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RATIONALITY CRISIS AND SUSTAINABILITY IN THE MARKET OF FUELS IN THE STATE OF PARAÍBA

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ABSTRACT

The article aims to present an introductory analysis of the theme, aiming to examine some of the key aspects of the production and consumption of gasoline and ethanol, at national and regional levels, particularly in the state of Paraiba, contrasting with the environmental crisis set in our times, based on the teachings Enrique Leff. Points together: the growing number of vehicles in circulation in Brazil and Paraíba from 1998 to 2016, relating to the growth of emissions of greenhouse gases; gasoline and ethanol production costs and the price to the end consumer; the formation of prices of these fuels, particularly with an emphasis on taxation; and the sustainable production and use of ethanol. For this, a survey was conducted with descriptive exploratory nature, comparative, qualitative and quantitative and bibliographic and documentary, taking as data analysis technique called a SWOT analysis. It is concluded, among other things, that the ethanol production offers major advantages when compared with

gasoline and must be stimulated their mass consumption. However, it is the sugarcane industry make sustainable market, especially in social and environmental terms. Stay the way it is it will only aggravate the symptoms of today's global environmental crisis.
Keywords: Environment; Environmental crisis; Energy Matrix; Sustainability.

CRISE DA RACIONALIDADE E SUSTENTABILIDADE NO MERCADO DE COMBUSTÍVEIS NO ESTADO DA PARAÍBA

RESUMO: *O artigo pretende apresentar uma análise introdutiva da temática, objetivando examinar alguns dos principais aspectos relativos à produção e consumo da gasolina e do etanol, em âmbito nacional e regional, particularmente no estado da Paraíba, contrapondo com a crise ambiental posta hodiernamente, embasados nos ensinamentos de Enrique Leff. Aponta, conjuntamente: o crescimento do número de veículos em circulação no Brasil e na Paraíba, no período de 1998 a 2016, relacionando-o tanto ao crescimento de emissão dos gases do efeito estufa quanto aos custos de produção da gasolina e etanol, bem como ao preço para o consumidor final; à formação dos preços desses combustíveis, com particular ênfase na tributação; e à sustentabilidade da produção e uso do etanol. Para isso, realizou-se uma pesquisa com cunho exploratório-descritivo, comparativo, qualiquantitativo e bibliográfico-documental, assumindo como técnica de análise de dados a denominada análise SWOT. Conclui-se, entre outros aspectos, que a produção do etanol oferece maiores vantagens quando comparada com a da gasolina, devendo ser estimulado o seu consumo massificado. Contudo, cabe ao setor sucroalcooleiro tornar o mercado sustentável, principalmente em termos socioambientais. Permanecer do modo como está só agravará os sintomas da atual crise ambiental mundial.*

Palavras-chave: *Meio ambiente; Crise ambiental; Matriz energética; Sustentabilidade.*

INTRODUCTION

One of the current and long-debated issues in the current and ongoing environmental crisis is the preservation and rational use of natural resources, specifically the use of fossil fuels, among them oil. Frequent use of this source of non- renewable energy is mainly due to its conversion into gasoline, for industry and for motor vehicles.

Negative effects on the ecosystem caused by the indiscriminate use of this input include the emission into the atmosphere of the so-called greenhouse gases (GHG), which is responsible for, among other effects, global warming, and soil and water contamination.

The results already compiled and announced by the Ministry of Science, Technology, and Innovation (MCTI, 2014), related to the estimates of greenhouse gas emissions, show a growth of these, especially in the energy sector (due, among other factors, to the burning of fuel and fugitive emissions from the oil, gas and coal industry) from 187.739 million tons in 1990 to 446.154 million tons in 2012.

In view of this, economic rationality, resulting from a neoliberal economy, ends up allowing harmful, polluting and degrading practices to the environment, since market rules are always using less expensive means, in order to maximize profits, regardless of whether the economic result also triggers an immediate or immediate environmental risk.

The maxim of the economic agents involved in this market is: to internalize the gains and externalize the costs, by the induction to the consumption of goods and services harmful not only to the preservation and protection of the environment, as well as to their respective natural resources.

One of the viable alternatives to a structural change in this sector and a promoter of sustainable development is the stimulation and exchange in the production and consumption of oil, gas, and coal for renewable and low-carbon fuels, like ethanol.

