

Debate on bioenergy gains force in the sector

With increasingly greater efforts to come up with sustainable solutions for the planet's energy generation problems, the pulp and paper sector envision a series of opportunities taking shape before their eyes. From the use of biomass for producing energy, to the production of ethanol using cellulose, there's a plethora of possibilities for better tapping the potential of existing forest

By Marina Faleiros



BY STORA ENSO

Pulp and paper companies can use their knowledge in eucalyptus plantation to produce biomass and new biofuels

In a scenario of unstable oil prices and the growing pursuit of sustainable alternatives to maintain economic growth, biofuels are standing out more and more as a profitable and clean solution for the challenges of producing energy throughout the world. Brazil has a vocation in this segment, given its vast amount of plantable land and large scale production of sugarcane-based ethanol.

On account of the high demand for energy, new technologies – such as cellulose ethanol – are already in the crosshairs of scientists and companies. This movement in the pursuit of new options shall only grow, in view that ac-

cording to the report Sustainable Brazil, Energy Market Challenges published by consulting firm Ernst & Young, Brazil will go from the number 11 position of largest energy consumers in the world to the number seven spot by 2030, representing a 3.3% average annual growth in demand. In this scenario, the search for coal and biofuels shall increase 3.6% per year (see comparisons in the table below).

In spite of not directly participating in the sale of energy, the pulp and paper sector depends on energy to be more competitive and, as such, has developed various technologies for using biomass and burning black liquor in its boilers. In

addition, with the appearing of processes that break the sugar molecules from cellulose, eucalyptus may become attractive for a new and promising cellulose-based ethanol market, which means being able to use forest waste that until now was not used by the industry.

Swedish-Finnish based Stora Enso has been investing in eucalyptus-based sustainable energy since 2006, when it initiated a partnership with oil producer Neste Oil to use forest waste to produce gaseous and liquid biofuels. “The forest waste is gasified in a semi-commercial unit in Finland where fuel gas is extracted. The waste is then sent to a Neste

Oil refinery to be added to the petroleum being refined”, says Otávio Pontes, vice-president of Stora Enso for Latin America.

The executive believes that many things still need to be resolved before the commercial adoption of similar processes. “Due to the large size and continuous functioning, any new process added to a pulp mill needs to be exhaustively tested and have its financial feasibility proven”, he said. However, according to him, the potential of using wood coming from planted forests seems quite interesting, particularly in areas where there are no energy generation alternatives.

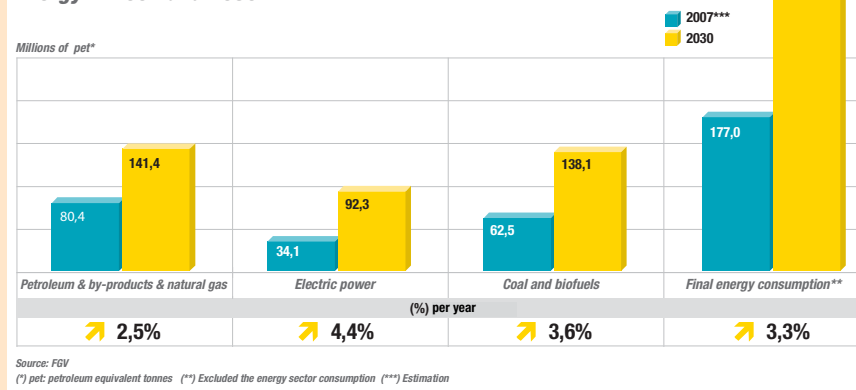
Projects regarding ethanol and the use of biomass gain even more force when analyzing global data. The Ernst & Young study says that US\$ 20 trillion will have to be invested by 2030 in order to keep up with global energy consumption, and that it will not be possible to solely base it on existing oil and natural gas reserves. The high price of oil is one of the factors that may encourage the production of biofuels, which are still very expensive today. According to the consulting firm, while the price of a barrel costs more than US\$ 40, the international biofuel market will expand. The study also shows that the increase in green energy supply will mainly take place through the production of cellulose ethanol on a commercial scale.

CELLULOSE ETHANOL IS ALREADY A REALITY...

One expert regarding the potential of cellulose ethanol is Professor Carlos Alberto Labate, from Escola Superior de Agricultura Luiz de Queiroz (ESALQ/USP). He says that Brazilian universities today already possess sufficient knowledge and studies to build a pilot plant to produce ethanol from eucalyptus biomass.

Labate also highlights the importance of pulp producers to immediately begin seeking solutions for waste left in forests, since large amounts of organic waste in the field translates into loss of energy potential. “An industry that’s highly efficient in assimilating carbon has huge gains from an environmental and market perspective, and one of the paths towards

Energy in 2007 and 2030



this is the production of biofuels, which can be ethanol, diesel, butanol”, he said.

Companies in the sector are already burning part of their biomass to produce electricity, such as pine and eucalyptus tree bark and black liquor. However, Labate points out that burning eucalyptus bark in the boiler is a much less efficient process for producing energy than fuel production.

According to him, Brazil already has the proven potential for cellulose ethanol, whereby the only thing missing is to take the next step, which would be the construction of a pilot mill. However, achieving commercial scale is still a long ways away. Luis Augusto Cortez, Agriculture Engineering professor at Unicamp, stresses that despite the various initiatives in Brazil and throughout the world to produce cellulose ethanol, nothing is viable yet from a commercial perspective. “There exists controversy regarding the amount of time it will take to reach an industrial scale, but I believe that it will take place in ten years”, he said.

