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SUGARCANE ETHANOL AND THE LATIN AMERICAN ENERGY INTEGRATION

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ABSTRACT

Most of Latin American and Caribbean countries, with a few exceptions, depend on imports to meet their energy needs; at the same time they present appropriate conditions towards the implementation of bioenergy programs for the production of bioethanol and bioelectricity within the sphere of their sugarcane industry. These notes comment the advantages that could be achieved with this type of bioenergy programs and discuss the obstacles that prevent these countries to start using these alternatives, indicating their perspectives and the essential roles of cooperation and integration working as factors to overcome the lack of information and the uncertainties that might still remain. Relying on an appropriate technological support, other countries of the region will be able to use the Brazilian bioenergy model to develop the use of their own resources with advantages for all of those involved.

INTRODUCTION

As sugarcane ethanol has well-proven its sustainability through its environmental differentials and its economic competitiveness, the fact that some countries of Latin America and the Caribbean, with a few exceptions, have not implemented programs aiming at the introduction of this biofuel to their energy matrix still calls expert's attention. Most of these countries are completely dependent on imported fuels, whose supply along the past few years has consumed a high amount of their resources, imposing a heavy burden on the society. However, most of these countries have a secular sugarcane industry with good performance indicators and perfect conditions to offer a national renewable fuel, creating an industry that is able to work synergetically with other relevant goals such as the generation of jobs and the dynamization of productive activities. As an example of the effects, the generation of bioelectricity may be carried out in important levels, in many cases, reducing the use of fuel used in thermal power plants.

Indeed, the production and use of biofuels show a great potential both in Latin America and in the Caribbean, with the possibility of meeting multiple goals, not only energy ones. This potential has been presented in several studies that confirm this region to be one of the most well-favorable to invest in this energy technology. Among the studies that show such potential, it is possible to mention several studies carried out by the Economic Commission of Latin America and the Caribbean, CEPAL, especially in the Central-American sphere (CEPAL, 2004a; CEPAL, 2004b e CEPAL, 2006). Having a broadening character, a review of the advances and the perspectives for bioethanol as an energy vector in the Latin American context were presented by (2007), by the Inter-American Institute for Cooperation on Agriculture (IICA, 2007) and by the Inter-American Development Bank, (BID, 2007).

These notes present an brief review of the two bioethanol programs that are effectively being implemented in Latin America, besides Brazil's, estimate the production potential for each country

based on the installed capacity of the sugarcane industry and indicate the evolution in the bioethanol production that has been observe along the past few years. The obstacles that must be considered for the effective and broaden implementation of these programs, which passes through the energy cooperation and integration of the region, are also presented and commented.

TWO EXPERIENCES: COLOMBIA AND COSTA RICA

Aiming at implementing programs for the productions and use of bioethanol, many Latin American countries have been taking actions to introduce bioethanol blends, usually between 5% and 10% in volume, to the gasoline, establishing the legal basis and the regulatory mark, without, however, observing significant changes within today's fuel market scenario. Among the several ongoing initiatives, two countries can be highlighted due to their advances: Colombia and Costa Rica (HORTA NOGUEIRA, 2007).

In 2001, through the promulgation of Bill 693, Colombia started to implement the production and use of ethanol. The main objectives of this Bill are the reduction in the emissions of hydrocarbons and carbon monoxide, the maintenance and the generation of agricultural jobs, the agro-industrial development and the contributions towards the strategic purpose of energy self-sufficiency. In short, the first article of this Bill establishes that "the gasoline used in urban centers that have more than 500 thousand inhabitants must contain compounds such as carbureting alcohol by September 2006". The same Bill defines the oxygenated gasoline with a content of 10% of biofuels (UPME, 2006). In order to meet this purpose, a program was designed and its implementation was preceded by careful planning and information to those who were involved. Today it is fully in motion. As institutional agents that are relevant in this sense, establishing goals and defining chronograms, Unidad de Planificación Minero-Energética, UPME, official organ of energy planning, and Corpodib, a mixed economy venture dealing with innovating projects, must be mentioned.

