Take care of the planet in your daily life

Sugarcane's contribution to climate change mitigation

Global warming is
the greatest challenge
of the 21st century.

Some solutions are
simpler than you think.

Discover
sugarcane's
contribution to
climate change
mitigation.

CLEAN ENERGIES FROM SUGARCANE HELP TO REDUCE EMISSIONS

A leader among countries that base their economic development on renewables, Brazil has one of the cleanest energy matrixes in the world, with nearly half of the country's energy obtained from renewable sources. For this reason, Brazil could be a low carbon economy, but unfortunately, Brazil is currently the fourth largest emitter in the world, a negative record mainly resulting from GHG emissions from deforestation, responsible for half of the country's total emissions. While agriculture contributes with 26.5% of emissions, followed by industry (8%) and transport (6.3%) sectors, energy production accounts for only 1.35% of total emissions.

Nevertheless, GHG release into the atmosphere caused by deforestation is expected to decrease in the future, provided that the ambitious targets for zero illegal deforestation set by the Brazilian government in the National Plan for Climate Change, released in 2008, are implemented. At the same time emissions from other sectors are forecasted to significantly increase, as it is the case for transports where emissions are expected to grow by 50% by 2030. Therefore, Brazil will have to take a set of concrete measures to promote low carbon technologies and preserve its clean energy matrix in the future.

Some solutions are simpler than we think and their implementation cost is very low. Sugarcane is now the number one source of renewable energy in Brazil, representing 16% of the country's total energy consumption, second only to fossil fuels. The sugarcane sector offers a wide range of value-added products – including food, feed, biofuels, bioplastics, and bioelectricity cogenerated in integrated biorefineries – which can make a substantial contribution to the mitigation of GHG emissions in Brazil and in many other countries.

Sugarcane ethanol in transports: a tangible reality

By the late 1970s, faced with the oil and economic crises, Brazil adopted a set of objective policies to reduce its dependence on oil and turned to ethanol as a pillar of its transportation fuels. The ethanol program, which was put in place over 30 years ago, helped Brazil to replace half of its gasoline consumption with ethanol today.

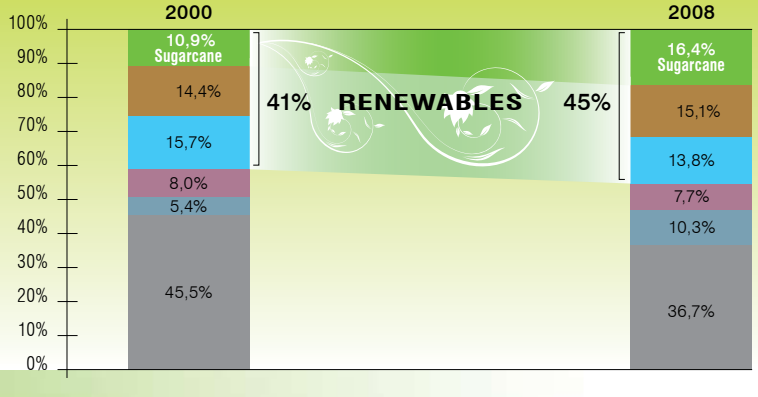
There is no pure gasoline in Brazil. By law, all gasoline sold in the country is blended with 20-25% ethanol (E20-E25), in addition, Brazil produces 100% ethanol (E100) that consumers use to fill up their Flex-Fuel Vehicles (FFVs). Launched in 2003, this technology allows cars to run on pure ethanol, gasoline or any mixture of the two fuels. These cars became very popular, and five years after their introduction, they account for 25% of the Brazilian light vehicle fleet and for 90% of the new cars sold in the domestic market.

The increasing use of ethanol as a fuel has a very positive impact on the reduction of the Brazilian transport sector's emissions. A recent study by the International Energy Agency has confirmed that sugarcane ethanol can deliver a verifiable reduction in GHG emissions that can exceed 100% (if surplus electricity is sold to the distribution grids) when compared to gasoline. In addition, its energy balance is highly positive: 9.3 units of renewable fuels can be obtained for each unit of fossil fuel used in its production. Sugarcane ethanol is, by far, the world's most efficient biofuel produced at a commercial scale.