As Grisoli (2011) asserts, a number of initiatives are underway to indicate sustainability factors for biofuels, so that they can fulfill their proposal to supply the sector's energy matrix, bypassing the negative externalities that may impact the environment.

In fact, and as can be seen in several studies in the area, this natural resource, together with other forms of renewable resources, is economically, socially and environmentally more viable compared to the

persistence in the use of non-renewable resources such as oil, which, while promoting economic growth, undermine the continuity of the existence of a healthy life on the planet.

Modern science has allowed a considerable amount of scientific knowledge to demonstrate the fragility and limits of the earth, which has taken millions of years to produce its varied natural resources, but no longer supports the present level of contamination to which it is subjected (NEGRET, 2001, p. 107).

Thus, this article intends to present an introductory analysis of the theme, aiming at examining some of the main aspects related to the production and consumption of gasoline and ethanol, at national and regional level, particularly in the state of Paraíba, in opposition to the environmental crisis posed nowadays utilizing as a background the teachings of Enrique Leff.

Among the specific objectives, the following are presented:

- To present the growth of the number of vehicles in circulation in Brazil and Paraíba, from 1998 to 2016 (only the models driven by gasoline and ethanol), in order to relate these data to the growth of greenhouse gas emissions;

- outline the costs of production of gasoline and ethanol, as well as the price to the final consumer;

- State the formation of the prices of these fuels, in particular of ethanol, with particular emphasis on taxation (Tax on Operations Relative to the Circulation of Goods and on Services of Interstate and Inter-municipal Transport and Communication Services (ICMS), mainly);

- Analyze the sustainability of the production and use of ethanol, based on the SWOT (*Strength*, *Weakness*, *Opportunities,* and *Threats*) *analysis*; and

- Draw a parallel between these points and the current environmental crisis in the energy sector.

The research, with an exploratory-descriptive, comparative, quali-quantitative and bibliographical-documentary (GIL, 2008), assumed the data analysis technique called SWOT analysis, by the investigation, respectively, of the forces, weaknesses, opportunities and threats related to production (JANNUZZI and GOMES, 2009), demonstrating the potential of this fuel to reduce the externalities produced by gasoline consumption, as well as its negative aspects, in order to give logical agreement with the theoretical framework exposed in the work, focused on pertinent

and appropriate aspects to the study, such as environmental rationality, environmental crisis, sustainability, ecological economics, among others.

Finally, it is believed that the research contributes scientifically in an empirical and multifaceted way, influencing the perception of the selected economic sectors, the final consumer, the State or, in a global way, the society.

1. COMPARATIVE ANALYSIS OF THE CONSUMPTION OF FUELS IN BRAZIL AND IN THE STATE OF PARAÍBA

In the foreground, it is necessary to list the number of automobiles in circulation in Brazil, as necessary to demonstrate the scale and importance of the study.

For that purpose, only the class of *flex-fuel* vehicles, excluding motorcycles, tractors, buses, trucks, among others, was selected from the updated numbers until December 2016, provided by the National Traffic Department (DENATRAN). Thus, for this collation, only motor vehicles classified as category B (cars) were selected by the Brazilian Transit Code (CTB).

This fact shows that the number of cars in circulation in Brazil, in the year 1998, was 17,819,843; in December 2016, reached the level of 51,296,982 (DENATRAN, 2017). In this period, in the state of Paraíba, the number went from 124,187 to 483,927 automobiles (DENATRAN, 2017).

It is worth noting that up to 2003, when the national fleet was about 23 million cars (169,440 in Paraíba), cars with *flex* technology were not yet in circulation, and the consumer had to opt exclusively for vehicles moved by alcohol or gasoline. Prior to the implementation of this technology, the ethanol auto industry was suppressive.

With the end of the oil crisis and the increase of national extraction in the early 1990s, there was an unprecedented incentive to the Brazilian oil industry. This fact ended up banning the production of ethanol until the insertion (and consolidation) in the automobile market with *flex* technology. With this technological advent, the consumption of ethanol has become more tangible; however, it did not supplant that of gasoline, as shown below.

In proportion to the increase in the car fleet, there was an increase in the emission of carbon dioxide ($CO_{2)}$ and greenhouse gases, according to the Organization for Economic Cooperation and Development (OECD).

