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Biofuels in Argentina, Brazil and Colombia

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Abstract. The use of biofuels worldwide has been taken as a measure to achieve the decarbonization of the economies of the countries. In this framework, Latin America is the second largest producing region in the world, after the USA in North America. Among the countries that produce and consume the greatest amount of biofuels are Argentina, Brazil and Colombia. These countries are responsible for producing and consuming second-generation biofuels from sugarcane, soybeans, corn and wheat. This article has been dedicated to showing the development of biofuel production and consumption in these three countries. Highlighting Brazil as the largest producer and consumer.
Keywords: Argentina, Biofuels, Brazil, Colombia, Decarbonization of the economy.

1 Introduction

The Intergovernmental Panel on Climate Change (IPCC) [1] is responsible for studying the science of climate change. Climate changes and global warming are responsible for the increase in the average temperature of the planet, sea levels and the melting of the polar caps and snow. Various consequences derive from this, particularly in Latin America periods of intense drought and reduced frequency of rains, leading to the risk of hydroelectric generation in the region. The IPCC has published in its reports that the existence of climate change is unequivocal and that it is due to anthropogenic causes, with 95% certainty [2] [3]. This has led to a worldwide history of policies and international agreements to try to slow down the emissions of greenhouse gases (GHG) that cause these changes, including the aforementioned Paris Agreement [4].

The consumption of fossil fuels for transport, power generation, the industrial sector and others, are the main sources of GHG emissions. By 2019, 84% of the world energy matrix is dependent on liquid fuels, gas and coal [5]. In the search to reduce emissions and dependence on these fuels, a new alternative of biological fuels or biofuels has emerged, which seeks to satisfy part of the world energy demand in the countries [6].

Biofuels are obtained from organic waste and are considered an unconventional renewable energy source. Currently, the United States is among the largest producers of biofuels worldwide. In 2014, this country produced about 4,700 and 54,300 million liters of biodiesel and bioethanol, respectively, from soybeans, corn and wheat [7]. Of these, approximately 30% come from industrial waste and algae and 60% are from non-human food products.

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South America ranks third in the world for biofuel production, with Argentina, Brazil and Colombia standing out. Brazil bases its production on sugar cane, soybeans and corn, exporting its surplus to the USA in 2014. On the other hand, Argentina bases its production on soybeans, being the fifth largest producer in the world. Finally, Colombia produces bioethanol from sugar cane [8].
Biofuels are classified in first, second, third and fourth generation. The first generation comes from biomass, especially from agricultural crops [9]. Similar to the previous case, the second generation are produced from biomass obtained as agricultural waste or waste plant material [10]. The third generation are based on the use of aquatic plants [11]. Finally, the fourth generation is produced from uncultivated land, without destruction of biomass [12]. Table 1 shows the types, processes and technologies applied in first and second generation liquid biofuels, highlighting that their application is not only for transportation, but also for power generation.

Table 1. Types, processes and technologies applied in biofuels

Type	Input	Conversion Process	Utility and Technology	Technology
First generation liquid fuels				
Bioethanol	Sugar cane and starches	Fermentation	Transport	Commercial
Biodiesel	Oilseeds, microalgae, vegetable and animal fats	Esterification	Transport	Commercial and I+D
First generation liquid fuels				
Bioethanol	Lignocellulose, grass, residues agricultural and forestry	Hydrolysis, gasification (Fischer-Tropsch)	Transport	Commercial
Biodiesel	Biomass	Gasification (Fischer-Tropsch)	Transport and generation of electricity	I+D

The production of biofuels begins with the policies established to achieve sustainable development, established in various international agreements, where the 2015 Paris one stands out [13]. Initially it was thought that, like that happens with fossil fuels, it would be produced in an unlimited way, however the amount of land required for growing biomass limits this production. [14].
This article shows the growing development of biofuels in Latin America in the countries Argentina, Brazil and Colombia for the period 2009 to 2019.

2 Carbon dioxide emissions from Argentina, Brazil and Colombia

Fig. 1 shows the evolution of carbon dioxide emissions for the period 2009 and 2019 of the countries of Argentina, Brazil and Colombia. In Brazil there is a decrease in emissions from 2014, unlike in other countries, where a slow increase is seen.

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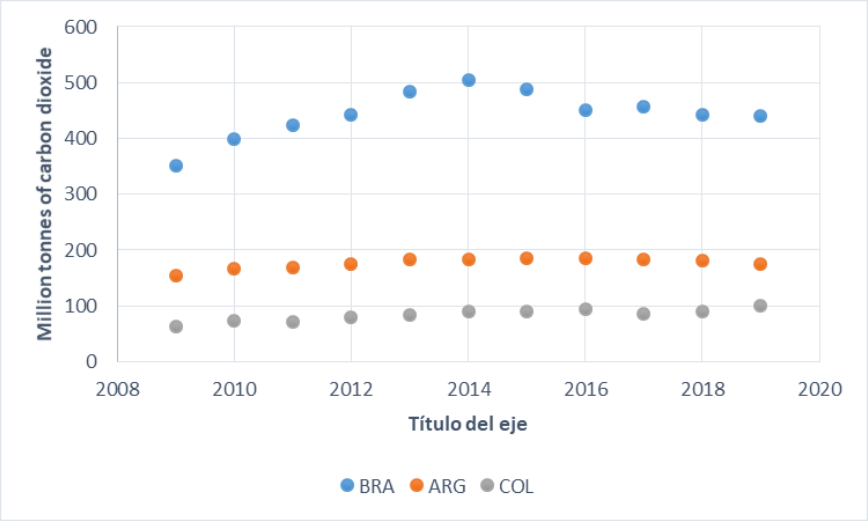

Fig. 1. Carbon dioxide emissions of the countries Argentina, Brazil and Colombia for the period 2009 to 2019 [5]

3 Producción y consumo de biocombustibles de Argentina, Brasil y Colombia

Fig. 2 shows the evolution of biofuel production, for the period 2009 and 2019 of the countries of Argentina, Brazil and Colombia. In this figure it can be seen that the largest producer is Brazil and that it has maintained sustained growth in its production. On the other hand, Fig. 3 shows the consumption of biofuels for these three (3) countries and, similar to the previous case, Brazil maintains a growing trend by being the largest consumer. Finally, in Fig. 4 it is possible to observe the production and consumption of biofuels in these three countries, where the tendency of these two indicators is to be equal.

