

## THE BIOFUELS: A CLEAN AND RENEWABLE ENERGY OPTION FROM SUGARCANE JUICES?

By

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MTBE, Ethanol, Gasohol.**

### Abstract

PRESENT day gasohol and biodiesel from a mixture with ethanol emerge not only as renewable fuels but also as a support to the sugarcane agro-industrial sector. To synthesise a cubic metre of ethanol, about 12 to 13.5 t of sugarcane are needed. The increasing interest in ethanol production is due to the unavoidable need for energy diversification and the wish of many countries to reduce the emission of greenhouse gases according to the Kyoto protocol. In 2007, 5.57 million cubic metres of ethanol were produced worldwide, 2.0 million m<sup>3</sup> in Brazil from sugarcane. In addition, biodiesel production is estimated to increase 10–12% annually from current levels of 985 000 m<sup>3</sup>. Pure biodiesel is biodegradable and non toxic, and eliminates contamination and toxic emissions as well as aromatic components present in fossil fuels. Brazil is the Latin American leader in R&D and promotion of ethanol use, while Mexico has been far behind in that subject. The mixtures of gasohol *E10* and *E85* are used in all vehicle types improving their performance. In addition, by MTBE substitution, contamination is reduced. At the beginning, MTBE appeared to be the best additive, but later it was proven to have a carcinogenic effect that could provoke genetic modifications and contribute to formation of ‘photochemical smog’. MTBE is still used in many countries through the import of large amounts of this additive. The promotion of biofuels must be based on the edification of a solid culture about their benefits to human health and the environment. The substitution of MTBE by ethanol and the subsequent addition of ethanol with vegetable oils to obtain biodiesel could increase dramatically the ethanol demand in the market. This paper deals with the actual possibilities and limitations of biofuels production in sugar-producing countries from technological and socio-economical points of view.

### Introduction

Much has been discussed in several cane sugar producing countries about the possibilities of developing an ethanol fuel program. However, most of these initiatives have been frustrated due to apparently economical reasons, although today the concept is being re-examined.

Gasohol and biodiesel, blended with ethanol, are emerging as the renewable fuels of the future. This comes from the health point of view and to support the sugarcane agricultural and industrial sectors which have been affected by several well known causes (Lois, 2003).

Today, the importance of the energetic matters all over the world causes us to be in permanent search for those alternatives which can be economical options regarding the availability of oil fuels. World trade in ethanol is shown graphically in Figure 1, and the main uses of ethanol are shown in Figure 2.

The main producers of ethanol are shown in Table 1. A comparison of ethanol production in Brazil, the USA and Europe is presented in Figure 3.

