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## Current scenario and prospects of use of liquid biofuels in South America



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## ABSTRACT

The rise of biofuels took place after the great oil crisis that impacted the world in the 70s. At that period, the mission of supplying the world's demand was given primarily to liquid biofuels. South America has a set of renewable energy sources and shows a great potential to contribute to the energy supply of the world in the coming years. Brazil leads the production of biofuels in South and Latin America since the 60s and also stands out at a global scale. Considering this context, this paper aims to approach the current scenario and the prospects of the main South-American countries, whose energy matrices receive relevant contribution from liquid biofuels. In South America, liquid biofuels stand out among renewable energies, represented mostly by ethanol and biodiesel. Brazil and Argentina lead the scenario and prospects of these biofuels in South America, while countries like Peru and Uruguay look for alternatives to supply such demands as they struggle internally for legislations that stimulate the use of biofuels in the energy matrix.

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### 1. Introduction

An interesting argument for the development of biofuel production is the reduction of emission of greenhouse gases (GHG) compared to fossil fuels [1]. Great discussions are currently raised

regarding the use of sustainable biomass from agriculture for biofuel production, while a great amount of scientific papers about the issue have been produced and investments in new researches for the use of biomass are generated all around the world [2,3].

Although biofuels are considered one of the most sustainable forms of replacement for fossil fuels, the integral performance in the biofuel chain is still not very clear [4–6]. Since biofuels are directly affected by national and international policies, such as low subsidies and rigorous specifications, the impacts on their

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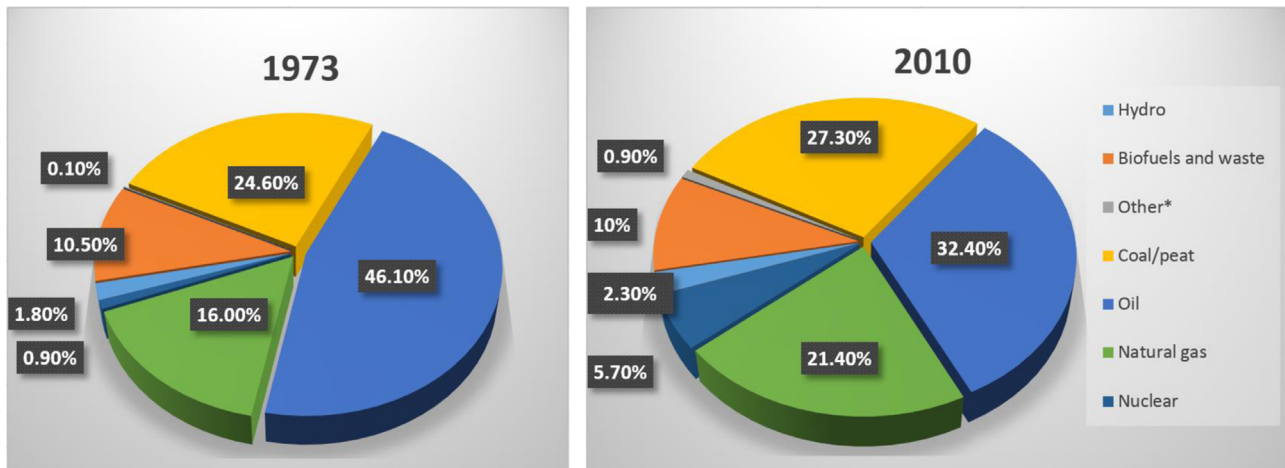


Fig. 1. Total primary energy supply by fuel in 1973 and 2010. \*Includes geothermal, solar, wind, heat, etc. (Data: IEA [15]).

productive chains have to be analyzed in distinct contexts applied to each reality [7].

Renewable fuels are mostly originated from agriculture, such as: sugarcane, oilseed crops and forest biomass, among others. The main biofuels produced in large scale are biodiesel, methane and ethanol, used isolated or in blends with their fossil equivalents [8].

With the variation and volatility of oil prices, besides the geopolitical instability of the countries that hold the major oil-fields, the use of liquid biofuels has been increasing. Energy safety is one of the primary factors behind this increase, especially in the transportation sector [9–11].

South America holds a diverse set of renewable energy sources, being able to contribute significantly to supply the world's energy demand in the future [12]. Thereby, the present paper aims to approach the current scenario and prospects of production of biofuels in the main South-American countries, whose energy matrices receive relevant contribution from liquid biofuels.

## 2. Biofuels in the current world scenario

The first oil crisis (70s) made the era of fossil fuels, previously abundant and of low cost, come to an end. The high taxes charged to the United States by the Arabs and the decrease in production and exportation made the price of the oil barrel quadruple between the years of 73 and 74 [13]. Since then, several developed and developing countries started to look for other sources of energy. The biofuels showed up in this context as an interesting alternative as much from an economic point of view as from the environmental and social ones [14]. Fig. 1 shows the global supply of primary energy. The steep reduction of oil supply and substantial increase of total energy supply are noticeable. Total energy supply jumped from 6107 Mtoe in 1973 to 12,717 Mtoe in 2010.

The modernization of emerging markets was responsible for intensive dynamics of industrialization, urbanization and development of infrastructure. One of the immediate consequences of this process is the boom for the internal demand of energy in countries like Brazil, Russia, India, China and South Africa [16].

The increasing energy demand of these emerging markets began to impact on the global energy matrix, affecting the global economy as a whole [17]. Consuming nearly 57% of petroleum products, the transportation sector is the most impacted by the variations in the price of these fuels. In this scenario, the incentive to bioenergy and the search for alternate fuels have been boosted since the first oil crisis. Bioenergy is also evaluated as a viable and promising alternative in short and medium terms, and is intended

to stand out in the global energy matrix in the coming years, primarily aiming to supply the demand of the transportation sector [18]. Fig. 2 shows the production of biodiesel and hydrated ethanol in 2013 and the predictions until 2022.

The linear increase of the prospect of global production for both biofuels is noteworthy. The enhancement of current techniques and the emergence of new technologies for the production of ethanol and biodiesel, besides the fuels of second and third generations, are the main factors that boost this prospect of increasing production and consumption in the coming years.

## 3. Biofuels in South America

The countries in South America show a set of advantages for the production of biofuels, such as soils rich in nutrients, suitable climatic conditions, land availability and cheap labor, when compared to countries in the European Union and the United States. Brazil is one of the few countries that show a history of increasing supply and use of biofuels for more than 30 years, which is due to the implementation of bioethanol as fuel for transportation. Furthermore, Brazil and Argentina have been producing biodiesel from seeds that are largely cultivated in these countries, especially soybeans. Several other countries of the same region show an interesting potential for biofuel production. However, only with a recent wave of investments from the governments, Latin America comes boosting the production of biofuels at medium and long terms [12,20].

A large portion of the liquid biofuel production is expected to take place in the Southern Hemisphere, because of unsuitable climatic conditions in most of the Northern Hemisphere. Larger biomass production and lower cost are factors that stimulate biofuel production in the tropics. Therefore, biofuels have the potential to offer opportunities for social and economic development, besides giving access to energy in developing countries [22].

The participation of South and Central America in the global production of biodiesel reached the second position by region (Fig. 3), coming right after Europe. Brazil stands out with 12.3% of the global production of biodiesel in 2010 [21].

The growing market of biofuels in this region has both positive and negative impacts concerning the economy, environment and society, and several factors affect its maintenance. Currently, the biofuel market is limited in several Latin countries. It shows stability in Brazil, Colombia and Argentina, mainly because of the concentration of ethanol production [22,23].

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