Thus, reflecting a worldwide phenomenon, Brazil increased from 271 million tons of CO_2 in 1998 to 476 million tons of CO_2 in 2014, and the linearity of the share of this sector in the estimated volume of emissions remains striking. Similarly, although with a much less significant percentage, greenhouse gases rose from 709,934 thousand tons in 1998 to just over 1 million tons in 2012 (OECD, 2017).

In the year 2016, according to data from the National Agency of Petroleum, Natural Gas, and Biofuels (ANP), the volume of ethanol sold in the national territory reached 14.586 billion liters, while more than 43.019 billion liters of type C gasoline were consumed. In the state of Paraíba, in 2015, the level of consumption of ethanol reached 131 million liters, compared to 662 million liters of gasoline (ANP, 2017). This reveals a huge discrepancy in the pattern of consumption of said energetic matrices.

However, according to data extracted from ANP (2013), since the insertion and consolidation of engines with *flex* technology in the market, in 2004, the consumption of hydrous ethanol was increased in all Brazilian states.

Currently, there is a considerable decrease in sales due to gasoline consumption induction policies by economic guidelines influenced by the oil industry. In addition, the crisis in the sugar- alcohol sector and the lack of investments necessary to overcome it, as of 2009, caused prices to increase in all phases of the product, as well as the reduction in ethanol consumption, preventing the demand (ANP, 2013).

This shows that the consumption of a given product, although environmentally less impacting, is not a matter of ethics but is, in fact, an economic condition.

Leff (2004b) emphasizes a relevant aspect of the current environmental crisis, in which there is no consideration of the environment by the economic agent who, in order to maximize short-term profits, destructively extracts and transforms natural resources, stimulating the hyperconsumption, directed to markets and/or specific products, even if they are unsustainable.

Economic rationality imposed a pattern of production and consumption tending to satisfy the misleading needs created by the economic system itself, resulting from the overexploitation of renewable resources (LEFF, 2004b), corrupting man and society in their intrinsic relationship with the environment.

However, a paradigm shift in the energy sector is urgently needed,

through the implementation of massive incentives for the production and consumption of ethanol and other ecologically correct inputs that substitute for gasoline, not only because it is a renewable natural resource, but mainly depending on the sustainability inherent to it, in all aspects (social, economic and environmental), which will be explained later.

For example, according to the Association of Sugarcane Planters of Paraíba (ASPLAN-PB, 2017), the average cost of production of Brazilian ethanol is still the least expensive on the planet, US$0.18 (about R$0.56, with the trade dollar quotation of February 2017). However, it should be noted that the production cost of ethanol is variable for each crop.

According to Petroleo Brasileiro SA (PETROBRA S, 2017), the cost of production of type C gasoline occurs around 30% (thirty percent) of the final sale value, approximately R$1,125 a liter (ANP, 2017). Considering also the average degree of energy efficiency of ethanol compared to gasoline type C, that is, 70% (seventy percent), already counting the cost of production, we perceive the economic feasibility of replacing the second with the first mode of fuel.

In addition, besides the gross price of ethanol production is considerably lower than that of gasoline, the percentage value related to the taxation of these fuels is also very divergent, as is the case in the state of Paraíba (1996).

In relation to gasoline, the following taxes are levied: the Social Integration Program and the Contribution for Social Security Financing (PIS/COFINS), at the rate of 8% (eight percent), the Intervention Contribution in the Economic Domain (CIDE), in the percentage of 2% (two percent) and the Tax on Operations Related to the Circulation of Goods and on Services of Interstate and Inter-municipal Transportation and Communication (ICMS), in the percentage of 29% (twenty-nine percent), in addition to the costs of anhydrous ethanol, in the percentage of 14% (fourteen percent) and of the distribution and/or resale operations, in the percentage of 17% (seventeen percent). (PETROBRAS, 2017). Regarding ethanol, there is no incidence of PIS/COFINS or CIDE, but only the ICMS, at a rate of 25% (twenty-five percent).

With the gross price of production, we add the dividends for distribution and resale profits, as well as taxation, to reach the final price of consumer fuel.