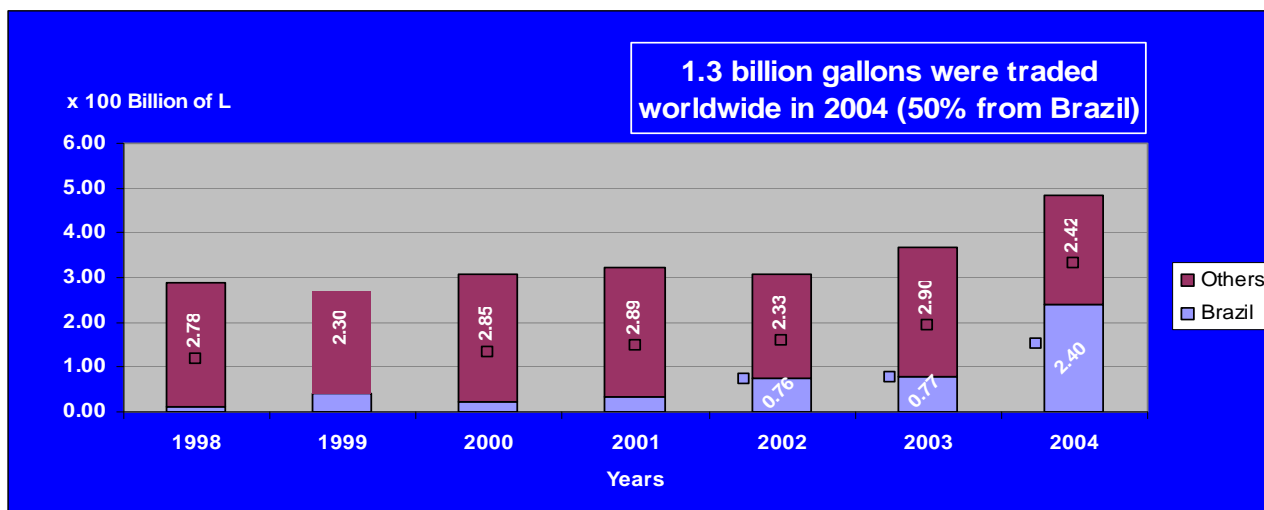


Fig. 1—World ethanol trade.

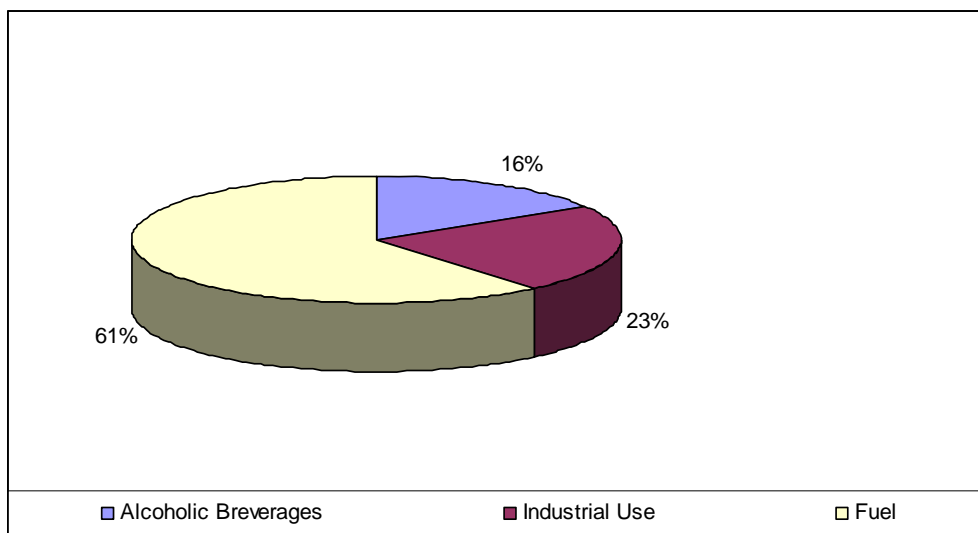


Fig. 2—Main world uses of ethanol (Albanesse, 2006).

Table 1—Ethanol production by countries (million litres, 2005).

