 million hectares of available land. The northeastern region of San Martin is particularly promising. It currently has 3,500 hectares of sugar cane but there are plans to develop another 7,500 and build 45 distilleries.[14]

The principal challenge to such projects is establishing transportation logistics in the jungle. A 1,029 kilometers pipeline is being planned to transport product to the Boyóvar port in Piura, but this project will require investment of US$185 million.[15]

There is no significant biodiesel production to report, though Peru does produce significant quantities of palm oil, soy, and sunflowers, all of which can be used for biodiesel.

D) PRIVATE SECTOR

Peru's biofuels market is still in its early phases. The Peruvian Association of Sugar and Biofuels Producers forecasts that investments of approximately $400 million will be needed in the next decade.[16] Several companies appear to be positioning themselves as leaders in this developing market. One is Palma Selva SA, which manages several major projects in the Lima region. The company owns 1,800 hectares dedicated to biofuels feedstocks and is expanding production of both sugarcane and palm oil. The company has already established partnerships with Coimex Trading Co., from Brazil, and US-based Coler & Colantino Consortium.

Another company, Pure Biofuels, is also emerging as an important player, with aspirations of becoming the leading biodiesel producer in Latin America. Pure Biofuels will construct its first biodiesel refinery near the Callao port in Lima, investing $30 million

in the project. The plant, which is to be operational by November 2007, will have an initial annual production capacity of 180,000 tons of biodiesel, with expansion to 360,000 tons per annum planned by 2009. The company will also increase investment to $100 million in the next four years to cultivate feedstock in the Andes and Amazon regions. Pure has also signed pre-sale MOUs with local Peruvian fuel distributors for the entire production of the Callao facility. [17]

In January 2007, Texas-based company Maple announced plans to begin ethanol production from its project in coastal Peru in the second quarter of 2009. The company aims to begin testing sugarcane in a pilot area in March, with full-scale planting to start in November.[18]

E) RESEARCH & DEVELOPMENT

The government anticipates that research and development for new biofuels technology will be led by national universities and by the National Council of Science, Technology and Technological Innovation (CONCYTEC). These entities will help create the technology and design infrastructure for the production, commercialization and distribution of biofuels.[19]

CONCYTEC has already begun research on the production of biodiesel based on oil resources from the Amazon. For its part, the Universidad Nacional Agraria La Molina (UNALM) has begun research on the production of biodiesel from edible oils and has created small-scale prototypes.[20]

F) CONCLUSION

The elements for the development of a sustainable biofuels sector in Peru appear to be in place. A basic legal framework has been approved. Fuel blending targets have been established, environmental concerns are being addressed, and the country already has a high-yield sugar cane industry the expansion of which could feed ethanol production. Peru has also concluded two cooperation agreements with Brazil and has negotiated preferred access to the US market although this agreement is still pending approval by the US Congress. Importantly, several private-sector firms have made initial investments in biofuels production. Questions remain, however, about the feasibility of government plans to expand sugar cane production in the Amazon region and, more broadly, whether biofuels can be competitive with petroleum products.

Endnotes

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Source: World Factbook

A) INTRODUCTION

Uruguay currently ranks 73rd out of 120 countries in global competitiveness, according to the World Economic Forum.[1] The nation continues to struggle to establish itself as a contender in the global economy as well as to improve the livelihoods of its people. In the 2005 United Nations Human Development Report, Uruguay was ranked 46th in human welfare, which includes measures of poverty, health, and education.[2]

Uruguay began liberalizing its economy in the 1970s, focusing on the opening of trade barriers and financial flows. In 1991, Uruguay became a member of Mercosur (the Southern Cone Common Market). As a result, its economy and energy policies were and continue to be highly integrated with those of other Mercosur members, particularly Argentina and Brazil. Eight years later, in 1999, Uruguay experienced a major recession due to low commodity prices and struggling export markets. A devaluation of Brazil's currency and economic crisis in Argentina contributed to the country's dire situation, putting drastic downward pressure on Uruguay's exports and tourist revenues. Uruguay was forced to borrow extensively from international financial institutions, particularly the IMF. Finally, in 2003, Uruguay managed to recover and achieve economic growth, which has continued up to the present with the help of healthy export markets and increased trade with the United States. According to the U.S. State Department, Uruguay presently enjoys a favorable investment climate, with a strong legal system and open financial markets.[3]