The first bioethanol fuel Colombian plant started to produce in 2005 with a production of 300 thousand liters a day. Along 2006, five other plants started to produce the same biofuel, all of them located in the Valley of River Cauca, with a combined capacity of 357 million liters a years. Sugarcane crops develop well in this region with harvests all year round, assuring the distilleries a high availability. The Colombian government expects the country to reach an annual production capacity of 1.7 million liters of bioethanol by 2010, the necessary volume to add 10% to the gasoline and attain exportable surplus ranging about 50% out of the total produce (UPME, 2007).

In Costa Rica the first experiences with carbureting bioethanol took place during the 1980s, but they were set aside due to the low cost of oil in 1985 and on. However, with recent scenarios more favorable to biofuels, the government of this country articulated a new program to implement the use of bioethanol. In May, 2003, the executive power published Decree n. 31 087-MAG-MINAE, creating a Technical Commission to "formulate, identify and design strategies aiming at the development of anhydrous ethanol, distilled, and use local raw-material as a substitute of the MTBE of the gasoline". The basic objectives presented by this Decree were: Agro-industrial development (economy reactivation, generation of the aggregated value), environmental improvement (for example, due to the replacement of the MTBE) and from the energy point of view, the diversification of the sources and the reduction in the external dependence of the fuel. Initially, the program aims at adding 7.5% of ethanol to the gasoline used in the country, which will be developed in successive stages for the assimilation of the operational procedures and the gradual expansion of the infra-structure. Experiments using different vehicles were carried out with the fuel blend. As the results were good the commercialization in limited markets began. Considering the addition of 10% of bioethanol to all the gasoline used in the country, the demand of this fuel is estimated to be 110 million liters/year in 2010. The state owned oil company, RECOPE, has played an important role regarding the appropriate introduction of bioethanol to Costa Rica (RECOPE, 2007).

Today, Costa Rica relies on 15 agro-industrial units to process the sugarcane produced by 12 thousand producers, but it manufactures ethanol in only two plants, besides a dehydrating unit that processes the imported product and exports it to the North-American market. It is estimated that 16% of the gasoline commercialized in the country has ethanol (Comisión Nacional de Biocombustibles, 2008).