Specifically, in the state of Paraíba, data released by the National

Petroleum Agency (2017) corroborate with the aforementioned information because, for the composition of the final price of ethanol, it is perceived that the costs related to taxation and production are substantially lower when compared to gasoline. And even though the expenses related to the distribution and resale of ethanol are at a level above those practiced for gasoline, it costs on average, a Brazilian real less per liter.

Brazil occupies a prominent position in the production of ethanol from sugarcane, mainly due to the more favorable energy balance, as well as the low production costs, previously specified, which guarantees it the title of the largest exporter of this biofuel (GRISOLI, 2011).

Nevertheless, as an example, it should be pointed out that in the state of Paraíba, in February 2017, according to ANP (2017), the average price of ethanol was R$2,864, while the average price of gasoline in that period was quoted at R$3,749. It also occurs in other states, where, as opposed to the cost of production, the price destined to the final consumer of ethanol operates above 70% of the final price of gasoline, thus directing it to its consumption.

In this way, the preference for the consumption of type C gasoline, to the detriment of hydrated ethanol, is verified, allowing, therefore, that, although the cost of its production is more attractive in financial terms, the increase of the price to the end consumer ends up discouraging their consumption.

The external influences of the market, as well as the pressures of economic groups and their interests in the petroleum industry, please the final consumer, in line with the logic of the market of capitalist accumulation, inducing and shaping demand and of the needs of society (LEFF, 2004a).

This controlled maneuver of production and consumption, not restricted to the energy sector, reveals the unscrupulous behavior of economic agents, consistent with a commodified treatment of environmental goods and revealing an unprecedented environmental crisis that compromises humanity's conditions of existence.

In the light of this, Enrique Leff proposes to redefine the current economic system for an ecological economy, to critically examine the "ecological and energy degradation resulting from the production and consumption processes", and subject "the economic exchange to the conditions of the general metabolism of nature" (LEFF, 2004a, p. 44).

2. ANALYSIS OF THE SUSTAINABILITY OF ETHANOL PRODUCTION AND CONSUMPTION

Among the effects resulting from the production of ethanol, called externalities, we can enumerate the most relevant ones in order to legitimize the induction of its consumption in the market. That said, what is sought is the maintenance of the correct environmental balance, according to the dictates listed in art. 225 of the Federal Constitution (BRASIL, 1988). Otherwise, there would be no reason to favor a product as harmful to the environment as the current predominant one, derived from petroleum.

In this aspect, Paixão and Fonseca (2011, p. 53) establish, with propriety, the meaning of sustainability, from the economic point of view, which "implies good management of natural resources, associated with the minimization of costs caused by the use of these resources to guarantee perenniality to the productive process".

Given this, it is imperative to know the main aspects (positive and negative) regarding the production of ethanol, and the measures to be taken in order to raise the degree of sustainability.

According to Paixão and Fonseca (2011), the Brazilian sugar-alcohol industry's main concern is the elimination of sugarcane burning in the agricultural phase, since, although it is the most favorable form of management for the rural worker, a predominant resource at this stage of production, it does bring about negative environmental consequences of great relevance, such as destruction and degradation of ecosystems, harm to the soil, the emission of pollutant gases and particles and release of GHG to the atmosphere (PAIXÃO E FONSECA, 2011).

Still in agreement with the same authors, the procedural change turns out to be an economically advantageous factor for its production, since, besides the cane harvest *in natura* representing a potential resolution for the problem of the negative environmental externalities generated in the burning process, it results in other significant economic gains, because, like bagasse, other leftovers and residues of the plant, such as tips and straws, can be used as input in cogeneration of electricity (PAIXÃO E FONSECA, 2011).

Regarding the release of GHG, the volume produced and deposited in the atmosphere inherent to the combustion of residual biomass from the *raw* cane harvested for the production of electric energy is equivalent to the relative emission of the burning of that biomass in the field at harvest.

In this way, the alternative of burning for the production of electricity is preferable, since it is shown as a positive and important externality, which is completely non-existent in the burning option in the field (PAIXÃO E FONSECA, 2011).

In this sense, in 2002, the Federal Government officialized the Incentive Program for Alternative Energy Sources (PROINFA), determining that the contracting, by Centrais Elétricas Brasileiras SA (ELETROBR AS), of at least 3,300 *megawatts*, or of energy from renewable sources.