B) GOVERNMENT POLICIES

In 2003, the Uruguayan Government approved Law No. 17.567, which states that the production of biofuels is in the "national interest," and is therefore eligible for a variety of fiscal incentives and tax exemptions.[4] The government also created an official, inter-institutional National Biofuels Commission to advise authorities on the framework for state policies related to biofuels production and use. The Commission is composed of members of the National Direction of Energy and Nuclear Technology (DNETN), the Ministry of Cattle (MGAP), the National Administration of Oil, Alcohol and Portland Cement (ANCAP), the University of the Republic (UdelaR), and the National Institute of Agricultural Research (INIA).[5] These ministries and institutions have identified a number of reasons to expand the biofuels industry in Uruguay, including:

- Providing jobs and improving livelihoods in Uruguay's rural areas;
- Reducing consumption of petroleum;
- Limiting greenhouse gas emissions; and
- Diversifying the country's power matrix.

The Uruguayan government has also established a National Program of Bioethanol (Pronabio-E), ostensibly to coordinate the production of ethanol in different agricultural regions throughout the country. Pronabio-E is currently working with the municipalities of Montevideo, Canelones, Maldonado, and Treinta y Tres, as well as unions and institutions from the states of Bella Unión, Paysandú, Salto, and Durazno. The program focuses especially on the processing of sugarcane for ethanol production, and Pronabio-E predicts that an expanded sugar-alcohol industry will have great economic, social, and environmental benefits.[6]

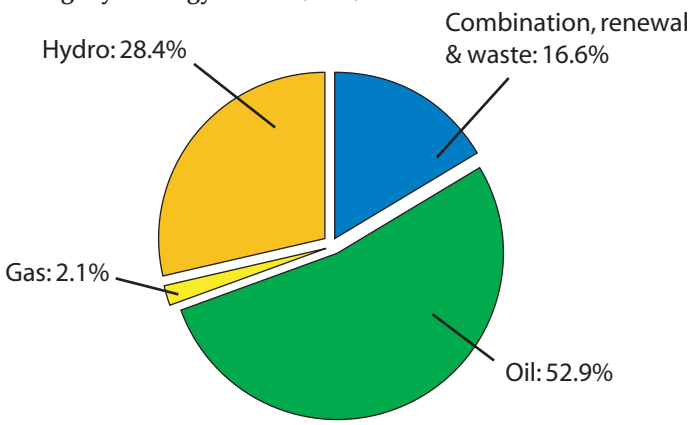
The creation of the Biofuels Commission and Bioethanol Program reflects the Uruguayan government's interest and investment in the cause of sustainable energy resources and environmental protection. While additional steps will have to be taken to establish a clear regulatory framework regarding biofuels production and use, including blend targets, the government of Uruguay has already made a great deal of progress.

Relations with Brazil
Uruguay and Brazil are both members of the Mercosur trading bloc and the countries have a number of additional bilateral agreements. While the two countries have not established formal cooperation on biofuels, there is discussion of establishing a shared research center to develop new cane varieties suitable to their common conditions.

C) CURRENT SITUATION

Energy Matrix
The primary source of Uruguay's energy is oil, followed by hydropower [Chart 1.8a]. Oil consumption reached roughly 5.7 million liters (35,700 barrels) per day in 2005, almost all of which was imported. The nation's only refinery, the La Teja facility near Montevideo, has the capacity to refine 8 million liters (50,000 barrels) of oil a day.[7] The National Administration of Combustibles, Alcohol and Portland Cement (ANCAP), which is state-owned, controls the oil sector in Uruguay.