POTENTIAL AND EVOLUTION OF THE PRODUCTION OF SUGARCANE ETHANOL IN LATIN AMERICA

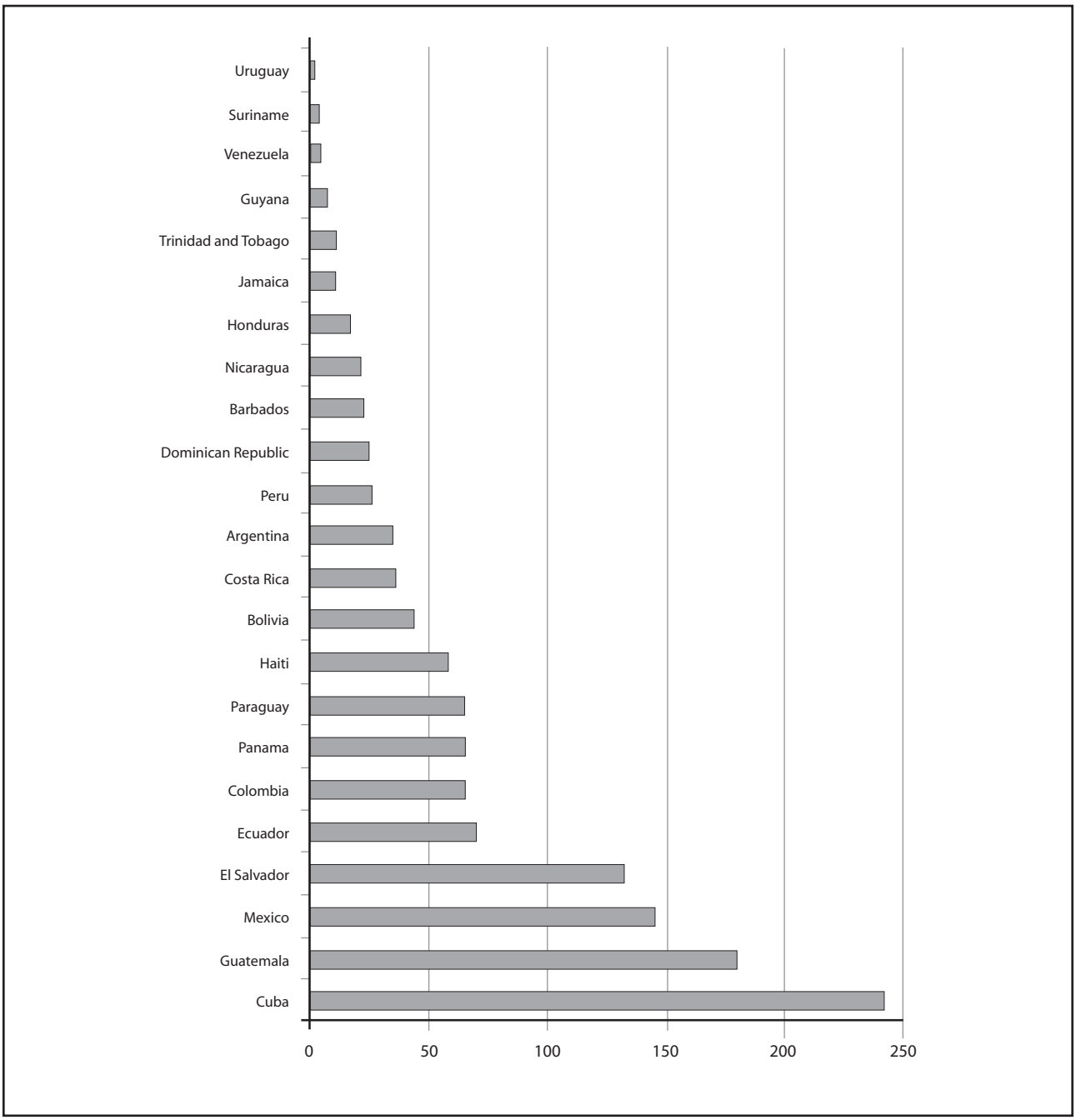
Two scenarios have been analyzed to show the potential of the Latin American countries towards the promotion of a 10% blend of sugarcane ethanol in the gasoline internally consumed, particularly regarding land availability and the size of the local sugarcane industry (CEPAL, 2007): a) production of bioethanol out of the conversion of exhausted molasses, assuming a productivity of 78 liters of bioethanol per ton of produced sugar, and b) the exclusive production of bioethanol, considering an agricultural productivity of 75 tons per hectare and an industrial productivity of 80 liters of bioethanol per ton of sugarcane, corresponding to 6 thousand liters of bioethanol per hectare. For the first case, the fraction of the bioethanol demand that could be met only with that byproduct of sugar manufacture was determined and for the latter, the area of sugarcane demanded was determined as a percentage of the total agricultural area and of the area used for sugarcane crops, according to FAOSTAT (2007). The data regarding the gasoline demand and, therefore, the bioethanol demand, refer to values of 2005, the most recent data available (OLADE, 2006). The results are illustrated by the following figures, where only the countries that have over a thousand hectares of sugarcane crops were included. Brazil has been excluded from this analysis, given that the country already has a huge program for ethanol production and use, including the use of pure bioethanol. This way, there was no meaning in using these indicators.

As it can be observed in these figures, sugarcane bioethanol can be produced according to national needs, without significant impacts. For the Latin American region, aiming at a 10% blend of bioethanol and gasoline, the average demand would be met in 35% through the use of the existing molasses or, alternatively, increasing today's sugarcane cultivated area by 22% for the production of bioethanol, which means about 0.4% of the agricultural land. However, there is a significant diversity among the countries. This way, Cuba, Guatemala, Guyana and Nicaragua present high potential availability for bioethanol production out of molasses, higher than the demand corresponding to a 10% blend in the gasoline.