USA	16 214
Brazil	16 067
China	3800
India	1700
France	910
Total	44 875

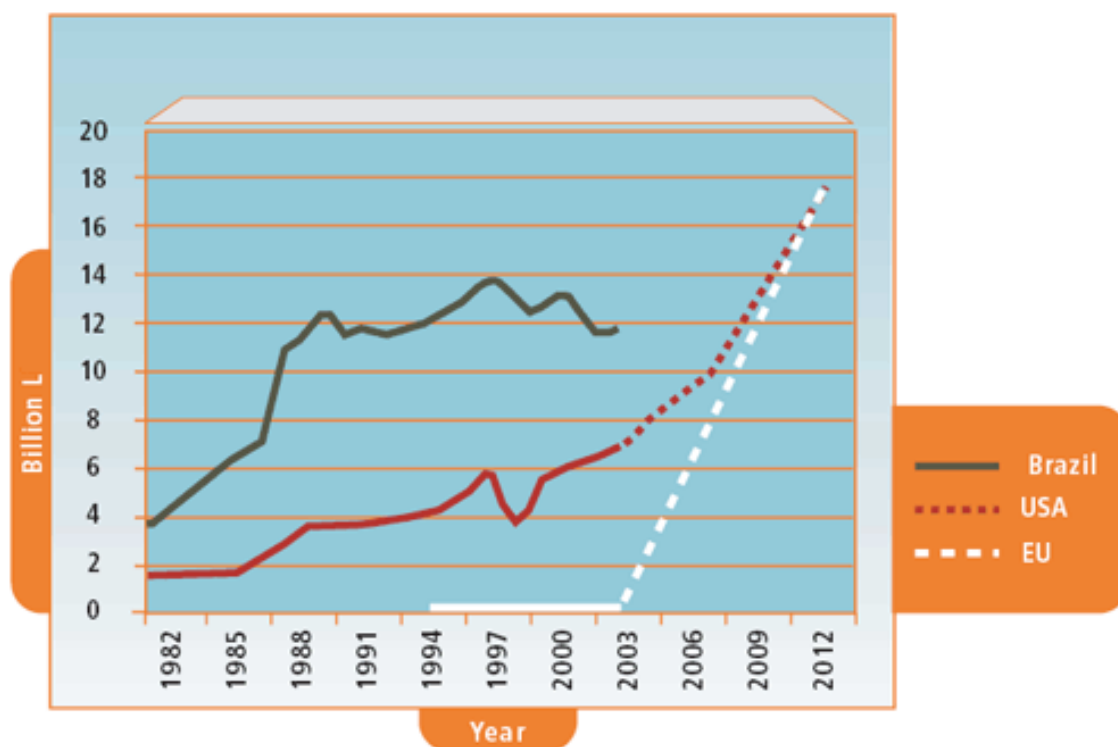


Fig. 3—Comparison of ethanol production between Brazil, USA and Europe (Albanesse, 2006).

### The importance of the gasohol production

Ethanol ( $C_2H_5OH$ ) mixed with gasoline forms biogasoline or *gasohol E10* (10% of ethanol in the mix and 90% of gasoline), but the ethanol could be used in higher amounts like *E85* (85% of ethanol). The gasohol improves the octane number of the fuel mix and also of the emissions of the motors.

### What is biodiesel?

Biodiesel is a cleaner and safer liquid fuel of vegetable origin obtained from renewable sources, such as vegetable oils and animal fats, by means of a process known as transesterification; today the EU supplies around 66% of the world biodiesel production with 6500 million litres per year. Brazil has decided to mix 3.0% *biodiesel* with all the diesel commercialised in the country. The pure *biodiesel* is biodegradable, non toxic, and mainly free of sulfur and aromatic substances. A mix of 20% biodiesel with petroleum diesel or 25% with ethanol and conversion catalyst totally eliminates air pollution.

### What is methyl- tertiary- butyl ether (MTBE)?

It's an oxygenating agent obtained by the reaction of isobutylene and methanol, widely used as an additive in gasoline and a substitute for lead tetraethyl ( $CH_2CH_3$ )<sub>4</sub>. Initially, it appeared to have good performance, but lately it has been proved to be highly toxic. In México it's still widely used.

### Steps and challenges for the development of a strategic program of biofuels from sugarcane juices

- i) Public acceptance and support for ethanol as fuel or as *gasohol* and *biodiesel*.
- ii) Economic viability in the use of local production facilities for the manufacture of ethanol from locally produced cane juice.
- iii) To learn more about the ecological and health benefits from the removal of MTBE and its substitution by ethanol obtained from sugarcane.

- iv) Diversification of sugarcane production by the manufacture of higher value-added co-products.

### Conclusions

- The removal of MTBE by ethanol for the production of biofuels could dramatically increase ethanol demand.

In this way, the sugar industry would be able to double its production capacity in a short time and satisfy the demand originated by the replacement of MTBE.

- The net increase in the ethanol production capacity must be as a result of an improvement in agricultural yields in the cane fields, as well as a diversified use of the existing sugar mills. All this will have a solid positive impact over net production and income, and will increase employment possibilities in the country.

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## LES BIOCARBURANTS: UNE OPTION D'ÉNERGIE PROPRE ET RENOUVELABLE A PARTIR DU JUS DE CANNE A SUCRE

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**MOTS-CLÉS: Biocarburants, Biodiesel, MTBE, Éthanol, Gasohol.**