Chart 1.8a: Uruguay's Energy Matrix (2003)



Source: International Energy Agency[8]

Uruguay, along with Paraguay, signed a deal in 2005 to receive preferential terms for crude oil imports from Venezuela, a newly-accepted member of Mercosur. In December 2005, Uruguay's ANCAP and the state petroleum company of Venezuela, Petróleos de Venezuela (PDVSA), agreed to conduct a feasibility study on an $800 million plan to double the capacity at the La Teja facility, including an upgrade of the refinery to allow it to better process heavier, Venezuelan crudes.[9]

The nation's four hydroelectric plants provide the majority of the nation's electricity; the Terra, Baygorria, Palmar, and Salto Grande plants have a combined capacity of 1,538 megawatts. In addition, in May 2006, Uruguay and Argentina agreed to study the feasibility of a new, 265-megawatt, hydro facility to be constructed near Salto Grande. These plants can cover the nation's energy demands under normal conditions, but shortfalls in water supply, due to seasonal variation, are covered either through imports, or through oil- and diesel-run generators. During peak demand periods, the country's National Administration for Electricity Use and Transmission (UTE) will also rely on thermal power plants and mobile diesel generators.[10]

Biofuels Production

Uruguay has 17.36 million hectares of land, 210,000 hectares of which are irrigated. 1.37 million hectares, or just under 8%, are arable, and 42,300 hectares, or 0.24% of total land are dedicated to permanent crops.[11] Uruguay depends on agriculture, which accounts for nearly 10% of the nation's GDP and more than half of its exports.[12] In terms of starch crops available for ethanol production, Uruguay produces rice, wheat, corn, and barley.[13] The nation is the largest exporter of rice in Latin America and the Caribbean, exporting over 1.2 million tons per year.[14] It also produces some 500,000 tons of wheat, 400,000 tons of barley, and 200,000 tons of corn annually.

Ethanol Potential

The primary ethanol feedstocks listed above, produced in surplus and exported, could be redirected toward ethanol production, allowing Uruguay to develop a value-added industry. Uruguay is a net exporter of both rice and barley, making those crops the most promising foundation for an expanded ethanol industry.[15]

Countries that are significant importers of gasoline are also good candidates for ethanol production. An ethanol plant that produces 40 million liters a year (the average output of ethanol plants in Brazil) could supply a 1.1 million liters a day (7,000 barrels) gasoline market with a 10% ethanol blend. Uruguay imports only 159,000 liters (1,000 barrels) per day of gasoline, and only 524,600 liters (3,300 barrels) per day of diesel fuel.[16]

Biodiesel Production
There is a domestic biodiesel market and there are strong incentives to further develop this market, given the importance of diesel to the country's electricity supply and the country's dependence on oil imports, including diesel. In 2004, Uruguay produced 5,390 tons of oilseed and 377,000 tons of soybeans from 245,350 hectares, both of which can be used as feedstock for biodiesel production.[17] There are three biodiesel plants in Uruguay, two of which are located in Montevideo. However, they do not utilize the above mentioned crops as feedstock; one uses fried cooking oil waste, and the other uses animal fat.

D) PRIVATE SECTOR

Uruguay is in the very early stages of developing a significant biofuels industry. As such, private investment is especially important. As of June 2006, several German and Canadian investors were planning to invest $45 million in an ethanol plant in Treinta y Tres, a rice-growing region of Uruguay. The plant would use the hulls and stalks of the rice, which are usually disposed of as waste products.[18] The project, if completed, will significantly increase the capacity of ethanol production at Treinta y Tres.

Several other firms are cooperating to launch new biofuels projects and expand existing ones. COPAGRAN (Cooperativas Agrarias Nacionales), EcoDiesel, and Cooperativa Cradeco initiated a program in April 2006 to expand production of biodiesel from oilseeds.[19] The project will cost US$70 million and is slated to begin in 2007. It will establish 25 micro-plants around the country to produce biodiesel using sunflower, soybean, and canola oilseeds near the fields where the grains are cultivated.

E) RESEARCH & DEVELOPMENT

Information available regarding research and development efforts in Uruguay is limited. The University of the Republic monitors the production standards for the country's largest biodiesel plant.[20] At least one professor in the University's Department of Chemistry, Dr. María Antonia Grompone, is involved in the study of oils and fats, including for biodiesel production.