Several factors explain why sugarcane ethanol helps to reduce GHG emissions, to list a few:

- Sugarcane absorbs 22-36 tons of CO_2 per hectare per year;
- Sugarcane is a semi-perennial crop that is replanted only every six years on average, reducing the release of CO_2 following tillage. No-till techniques are also strongly encouraged, considerably reducing the amount of fuel necessary to run the agricultural machinery in the field;

Brazil's green energy matrix



Source: BEN (2009). ***Elaboration:*** UNICA

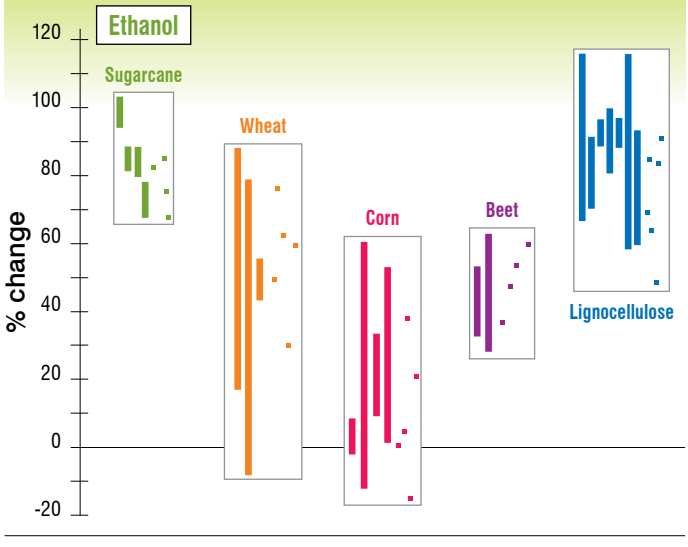
- The use of agro-chemicals in the sugarcane sector is low compared to other crops and the biological control of plagues is widespread;
- Sugarcane mills are self-sufficient in energy, which is cogenerated with the residues of sugarcane (bagasse).

Thanks to the increasing consumption of sugarcane ethanol, about 600 million tons of CO_2 emissions were avoided since the introduction of the program in the late 1970s. In order to obtain the same reduction of CO_2, two billion trees would need to be planted over the next 20 years.

New sugarcane-based products to maximize the reduction of emissions

The potential of sugarcane to mitigate GHG emissions can be further developed. Ethanol consumption is currently concentrated on passenger vehicles but it is expanding to other means of transportation. Ethanol-fuelled buses are commonly used for public transportation in Sweden and are currently being tested in Brazil. The first flex-fuel motorcycles were launched in Brazil in 2009 and some Brazilian crop dusting planes fly on ethanol. But the next revolution for low carbon fuels might come from second-generation cellulosic ethanol and hydrocarbons, such as diesel, gasoline and jet-fuel, made from sugarcane. Considering the very promising results obtained from pilot experiences, commercial scale deployment for some of these products is expected in the next three to five years.

GHG emissions avoided with ethanol replacing gasoline



Note: Reduction of GHG emissions calculated on a life-cycle basis.
Sources: IEA and UNEP for OECD (2008), *Economic assessment of biofuel support policies*, based on a review of recent articles.

Finally, the application of sugarcane ethanol in the chemical industry offers good solutions to reduce the emissions of this traditionally highly fossil fuel dependent sector. As oil prices become increasingly volatile, the use of ethanol as a raw material to produce bioplastics (PHB, polyethylene, PVC) is expanding. In fact, the production of one ton of sugarcane-based bioplastic removes 2.5 tons of CO_2 from the atmosphere, while one ton of the same material produced with naphtha releases 2.5 tons of CO_2 into the atmosphere.

Projections for the Brazilian sugarcane industry

	2008/09e	2015/16	2020/21
Sugarcane production (million t)	**562**	**829**	**1,038**
Sugar (million t)	**31.2**	**41.3**	**45.0**
Internal market and stocks	10.2	11.4	12.1
Surplus export	21.0	29.9	32.9
Ethanol (billion L)	**27.0**	**46.9**	**65.3**
Internal market and stocks	22.2	34.6	49.6
Surplus export	4.8	12.3	15.7
Bioelectricity (MW average)	**1,800**	**8,158**	**13,158**
Bioelectricity in Brazilian energy matrix (%)	3%	11%	14%

Note: *e* = estimated data; potential generation of surplus electricity has been calculated based on the utilization of 75% of the available bagasse and 50% of the available straw, and considering the sugarcane production during most recent harvest.
Sources: UNICA, Copersucar, Koblitz and Cogen.