According to UNICA, in 2008 the Brazilian sugar and alcohol industry, using the process of generating electric energy through the burning of sugarcane biomass, was responsible for negotiating almost 2,500 *megawatts* of electric energy (UNICA, 2009).

This shows that by-products derived from sugarcane have increased their participation in the energy matrix and, since 2007, have become the second primary source of electric energy in the country (PAIXÃO E FONSECA, 2011).

In a complementary way, the use of controlled traffic structures (ETC's), in substitution for the burning of sugarcane, enables the harvesting of sugarcane *in natura* in fields with a slope of up to 40% and consumes less diesel per hectare, reducing the emissions of precursor greenhouse gases and pollutants and particulates gases.

Apart from these considerations, the elimination of tetraethyl lead from gasoline can be enhanced by its replacement with hydrated ethanol.

Regarding the use of water, a considerable part of the irrigation is made by rain (MACEDO, 2007). This fact shows that the low demand for water is an important factor for the reduction of environmental impacts, which ends up avoiding drag of nutrients, pesticide residues, soil losses etc. (JANNUZZI and GOMES, 2009). Another aspect to be mentioned is the total use of production residues (vinasse and ash) in the irrigation process of the crop, reducing the need for water consumption.

It happens that there are exceptions to this practice, such as when there is an increase in areas for sugarcane planting, especially for regions with marked rainfall *deficits*. Irrigation of sugarcane is a common practice in the states of the Northeast; however, production, in the industrial phase, is the largest consumer of water in the environment (JANNUZZI and GOMES, 2009).

The use of vinasse as a fertilizer, while reducing water consumption, has the potential to cause the salinization of groundwater by

the leaching of its elements, as well as the nitrification of the soil. Thus, although vinasse is an organic byproduct and contains water and mineral nutrients, it needs to be controlled (JANNUZZI and GOMES, 2009).

As a way of getting around these situations, some measures are presented aimed at the sustainability of the sugar and alcohol sector in the area of water. Consideration should be given to the practice of reconversion of surface irrigation systems, which is the main method of irrigation used in the country, showing very low utilization in the case of regions with a rainfall *deficit*, irrigation can be presented in an environmentally and economically viable way, provided that efficiency-based methods are used, such as those that use equipment that is more easily controlled, indicating adequate management of the irrigation systems. surface irrigation and those that include systems for greater uniformity of water application (by spraying) and localized irrigation (by drip and micro sprinkler, for example) (JANNUZZI and GOMES, 2015).

Consideration should also be given to encouraging the reduction of water collection, use, and release. About 90% (ninety percent) of its use occurs in four processes: cane washing, condensers/multi jets in evaporation and vacuums, cooling of vats and alcohol condensers. The use of water in the cane washing, around 5 cubic meters per ton, can be reduced with dry cleaning. It is possible to achieve values close to 1 cubic meter of water per ton of sugarcane, with optimization of reuse and use of the added waste water from the vinasse for irrigation (called fertigation) (JANNUZZI and GOMES, 2015).

Both soil moisture and compaction are factors directly related to the useful life of the sugarcane crop. The traffic control systems and the practice of no-tillage are resolvable for the mentioned parameters of production. When applied, they provide greater soil wetting, greater efficiency in the utilization of rainfall, a decrease in soil compaction and in the occurrence of floods (losses of soil, nutrients, and water), as well as the decrease in the use of herbicides and fertilizers (JANNUZZI AND GOMES, 2015).

Another problem related to sugarcane planting is related to the expansion of production areas, because, according to Nassar et al. (2010), the changes in soil use resulting from the expansion of sugarcane plantations occur when this crop replaces an area previously destined to other activities or vegetation. According to the researchers, such expansion occurs mainly in areas of pasture, formerly intended for agricultural production or other

crops, reducing the effects on native vegetation.

Still in Nassar et al. (2010), according to a survey carried out between 2005 and 2008, ethanol production increased from 16 to 27 billion liters per year, which led to an increase of 2.4 million hectares of cane cultivation. Within this advance, the direct replacement of native areas was of 9,700 hectares and of 181,000 hectares, indirectly.

The state of São Paulo has been at the forefront of solving the advance of cane planting over native areas, creating agro-environmental zoning, which disciplines land expansion and occupation, including the creation of biodiversity corridors (COSTA, GUILHOTO, 2011).