There is also a growing number of companies involved in research and development for the sector. Biodiesel Uruguay currently serves as a portal for information and news about various R&D efforts as well as new projects and policies.[21] The official Biofuels Commission, established by the government, is also committed to investigating the viability of existing biofuels processes and the development of new technology.[22]

F) CONCLUSION

Uruguay is in the early stages of establishing a domestic biofuels industry. The national government has made some progress in promoting the industry, including the establishment of the National Biofuels Commission and National Program of Bioethanol (Pronabio-E), but much remains to be done. Uruguay's agricultural capacity, particularly in starch crops, and its need to reduce its dependency on oil imports and create rural jobs make the nation a good candidate for investment in this emerging sector.

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Source: World Factbook

A) INTRODUCTION

Venezuela is one of the world's top oil producers and one of the few oil-rich countries that also has the potential to grow large volumes of crops for the production of biofuels. The country could develop significant production capacity for biofuels thanks to its size, climate, topography, and cultivated crops.

However, there is no official government policy for biofuels yet in place and the country is likely to remain a net importer of ethanol for several years. The lack of a clear legal framework has been a stumbling block to the development of the industry. In addition, the deficit in sugar supply raises concerns about that industry's potential to support the production of ethanol.

B) GOVERNMENT POLICIES

Venezuela has no policies established for the biofuels industry, but the government has indicated an interest in expanding sugarcane cultivation for ethanol production for use as both an MTBE-replacement additive at a 10% blend and as a tool of rural development.

In March 2006, Hugo Chavez announced Plan 474 to plant sugarcane and build the distilleries necessary for the production of ethanol. According to the statement, the government intends to allocate $900 million over five years to the production of ethanol.[1] The funding will contribute to the development of 17 ethanol production plants

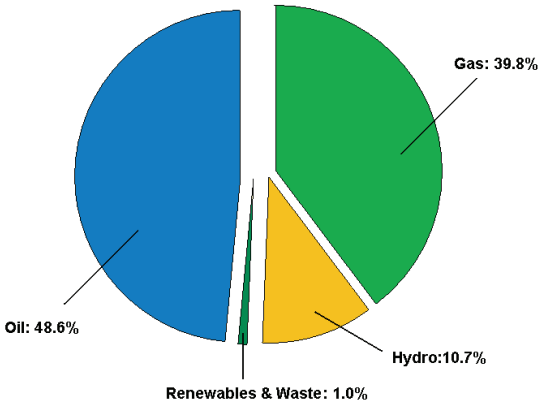
and could provide 600,000 new jobs by 2009.[2]

Relations with Brazil
In February 2005, the Venezuelan Ministry of Energy and Oil, the Brazilian Ministry of Mines and Energy, and the presidents of PDVSA (Petroleos de Venezuela), Venezuela's state owned company, and Petrobras signed an agreement. All sides pledged to share knowledge on the production of ethanol based on sugarcane and to integrate their industrial and technological sectors. They also agreed to work together to revise and amend Venezuela's regulatory framework to include ethanol in the energy matrix.[3]

C) CURRENT SITUATION

Energy Matrix
In 2004, oil and natural gas made up 48.6% and 39.8% of Venezuela's energy consumption, respectively.[4] The country is a founding member of the Organization of Petroleum Exporting Countries (OPEC) and the world's eighth largest net exporter of oil.

Chart 1.9a: Venezuela's Energy Matrix (2004)



Source: International Energy Agency

Venezuela possesses the second largest proven reserves in the Western Hemisphere, with 79.7 billion barrels of proven conventional oil reserves, not including substantial extra-heavy and bitumen deposits that could total as much as 270 billion barrels. Venezuela contends that it produces 3.3 million barrels per day of crude oil; however, some industry analysts believe that number is closer to 2.8 - 2.9 million.[5] Also a major gas producer in the Americas, Venezuela's proven natural gas reserves are an estimated 4.276 trillion cubic meters, the second largest in the Western Hemisphere behind the US. In 2004, the country produced 27.2 billion cubic meters of natural gas, consuming the same quantity that year. Crude oil production restricts that of natural gas, as roughly 90% of gas resources are associated.[6]

In January 2007, Venezuela began the process of exerting national sovereignty over its natural energy reserves, taking control of 32 oil fields. PDVSA's current production is difficult to approximate, with average output estimated to be 1.6 million barrels/ day; the company projects that it will achieve a production capacity of 5.847 million barrels per day 2012.[7]

Biofuels Production
Venezuela's abundant gas and oil is a major factor discouraging the development of a biofuels industry. Although Venezuela cultivates significant quantities of sugarcane (8.81 million tons annually[8]) and palm kernel (315,000 tons annually[9]), there is currently no ethanol or biodiesel production in Venezuela.