Green electricity from sugarcane waste and residues

One ton of sugarcane has the same energy content than 1.2 barrels of oil. The sugarcane juice, which is used today to produce sugar and ethanol, represents only one-third of the plant, the remaining two-thirds is bagasse (fiber residues after sugarcane's crushing) and straw. Mills use the sugarcane bagasse to generate vapor and produce bioelectricity for self-consumption. But this is not the end of the story. The excess of this clean energy is sold to the distribution grids, substituting other forms of carbon-intense electricity such as the one produced by fossil thermoelectric plants. Today, 3% of Brazilian electricity demand (1,800 MW average) is met by sugarcane bioelectricity produced at ethanol mills. With the progress in mechanized harvesting and the phasing-out of sugarcane open-air burning, part of the cane straw will also be used to generate bioelectricity in the near future. Together with new investments in transmission grids and high pressure boilers, the bioelectricity potential of the sugarcane sector will increase considerably and is expected to supply 14% of the country's electricity consumption (13,158 MW average) by 2020.

Clean development mechanisms do not reward the full sugarcane potential

Current sugarcane-based bioelectricity projects will receive, between 2006 and 2012, Clean Development Mechanisms (CDM) carbon credits – the so-called "Certified Emission Reductions" (CERs) – for the reduction of about 5 million tons of CO_2. This amount is expected to increase by about 80% as many new projects have been submitted to the relevant authorities for approval. Cogeneration of bagasse power is one of the sectors in Brazil that has most utilized the CDM for renewable energy as a financial tool to help the development of low carbon projects. But, with only 10% of the registered CDM projects, Brazil is the third largest beneficiary of the United Nations support scheme for clean technologies, lagging well behind China (33%) and India (26%). The truth is that the CDM has not produced the results it was intended to at a global scale, mainly due to a set of methodological difficulties and administrative constraints. For instance, countries that have taken the lead to promote clean technologies some years ago and have adopted ambitious environmental legislations are penalized, since projects developed in these nations are not eligible for CDMs for not fulfilling the additionality requirement. As for the sugarcane industry, the production and consumption of ethanol, the leading industry's product with a very high mitigation potential, is not eligible under the current CDM scheme. These problems partially explain why Brazil, a relatively low carbon economy with a strong environmental regulation, lags behind China and India in number of CDM projects.

CLIMATE CHANGE MITIGATION REQUIRES AMBITIOUS PUBLIC POLICIES

A leader in renewable energy development and the world's largest producer of sugarcane ethanol, Brazil is setting the standard for emissions reduction without sacrificing economic growth. Still, to earn a position of global leadership in climate negotiations, Brazil must adopt ambitious policies at home and be a front runner with innovative and pro-active proposals at the international level.

More than 50% of Brazil's emissions are related to land use changes mainly resulting from illegal logging. Today, only 4% of the Amazon is covered by legitimate land titles and law enforcement in the region is extremely limited - a cruel reality that makes the rainforest a welcome mat for illegal settlers, be they poor families or big farmers. Because deforestation is seen as Brazil´s "original sin", the sustainability of any agricultural activity is systematically and unfairly questioned abroad, no matter the efforts done by producers to demonstrate their good practices. About 87% of sugarcane production in Brazil takes place in the Center-South region of the country, 2500 km away from the Amazon biome and the remaining 13% is located in the Northeast, a region also very distant from the rainforest. The sugarcane industry has clearly positioned itself against any expansion over forested areas and wetlands of Brazil and the sector supports the adoption, by the Brazilian government, of legally binding targets to significantly reduce the annual rate of deforestation in the Amazon region.

As a matter of fact, important steps have recently been taken by public authorities to help Brazil on its pathway to become a low carbon economy. The National Plan for Climate Change, which includes the adoption of national targets for eliminating illegal deforestation and the increase of the biofuels share in the transport matrix, has been released in December 2008. The government and the civil society, including the private sector, must now work actively on the effective and successful implementation of this plan. At the State level, the Sao Paulo State Plan for Climate Change provides positive incentives to reduce GHG emissions through the adoption of voluntary targets for some economic sectors, the reduction of 20% of emissions by 2020 for the energy sector and the voluntary public registration of emissions (which will facilitate the process to get environmental licenses in order to operate in the State). Finally, the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) recently issued a regulation requiring that, in order to renew their license and operate, thermoelectric plants using fossil fuels must compensate their emissions. One third of this compensation must be done through reforestation; the rest can be done through investments in other forms of clean energy.

There is no doubt that the greatest challenge of the 21st century is to tackle global warming and mitigate climate change. Meaningful reductions of GHG emissions require more than just political goodwill. It requires leadership, including from the private sector. The solutions developed by the Brazilian sugarcane industry, which could potentially be applied to the 100 countries producing sugarcane around the world, contribute to answering the challenge to produce and consume energy in a way that improves, not jeopardizes, our future.

Learn more about sugarcane's contribution to climate change mitigation at:
www.unica.com.br/en

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