

## The Status of Bioenergy in Brazil

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Brazil is one of the largest countries in the world, with an extensive surface of continuous land, a large supply of fresh water, abundant solar energy, and

a rich biodiversity. The wide range of climatic conditions, from temperate to tropical, together with advanced capacity in technology development, allowed considerable diversification of agriculture systems, making Brazil an important producer of food, feed, fibers and renewable fuels.



Brazil is currently recognized as a world leader in technology for tropical agriculture. The incorporation of many technological innovations led to the improvement in

the efficiency of resource use, high productivity and intensive land use, drastically reducing the environmental cost of producers. These aspects drive an increase in grain production over the last 20 years as a result of increased productivity. The grain volume has increased by 250% in the period, while the harvested area has grown less than 30%. Without advances in crop productivity and increased agricultural system's efficiency, additional 58 million ha would have been necessary to reach today's production.

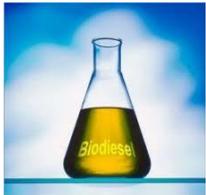
The development of technologies for the use of agricultural inputs and their residues in the

generation of Bioenergy, place Brazil to occupy a world leading position as green energy producer and user. Approximately 45% of all power generation in Brazil comes from renewable sources and it compared with other countries in the world is a source of reference, because on average the world in renewable energy accounts for only 14% of energy generated. Among the major renewable sources stand out the hydroelectricity (15%), the biomass (31.6%), being 12.5% of firewood & Charcoal, 16% of sugarcane derivatives and other sources 3.1%. Sugarcane surpassed hydroelectric power in the Brazilian energy matrix. Everything indicates that sugarcane will have growing importance in the country's energy matrix. The non renewable sources in Brazil correspond 55%, being petroleum and derivatives (36.7%), natural gas (9.3%), mineral coal and derivatives (6.3%) and uranium (1.4%). A striking example of the country's success in energy security is the ethanol production chain.

The production and use of ethanol from sugarcane in Brazil is a global model for Bioenergy production, distribution, and use, and is recognized as one of the most efficient in the world. Like ethanol, biodiesel is also receiving increased attention in Brazil, with development of new source materials, production and industrial technologies.



The production chain of sugarcane ethanol is based on 1st generation conversion and co-generation processes. The largest challenges for R&D remain in the development of 2nd generation technologies for the production of ethanol from lignocellulosic materials. Bioethanol from sugarcane has the most favorable energy balance among ethanol from others sources, having an energy output/energy input ratio of about 8, while wheat has 1.3 and sorghum 4.



The production chain of biodiesel is structured and uses well known transesterification process for oils and fats using methanol. Biodiesel made from soybeans has an unfavorable energy balance when

compared with others materials, so, this is one of the reasons for the efforts that are being made to increase the use of raw material oh higher energy density for the production of biodiesel.

With the urgent need for changes in the energy matrix, especially in terms of replacing non-renewable sources, research in Brazil on Agroenergy and biofuels has concentrate in the medium term, on two points. First, the development of new technologies for energy production (ethanol from cellulose, products of bio-refinery, hydrogen), that include the enzymatic pathway for ethanol from lignocellulosic materials; the enzymes, fungi, bacteria and catalysts with impact in energy production and R&D focusing the concept of bio-refinery. Second, the development of technologies for economical use of by-products and residues which involve the economical use of meals, glycerin & by-products of biodiesel production; the economical use of by-products from the charcoal industry for the production of biofertilizers and biopesticides and, the economical use of residues and by-products from the 1st and 2nd generation ethanol production processes. For the longer-term objectives, the studies are focusing in the development of novel production systems and raw materials with superior characteristics for the production of energy, the zoning and evaluation of environmental, economic and social impacts of Agroenergy sources for the identification of areas for competitive and sustainable production and the last the development of technologies and production systems aiming at using degraded areas for the production of Bioenergy.



This presentation will review the development of ethanol and biodiesel programs and researches in Brazil, emphasizing the key drivers that allowed the country to

occupy a world leading position as green energy producer and user.

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