In another example, in Haiti, Suriname, Uruguay and Venezuela the size of their sugarcane agro-industry does not meet even the 10% demand of ethanol, under the considered scheme. From the land availability point of view, apparently, the situation may be considered almost without restrictions in the Latin American region. The exceptions are Barbados, Jamaica, Trinidad e Tobago, Suriname and Venezuela, which could produce enough ethanol for the 10% blend with less than 1% of their agricultural land.

An important factor that encourages the production of bioethanol in Latin American countries is the re-structuring of the sugar regime carried out by the European Union regarding the Common Agricultural Policy, which will reduce the price guarantees by 36% for these countries within the next years. In response to this situation, countries like Barbados, Belize, Jamaica and Guyana have considered directing their sugar availability to the production of ethanol. About that, Jamaica is the most advanced country, intending to implement the 10% ethanol mandatory blend in gasoline in 2008 (CEPAL, 2007).

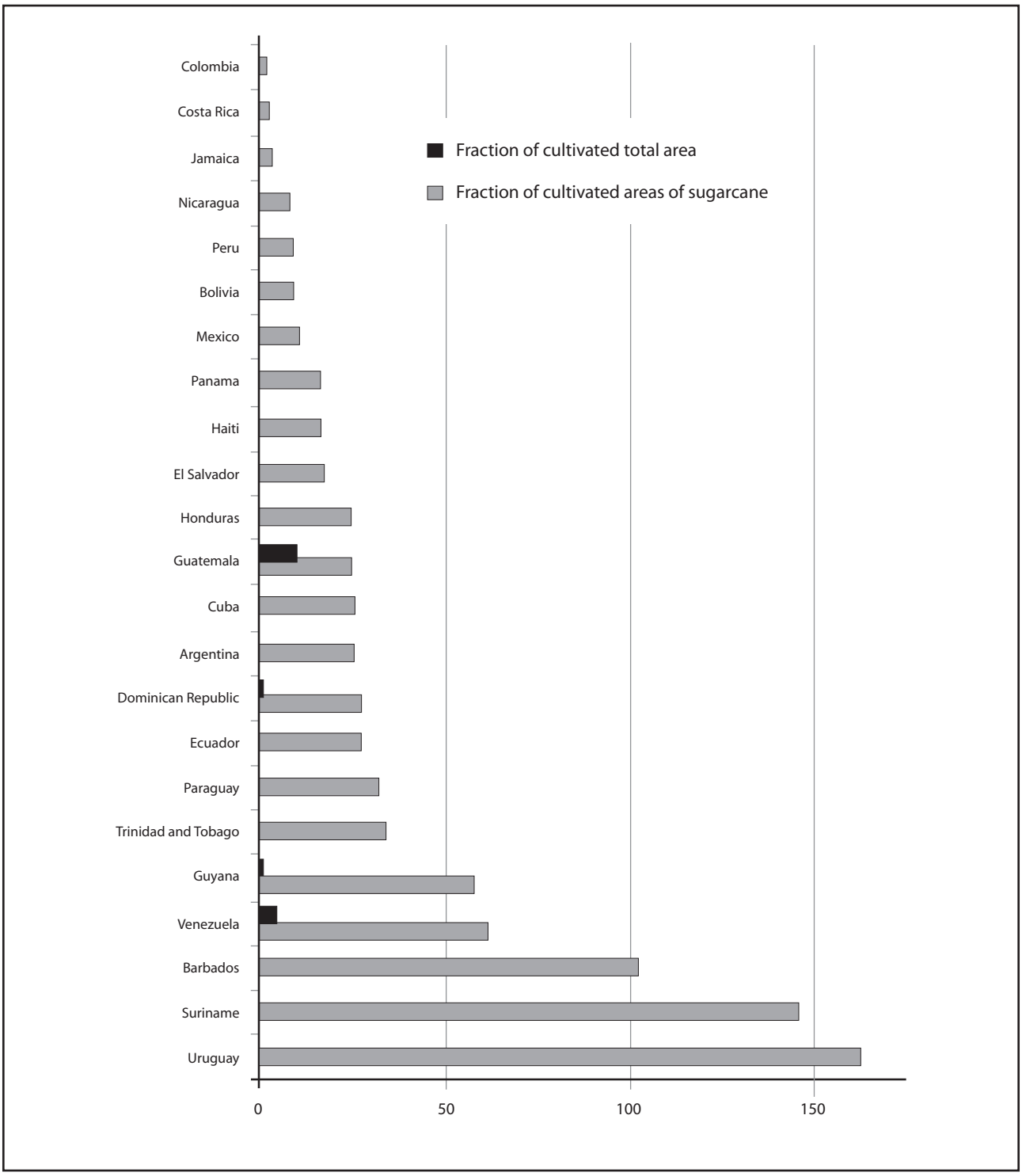
Besides supplying their internal markets, many times with limited sizes, Latin American countries have assessed the possibility of exporting bioethanol, especially to the United States. Some agreements support these initiatives such as the Dominican Republic – Central America Free Trade Agreement, ratified by the American Congress in 2005 and the Caribbean Basin Initiative, CBI, established by the North American Congress in 1983, exempting of importing taxes and other