Jannuzzi and Gomes (2009, p. 14) thus establish the meaning of biodiversity corridor:

> It is an area strategically destined to the environmental conservation in the regional scale. It comprises a network of protected areas interspersed with areas with varying degrees of human occupation. Management is integrated to increase the possibility of survival of all species, the maintenance of ecological and evolutionary processes and the development of a regional economy based on the sustainable use of natural resources. In areas of high forest fragmentation, such as the Atlantic Forest, Biodiversity Corridors also aim to recover and connect forest fragments. Thus, it is hoped to overcome the isolation of protected areas and expand the connectivity of native environments, allowing the transit of the species of flora and fauna among the remnants.

In view of this, it can be seen that, from the environmental point of view, ethanol production is sustainable compared to other energy matrices, and that the intercurrences in the sector can be adequately addressed, depending on the adoption of mitigating measures by its producers. On the social side, and considering the technological progress, which potentially causes reductions in employment through the use of agricultural mechanization, it is verified that the expansion of the sector involves the global increase and improvement in the quality of jobs (VIEIRA; LIMA; BRAGA, 2017).

According to the 2nd Sustainability Report of the sugar and ethanol sector, published by the Sugar Cane Industry Union (UNICA), the sugar and alcohol industry plays a strategic role in fostering jobs at the national level. According to the Annual Report of Social Information (RAIS) of the Ministry of Labor and Employment (MTE), in 2008 there

were 1,283,258 formal jobs, of which 481,662 were related to sugarcane cultivation; 561 292 entered in the raw sugar mills; 13,791 for the refining and milling of sugar; and, lastly, 226,513 workers operating in the production of ethanol (UNICA, 2015).

By estimate, the report still states that for each direct job two indirect ones are generated. In this way, it reaches the mark of 3.85 million people allocated in jobs related to the production of sugar cane. It is also pointed out that such direct jobs comprise a great diversity of functions, positions, and specializations. On average, a standard plant has about 400 jobs, ranging from manual labor to highly qualified functions, both in technical and/or administrative areas (UNIQUE, 2015).

In addition to the direct and indirect effects of job and income generation by the sugar and alcohol industry, the above-mentioned report, presenting data from the IBGE of 2009 on socioeconomic impacts, emphasizes that, regarding the manual worker, the formal employment index reached the level of 79.6%. That said, it urges that the social impact of the sugarcane industry in Brazil should not be evaluated only for the jobs it generated. Of equal importance, it should be noted that the sector, spread throughout much of the national territory, functions as a decentralized income and contributes to the regional distribution of wealth, since this activity is present in 25 of the 26 Brazilian states, comprising 1,042 almost 20% of all Brazilian municipalities (UNICA, 2015).

Regarding schooling, the average number of employees in sugarcane farming is still low, although there has been a significant increase in recent years. Still according to IBGE data from 2009, the period of school activity of these workers is, on average, from 4 to 5 years This result explains that the sugar and alcohol industry is responsible for the inclusion in the labor market of a mass of labor that would hardly be absorbed in other branches of economic activity. In this respect, it can be praised that the increase of mechanization implies a growth in the demand for more qualified professionals. To exemplify, it has been that a mechanical harvester replaces the work of about eighty people with low qualification; however, requires twelve workers with technical training in automation and mechanization (UNICA, 2015).

Regarding the salary mass, still in the 2nd Sustainability Report of the sugar-energy sector published by ÚNICA, it is pointed out that schooling directly influences the salaries of the sector worker. Thus, in order to evaluate the remuneration framework of workers in sugarcane

plantations, a comparison is necessary in relation to the employees of other crops. Therefore, between 2007 and 2009, it was verified that the sugarcane worker had an average income of R$721.58, only below the worker of the soybean farms (average of R$905.33), where there is a high degree of mechanization, demanding more skilled labor. In other crops (coffee, rice, maize, and cassava), the rural worker has a lower remuneration compared to the sugar and alcohol sector (UNICA, 2015).

Still, it should be noted that there are few studies and detailed care on the part of employers in the field, regarding compliance with health and safety standards, especially regarding compliance with Regulatory Norm (NR) no. 31 (VEIGA FILHO, 2007), of the Ministry of Labor and Employment, specifically dealing with workers working in agriculture (BRAZIL, 2005).