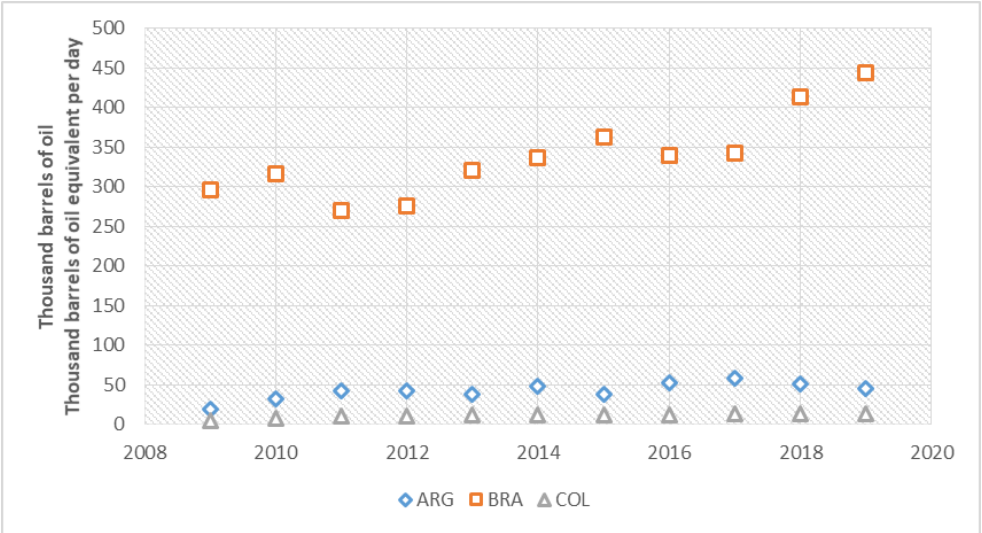

Fig. 2. Biofuel production of Argentina, Brazil and Colombia for the period 2009 to 2019 [5]

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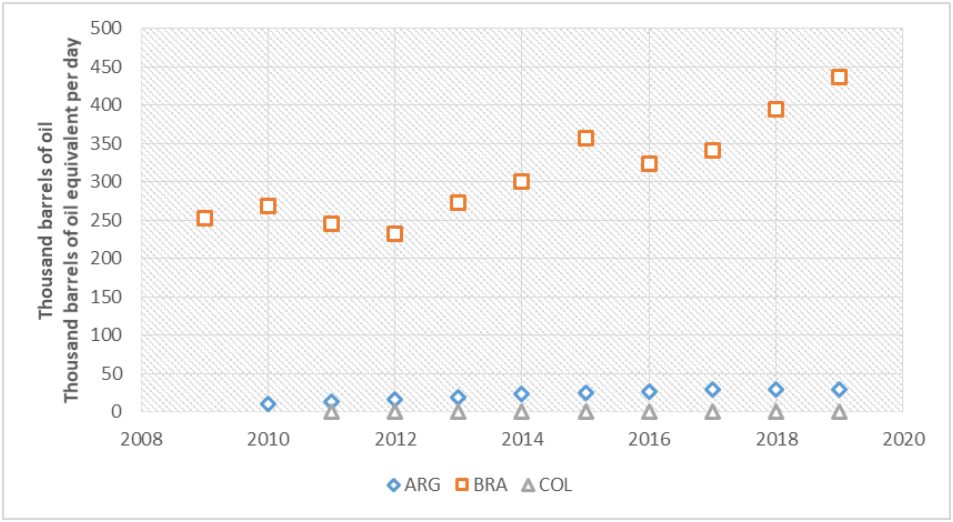

Fig. 3. Biofuel Consumption of Argentina, Brazil and Colombia for the period 2009 to 2019 [5]

Fig. 4. Biofuel consumption and production in Argentina, Brazil and Colombia for the period 2009 to 2019 [5]

Conclusions

The use of biofuels worldwide has been taken as a measure to achieve the decarbonization of the economies of the countries. In this framework, Latin America is the second largest producing region in the world, after the USA in North America. Among the countries that produce and consume the greatest amount of biofuels are Argentina, Brazil and Colombia. These countries are responsible for producing and consuming second-generation biofuels from sugarcane, soybeans, corn and wheat. This article shows the development of biofuel production and consumption in these three countries. Highlighting Brazil as the largest producer and consumer. In Brazil there is a decrease in emissions from 2014, unlike in other countries, where a slow increase is seen. Additionally, it is shown that the largest producer is Brazil and that it has maintained a sustained growth in its production. In addition to the consumption of biofuels for these three (3) countries and, similar to the previous case, Brazil maintains a growing trend as it is the largest consumer. Finally, it is possible to observe the production

and consumption of biofuels in these three countries, where the tendency of these two indicators is to be equal.

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