Source: CEPAL, 2007.

FIGURE 1 Fraction of the bioethanol demand to blend 10% to the gasoline that can be produced out of the residual molasses conversion available in the sugar manufacture.

duties, within the defined conditions, ethanol imported from the beneficiary countries (Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, British Virgin Islands, Costa Rica, Dominican Republic, El Salvador, Granada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Montserrat, Netherlands Antilles, Nicaragua, Panama, Saint Christopher and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago). According to the rules established by the CBI the bioethanol can be exported in the following cases: a) volumes up to 7% of the American market without origin restrictions, i.e., only bioethanol processed in the country is acceptable, b) 132 million of liters of bioethanol as a supplementary quote, which contains at least 35% of local product; and c) a limited



Source: CEPAL, 2007.

FIGURE 2 Fraction of cultivated areas (total and of sugarcane) necessary to produce the bioethanol demanded to blend 10% to the gasoline, assuming the ethanol production straightly from the juice.

value of biofuel since it contains more than 50% of local content.

Responding the growing demand and understanding the new opportunities, ethanol production has been growing in many countries of the region, although the internal market has been ignored most of the times. The following table presents the evolution regarding bioethanol production for the main producing countries of Latin America, except Brazil. It is important to highlight

TABLE 1 Bioethanol production in Latin American countries, from 1999 to 2008 (thousand m^3).

Country	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Colombia	28	25	22	18	15	20	29	269	283	302
Argentina	174	171	168	150	150	167	165	188	195	240
Guatemala	45	55	65	65	65	65	65	80	100	150
Cuba	79	91	106	102	124	134	89	110	121	134
Bolivia	26	31	29	30	46	60	50	80	115	125
Nicaragua	33	27	22	28	29	27	29	29	45	75
Mexico	56	67	62	47	39	35	59	50	60	64
Ecuador	32	38	32	32	50	53	53	44	50	54
Costa Rica	30	30	30	30	30	30	30	40	50	50
Peru	28	28	29	30	30	22	16	16	19	23
Panama	13	11	10	13	13	14	14	15	15	15

* Estimated values for 2008.

Source: F. O. Licht, 2008.

this growth in countries like Colombia, Guatemala and Bolivia; the last two cases associated with the exportation of the biofuel to the North-American and European markets.

