# *THE ENERGY FROM SUGAR CANE BIOMASS IN BRAZIL*

Igor Gimenes Cesca, University of São Paulo, Phone +55 19 3253 1234, igcesca@usp.br
Fernando Antonio Slaibe Postali, University of São Paulo, Phone +55 11 3091 5915, postali@usp.br
Virginia Parente, University of São Paulo, Phone +55 11 3091 2617, vparente@iee.usp.br

## Overview

According to the International Energy Agency (IEA) (2016) definition, biomass is all organic matter derived from animals or plants available on a renewable basis. This group includes wood, agricultural crops, , energy forests, municipal and industrial organic waste. Until the industrial revolution, biomass was the most widely energy input harnessed in the world. It happened whenthere was only windpower for the use and navigation of animals in agriculture and biomass (GOLDEMBERG, 2009).

For the sugar-alcohol sector, more specifically, the use of energy is through the biomass of sugar cane. This biomass has high content of lignocellulosic materials, which can be used as feedstocks capable of providing energy (DIAS *et al*, 2009). As Kitayama (2008) also points out, this energy is distributed between sucrose, bagasse and straw in the proportion of one third for each of these parts. In this sense, sugar cane biomass can be converted into energy by means of (1) biochemical processes, for example, in the fermentation of biomass for the production of ethanol and (2) in direct combustion, for example when the biomass is burned to produce heat in the plant's boilers (HINRICH *et al*, 2015).

Thus, in sugar cane plants, biomass can be used to produce hydrated and anhydrous ethanol, sugar and as an input to the boilers. For the latter case, it is also possible to take advantage of the heat from bagasse burning (biomass after the grinding step) in the boilers to collect electricity. Thus, with this electricity, sugar cane plants are self-sufficient in energy.

The use of sugar cane biomass for energy purposes has many advantages. According to Marcovitch (2006), there were environmental benefits that were favorable for the reinsertion of sugar cane into the Brazilian energy matrix. Moreover, with the use of biomass residues, such as straw and vinasse, there is greater sustainability and efficiency with this input (SOUSA *et al*, 2010). In addition, among the socioeconomic advantages, a study by Moraes *et al* (2010) emphasized that the sugar and alcohol industry has a great influence on jobs creation.

Considering all the potential to generate energy from a sugar cane plant in Brazil, this paper aims to carry out a historical survey and describe the current situation of all energy that is generated from the sugar and alcohol industry in Brazil, characterizing supply and demand of energy in the sector and its impact on Brazilian energy as a whole.

## Methods

This work used a qualitative methodology. For that, a survey of scientific material, documents and official data was made. In this way, a descriptive and explanatory research was conducted.

## Results

In Brazil, sugar cane currently currently accounts for 25.1% of the domestic energy supply, after only oil and its derivatives (37.3%). In addition, sugar cane biomass alone corresponds to 16.9% (EPE, 2016). Regarding to the final consumption of energy, ethanol and sugar cane bagasse also have a prominent position, in third place, with 18% of total comsumption.

In addition, the transportation sector uses 32.2% of all energy produced in Brazil, of which 40% are ethanol (anhydrous and hydrated). Therefore, it can be stated that the main purpose of sugar cane biomass is in the transport sector (EPE, 2016). For the production of ethanol, Brazil currently has 383 plants authorized by ANP (National Agency of Petroleum, Gasoline and Biofuels) with total daily production of 214,700 $m^3$/day (ANP, 2016). Today Brazil is the second largest ethanol producer in the world.

Nevertheless, this is still an unexplored source, with great potential to produce even more energy. Taking into account environmental and economic aspects, especially when compared to fossil-fueled thermoelectric power plants, and the proximity of the main consumer center in Brazil, sugar cane biomass is an input that could increase diversification and increase the supply of energy in Brazil.

## Conclusions

The sugar cane is part of Brazil's history, such that the energy harnessed from sugar cane has enormous relevance in the internal energy supply and also in demand with ethanol. Not only that, but there are also several economic and environmental benefits in the energy utilization of sugar cane biomass. Even so, it is a source that could be more used, if there were public policies directed to stimulate the sector.

## References


AGÊNCIA NACIONAL DO PETRÓLEO (ANP). *Boletim do etanol Nº07/2016*, 2016. Avaialable at www.anp.gov.br (Portuguese language reference).

DIAS, M. O. S.; ENSINAS, A. V.; NEBRA, S. A.; MACIEL FILHO, R.; ROSSELL, C. E.; MACIEL, M. R. W. Production of bioethanol and other bio-based materials from sugarcane bagasse: integration to conventional bioethanol production process. *Chemical Engineering Research and Design*, v. 87, n. 9, p. 1206-1216, 2009.

EMPRESA DE PESQUISA ENERGÉTICA (EPE). *Balanço energético nacional 2016: ano base 2015*. Ministério de Minas e Energia, 2016 (Portuguese language reference).

GOLDEMBERG, José. Biomass and energy. *Química nova*, v. 32, n. 3, p. 582-587, 2009 (Portuguese reference).

HINRICHS, Roger A.; KLEINBACH, Merlin; REIS, Lineu Belico dos. *Energia e Meio Ambiente*. Cengage Learning Edições Ltda, São Paulo, SP, 2015 (Portuguese language reference).

INTERNATIONAL ENERGY AGENCY (IEA). *Bioenergy*, 2016. Avaialable at: https://www.iea.org/topics/renewables/bioenergy/. Last access in december/2017.

KITAYAMA, Onório. *Bioeletricidade: perspectivas e desafios*. In: III Seminário Internacional de Energia Elétrica, Gesel/UFRJ, Rio de Janeiro, 2008 (Portuguese language reference).

MARCOVITCH, Jacques. *Para mudar o futuro: mudanças climáticas, políticas públicas e estratégias empresariais*. Edusp, 2006 (Portuguese language reference).

MORAES, M. A. F. D. et al. *Externalidades sociais dos combustíveis. Etanol e Bioeletricidade: a cana-de-açúcar no futuro da matriz energética*, v. 1, 2010 (Portuguese language reference).

SOUSA, Eduardo Leão de; MACEDO, Isaías de Carvalho; PILAGALLO, Oscar. *Etanol e bioeletricidade: a cana-de-açúcar no futuro da matriz energética*. São Paulo, Luc Projetos de Comunicação, 2010 (Portuguese language reference).