For all of the above, the SWOT analysis carried out by Jannuzzi and Gomes (2009) points out some aspects of the advantages, disadvantages, sustainable solutions and risk potential to be overcome by the sugar and alcohol industry, among which:

Advantages:

- Reduced total cost of production in relation to the production cost of gasoline;
- Lower tax incidence compared to gasoline;
- None or little need for irrigation;
- Reuse/recycling of much of the water used for planting;
- Complete recycling of the industrial effluents (vinasse, filter cake, and residual water);
- Legislation of control and prohibition of the practice of burning;
- Improved soil conservation compared to other crops;
- Availability of land;
- Lower use of pesticides/fertilizers in relation to other crops (fertigation and optimization);
- Agri-environmental zoning in the state of São Paulo;
- Promotion of jobs at the national level;
- Greater formalization of labor contracts;
- Less need for professional qualification; and
- Average wage income higher than other national agribusiness products

Disadvantages:

- Final price to the consumer operates above 70% of the final price of gasoline;
- Soil structural changes (losses of water, nutrients, soil, salinization, acidity);
- High abstraction of water during the industrial phase;
- Air pollution (pollutants and soot) from burning and agricultural mechanization;
- Failure of inspection (burned and vinasse);
- Soil compaction;
- Salinization and contamination of the sheets and springs (vinasse, fertilizers and agricultural pesticides);
- Puffs and silting;
- Fragmentation of habitats and reduction of biodiversity; and
- Failure to comply with health and safety standards in the sector.

Sustainable solutions:

- Encouraging internal and external competitiveness vis-à-vis the oil market;
- Direct planting;
- Use of ETC's (assumes the harvest of the cane *in natura*);
- Precision agriculture;
- Information Technology;
- Controlled use of vinasse;
- Biodiversity corridors;
- Reduction of water collection, use, and release;
- Genetical enhancement;
- Enzymatic and acidic hydrolysis;
- Thermal concentration and biodigestion of vinasse;
- National agro-environmental zoning;
- The institution, in the labor field, of Specialized Service in Safety and Health in Rural Work (SESTR) and of Internal Committee for Prevention of Rural Work Accidents (CIPATR), meeting the specificities of Regulatory Norm no. 31, MTE (BRAZIL, 2005).{/0

Potential risks to be overcome:

- Decrease in the monopoly of the agricultural areas used for the production of ethanol;
- Cumulative effects of land use and agricultural implements;
- Depletion of water resources: increased demand for irrigation in areas with water deficit and industrial water use;
- Increased use of pesticides and inorganic fertilizers;
- Displacement of crops and pastures;
- Risks of degradation and burning of reserve areas; and
- Higher professional qualification of workers.

FINAL CONSIDERATIONS

Considering the socioeconomic and environmental scenario in which the production and consumption of ethanol, which is synthetically analyzed in this article, is inserted, it can be said with a serenity that both the production and consumption of this product offers more advantages when compared to the fossil fuels such as gasoline.

Although ethanol is a renewable natural resource, the search for improvements in the production stages, especially in the socio-environmental aspect, in order to make it even more sustainable, means that the energy source has the potential to reduce the resulting environmental impacts of a global transport matrix composed mainly of fuels derived from petroleum, like gasoline, and can thus become competitive.

In order to do this, it is necessary to emphasize the relevant role of the State, which, taking care of environmental protection, must elaborate and execute environmental public policies aimed at sustainable development in the energy sector, not only reducing the tax burden for ethanol production and consumption, but also discouraging activities potentially harmful to the environment, such as the production and consumption of gasoline and, thus, encouraging environmentally sustainable practices.

Thus, using this tool, it is possible for the State to induce a "green" practice of economic activities, promoting sustainable development and also protecting the environment.

In addition, there is a need for a cultural change in society regarding the awareness and mobilization of sustainable consumption fronts. Obviously, the role of industry and government companies in this area will be relevant if particular initiatives to refuse or boycott gasoline consumption can be effectively taken.

Finally, it is important to promote the discontinuity of stimulating the production and consumption of non-renewable energy, which, in the current format, reveals one of the nuances of the global environmental crisis, whose fundamental axioms are a misrepresentation, environmental degradation and exacerbated profit maximization.

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