Venezuela currently imports 159,000 liters (1000 barrels) per day of ethanol from Brazil; and Petrobras announced that further investments on ethanol pipelines to Venezuela

will be made by 2010.[10] The two countries are negotiating a contract that would send 380 million liters of ethanol a year to Venezuela.

Ethanol Capacity Expansion
Venezuela's sugar deficit is a major impediment. In 2005-2006, the demand for sugar in Venezuela was 960,000 tons, but production only reached 630,000 tons, forcing Venezuela to import. The nation's sugarcane industry does not currently have excess for use in the production of ethanol.[11] In addition, there is no infrastructure (production or supply chain) in place yet.

According to analysts, this gap could be closed by increasing the amount of cultivated land from 125,000 to 180,000 hectares of sugarcane, and the government has indicated interest in this approach.[12] PDVSA recently announced that it would seed 276,000 hectares of sugarcane in order to produce 4 million liters (25,000 barrels) of ethanol per day.[13] The western regions of Trujillo and Yaracuy are likely to receive major investments from PDVSA.[14] The state oil company also has plans to create a joint venture for the domestic production of sugarcane-based ethanol that would include the construction of at least 17 ethanol plants.[15]

In 2006, the oil industry indicated that between 2007 and 2009 additional sugar crops would be planted and harvested in the states of Zulia, Barinas, Trujillo, and Portuguesa (2007); Cojedes, Anzoatequi, Guarico and Monagas (2008); and in other states in 2009. Further, Alejandro Granado, the Refining Vice President of PDVSA, announced a pilot plant at Pio Tamayo Central where a distillery would be installed to process 25,000 liters of ethanol per day, and another in Yaracuy to process 500,000 liters of ethanol per day.[16] In December 2006, representatives from PDVSA and the government of Yaracuy met to discuss moving forward with the development of the plants.[17]

In addition, Venezuelan oil company Suelopetrol plans to launch a subsidiary, Ethapetrol, that will produce ethanol for premium gasoline manufacturing. Suelopetrol, a joint venture with PDVSA, is in negotiations with PDVSA for the entire supply of the 100,000 – 120,000 liter per day production.[18]

Biodiesel
While Venezuela does not currently produce biodiesel on a commercial scale, the Government has solicited assistance from Malaysia's Golden Hope Plantations Bhd to help manage their palm oil industry. Golden Hope seeks to expand Venezuela's palm oil production from its current 45,000 acres to 165,000 hectares.[19]

D) PRIVATE SECTOR

Venezuela's energy sector is highly politicized, and there is no significant private sector involvement in biofuels. Petrobras and PDVSA remain the only players with any significant investments in the sector.

E) RESEARCH & DEVELOPMENT

There is very little R&D activity related to biofuels. The agreement signed with Brazil includes a commitment to joint ethanol research through universities, research centers, and companies, but it does not appear that any initiative is underway.[20]

As part of its agreement to assist in the management of Venezuela's palm industry, the Golden Hope Academy will train 20 Venezuelan palm oil planters and the Malaysian Palm Oil Council will conduct joint research and development activities with Venezuelan scientists.[21]

F) CONCLUSION

Despite a cooperation agreement between the respective ministries and state oil companies of Brazil and Venezuela, there is little indication of any near term progress in developing a significant biofuels sector in Venezuela. Government policies setting a

framework for the industry are lacking, and no R&D initiatives are underway. Venezuela is a significant net importer of sugar, so there is no surplus feedstock. Private investors show no signs of interest in the sector. Although PDVSA has plans to construct 17 ethanol plants in the country, it is not at all clear how the necessary cane feedstock will be produced. With its enormous petroleum reserves, and current high oil prices, Venezuela lacks incentives for a serious drive for energy diversification.

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