It is interesting to compare today's productions, according it was shown in the table, and the values of the potential demand for bioethanol, necessary for the 10% blend of this fuel. In this sense, the Latin-American countries can be grouped into three categories:

a) countries where the production is small in relation to the demand (Mexico, Peru, Panama and Ecuador); the perspective for the introduction of this biofuel need greater effort;
b) countries where the production is close to the demand (Argentina, Colombia and Costa Rica); national programs for bioethanol use are ongoing or could be developed;
c) countries where today's production is lower than the foreseen demand (Guatemala, Bolivia, Cuba and Nicaragua).

Especially the last group, mainly Guatemala and Nicaragua, it is difficult to find arguments that could defend these countries for not investing immediately in programs for the introduction of the bioethanol to the gasoline that is internally consumed. Indeed, it does not matter the several plans, agreements, protocols and attempts regarding legislation adjustments, practically no advances have been registered showing that these countries have made any attempts to use the fuel they produce and export in their vehicles. In fact, besides the reasonability and sustainability of the bioenergy systems at these conditions, there are institutional difficulties and obstacles that will now be briefly discussed.

OBSTACLES TO BE CONSIDERED AND PERSPECTIVES

As it has been seen, some Latin American countries have great conditions to develop the production and the use of bioethanol. In some cases, this production is already taking place, but it has been focused on the external market. Considering the well-known advantages that could be achieved by a greater dissemination of this technology, meeting the domestic demand, the observed inertia is a paradoxical outcome. However, a more detailed analysis lets one notice that a significant obstacle is the lack of information on biofuels that can help the decision making

process regarding innovative issues. This lack of information on biofuels added to disinformation and wrong and opportunistic information is often present in several countries.

The questions about the feasibility and opportunity for sugarcane bioethanol have evolved in an interesting way. First, there were doubts whether engines designed to use gasoline could operate with up to 10% of bioethanol without problems, even mentioning risks of phase separation in ethanol/gasoline blends. These doubts, basically planted by oil derivative distributing companies and other parties whose interests lied in preserving the dependence "status quo", fell to the ground one by one, for they did not have technical support and as the fuel markets in developed countries progressively decided to adopt the "Brazilian adding solution", once seen as something exotic and impossible to replicate.

Afterwards, there were questions regarding the production, about the economic and environmental feasibility of bioethanol production, which were progressively challenged by the reality itself. More recently, a new theme was added to the table of questions: the competition between the production of bioenergy and food, the significant scarcity in the region (refer to previous figures) and the fear that in a short run, the introduction of second generation biofuels may become the traditional routes non-economically feasible, which is certainly an incorrect view. So, In order to face this picture of inaccurate concepts and perspectives, it is necessary to provide clear, objective and provable information.

International agencies such as CEPAL and the FAO have made special effort towards giving all kinds of explanations to national authorities, however, in order to overcome this serious disinformation scenario, more powerful measures are necessary, and eventually Brazil can play a relevant role. As examples of the disastrous effects of the lack of basis for competent decisions, it is pertinent to ask what would be the fundamentals and the purposes of countries with a vast experience on the sugarcane industry, completely dependent on fuels imported at prices that are getting higher and higher, ignore them to go towards the production of biofuels through routes that are unlikely to succeed such as ethanol from sweet potato and sorghum, biodiesel from *Jatropha curcas* or castor oil (*Ricinus comunis*), before exploring their great bioenergy potential using conventional technologies and routes.

For Brazil, there are legitimate interests in the healthy expansion of the process of production and use of ethanol in the region, highlighting the formation of the ethanol international market and the business opportunities regarding the supply of equipment and services to the agro-industry. Regarding the last point it is worth to mention the technologies associated to improvements in the varieties of sugarcane, production, use and equipment optimization for sugar and alcohol plants, planting, growing and harvesting and transporting machines, and, in proper time, the "flex-fuel" technology of engine electronic management for the use of bioethanol or gasoline, a possibility that may progressively arise as the ethanol blending programs go further and the availability of this biofuel increases.

The development of production and use of biofuels, particularly sugarcane bioethanol, may represent a rationalization factor for the energy matrixes of the Latin American countries, providing new cooperation and exchange paths, strengthening their economies and promoting long lasting synergies towards a real sustainability.

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