### Résumé

DE NOS JOURS, l'essence et le biodiesel en mélange avec l'éthanol émergent non seulement comme combustibles renouvelables, mais aussi comme un soutien au secteur agro-industriel de la canne. Pour synthétiser, un mètre cube d'éthanol, il faut environ 12 à 13.5 tonnes de canne. L'intérêt croissant pour la production d'éthanol est dû à la nécessité incontournable de diversification de l'énergie et le souhait de nombreux pays de réduire les émissions de gaz à effet de serre dans le protocole de Kyoto. En 2007, 5.57 millions de mètres cubes d'éthanol ont été produits dans le monde entier comprenant 2.0 millions de m<sup>3</sup> au Brésil à partir de la canne. En outre, la production de biodiesel est vouée à augmenter de 10–12% par an par rapport au niveau actuel de 985 000 m<sup>3</sup>. Le biodiesel pur est biodégradable et non toxique et élimine la pollution et les émissions toxiques, ainsi que des composants aromatiques présents dans les combustibles fossiles. Le Brésil est le leader latino-américain dans la recherche, le développement et la promotion de l'utilisation de l'éthanol, tandis que le Mexique a été loin derrière dans ce domaine. Les mélanges d'essence E10 et E85 sont utilisés dans tous les types de véhicules pour améliorer leurs performances. En outre, par substitution au MTBE, la pollution est réduite. Au début, le MTBE semblait être le meilleur additif,

mais il a été prouvé éventuellement qu'il avait un effet cancérigène susceptible de provoquer des modifications génétiques et de contribuer à la formation de brouillard photochimique. Le MTBE est toujours utilisé dans de nombreux pays comme le prouve par le biais de l'importation de grandes quantités de cet additif. La promotion des biocarburants doit être basée sur l'élaboration d'une campagne intense sur leurs avantages pour la santé humaine et l'environnement. La substitution du MTBE par l'éthanol et le mélange ultérieur de l'éthanol aux huiles végétales pour obtenir le biodiésel pourraient faire augmenter considérablement la demande d'éthanol sur le marché. Cette communication traite des possibilités réelles et les limites de la production de biocarburants dans des pays producteurs de sucre du point de vue technologique et socio-économique.

## LOS BIOCOMBUSTIBLES: UNA OPCIÓN LIMPIA Y RENOVABLE A PARTIR DE LA CAÑA DE AZÚCAR

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**PALABRAS CLAVE: Etanol, Biodiesel, No-Contaminación, Efecto Invernadero, Biocombustibles.**

### Resumen

EN LA ACTUALIDAD el gasohol y el biodiesel con una mezcla con etanol emergen no solo como combustibles renovables, sino también como un soporte para el sector agro-industrial azucarero. Para sintetizar un metro cúbico de etanol se requieren entre 12 y 13.5 t de caña de azúcar. El creciente interés en la producción de etanol se debe a la inevitable necesidad de diversificar las fuentes energéticas y el deseo de muchos países de reducir la emisión de gases de efecto invernadero de acuerdo con el Protocolo de Kyoto. En el 2007 se produjeron en el mundo 5.57 millones de m<sup>3</sup> de etanol, 2.0 millones en Brasil, a partir de la caña de azúcar. Por otra parte, la producción de biodiesel se estima crece entre 10 y 12% anualmente a partir del actual nivel de 985 000 m<sup>3</sup>. El biodiesel puro es biodegradable y no-tóxico, elimina la contaminación y las emisiones tóxicas, así como los compuestos aromáticos presentes en los combustibles fósiles. Brasil es el líder latinoamericano en la I&D y la promoción del uso del etanol, México, sin embargo, está muy detrás en este aspecto. Las mezclas de gasohol E10 y E85 se utilizan en todo tipo de vehículos, mejorando su desempeño. Adicionalmente, al sustituir el MTBE se reduce la contaminación. En un inicio el MTBE pareció ser el mejor aditivo, pero posteriormente se comprobó que tenía efectos cancerígenos, que podía provocar modificaciones genéticas y contribuir a la formación de 'nieblas fotoquímicas'. El MTBE se emplea aún en muchos países, importándose grandes cantidades de este aditivo. La promoción de los biocombustibles debe basarse en la edificación de una sólida cultura de sus beneficios a la salud humana y el entorno. La sustitución del MTBE por etanol y la combinación del etanol con aceites vegetales para obtener biodiesel puede incrementar dramáticamente la demanda de etanol en el mercado. Este artículo trata acerca de las reales posibilidades y limitaciones de la producción de biocombustibles en los países productores de azúcar desde el punto de vista tecnológico y socio-económico.