...BUT THERE ARE STILL CHALLENGES

Despite Brazil being the first to produce ethanol from sugarcane, obtaining it from cellulose found in sugarcane bagasse or biomass is not easy. “Today, for the sugarcane industry, for example, it is still more worthwhile to burn the sugarcane bagasse to produce energy than it is to pursue its hydrolysis and transform cellulose into ethanol”, says Labate. The

pulp producer, however, can count on certain advantages: “The sugar extraction process is simpler for the eucalyptus bark, something that has major potential to be industrialized”, he said.

At present, various studies are being done with the objective of analyzing better ways to get to the sugar molecules of vegetals. To better understand the process, it is necessary to bear in mind that ethanol is the result of glucose fermentation from sugars.

In sugarcane juice, these sugars are already free to ferment, but in the case of biomass it is necessary to separate the components from the vegetal cell via a hydrolysis process. “The vegetal cell possesses a cellular wall made of cellulose, hemicelluloses and lignin, a phenolic compound that functions as cement and joins all polymers of the fiber”, explains Professor Labate. To release lignin, which is of no interest to the process, it is necessary to make an acid attack – which can be sulfuric or chloridic acid – or enzymatic. “There exist several studies on isolating these enzymes, such as those produced by fungi that degenerate wood and termites, which possess bacteria that produce cellulase, enzymes that digest cellulose”, he said.

Therefore, the challenges in enzyme studies are the most popular, as also attested by Cortez. “All stages in the process need to be functioning well for the business to grow and enzymatic hydrolysis has proven to be the one with



Brazilian market for biofuels will grow at a rate of 3,6% every year, and eucalyptus biomass can take a big share of this market

most potential, since when working with acids we run into environmental problems”, says Unicamp’s professor.

According to Laércio Couto, president of the National Network of Biomass for Energy (Renabio), assistant professor at the University of Toronto and guest researcher at Unicamp’s Interdisciplinary Nucleus of Energy Planning (NIPE), significant progress in the production of eucalyptus-based biofuels could be achieved by using the Fisher-Tropsch process, already utilized by Sasol in South Africa and that generates raw material for the production of chemicals. “Ethanol can be a production source of various products and create a true petrochemical complex based on cellulose ethanol”, he believes.

BIOMASS AS SOURCE OF ENERGY

If cellulose ethanol production still has several challenges to overcome before achieving commercial scale, which includes production process to increased demand and export ease, various companies are already working a new front: energy generation based on eucalyptus biomass.

Couto mentions Klabin as an example, which uses the waste from forest harvests to produce steam and electricity. “Companies like Cargill, Bunge, Caramuru, ADM and Perdigão are also interested in this subject matter and are already using

eucalyptus chips to produce energy in their industrial processes and drying of grains”, he said.

According to the PhD thesis *Assessment of Planting Density and Rotation of Fast Growing Crop for Producing Biomass*, oriented by Couto and produced by Marcelo Dias Müller from the Federal University of Viçosa, in 2006, the importance of biomass as a modern energy source surfaced in the 1970s with the oil crises of 1973 and 1979. The interest returned in the 1990s, with new technologies and the threatened depletion of fossil fuel reserves, as well as environmental aspects taking on greater relevance. In Brazil, renewable energy sources today represent 43.8% of the energy grid, while the global average amounts to 14%, while in developed nations they total only 6%. In the country, 29.2% of energy is biomass, of which approximately 12.9% of forest origin (wood and charcoal).

Renabio’s president points out another promising possibility. “The pulp and paper sector is a pioneer in producing electricity using forest waste and black liquor, with mills that are practically self-sufficient in terms of electricity. Now, the time has come for condensed planting of cloned eucalyptus to produce biomass for energy in short rotations of one to two years”, says Couto. He points out that Brazil is already at the forefront in this area, and may become the biggest exporter of eucalyptus pellets to Europe and woodchips for the entire world.

To seek improvements in biomass usage, Couto conducted in 2002 an experiment in areas owned by ArcelorMittal BioEnergia, in the city of Itamarandiba (MG), using a clone of a *Eucalyptus grandis* vs. *Eucalyptus camaldulensis* hybrid. A condensed planting was done measuring 3 m x 0.5 m in 24 months, in which 100 m³ of wood was obtained per hectare and 40 tons of dry biomass per hectare. “I believe that in the spacing of 1.5 m x 0.5 m I’ll be able to achieve the same production per hectare in one year and this short rotation is important for investors to obtain a quick return on investment”, he said.

Couto said that the industry can use this model to produce electricity in a very short term, with an internal rate of return of around 30% a year. “For the sugar-ethanol sector, which produces electricity from sugarcane bagasse, this is great since the bagasse exists during seven months of the year and in the five other months the cogeneration is halted”, he explains. He says that the compacted eucalyptus allows the mill to have this biomass in these five months when there’s no sugarcane bagasse. This project, which has already been applied at the Rio Pardo mill in Avaré (SP), is called Canalyptus. “Today, it is possible to say that all forest, sugar-ethanol and energy generation companies are interested in the use of compacted cloned eucalyptus plantations to produce biomass for energy in a short rotation”, he said.

Celso Oliveira, president-director of Brasil Biomassa e Energias Renováveis and chairman of the Brazilian Association of Brazilian Biomass and Renewable Energy Industries (ABIB), says that the international market is overly hurried in seeking new energies. “In Europe, today, everything is used as biomass for energy, such as elephant grass and even tree leaves, because they don’t have raw materials”, he said. Brazil has the advantage of possessing raw material, but new investments in research need to be made. “We have all the conditions to be a major biomass supplier for Europe, since everything can be exported, such as briquettes made out of rind of rice, cocoa, babassu palm, coffee, sugarcane bagasse and forest waste. The only thing necessary is for companies installed in Brazil to invest in this niche”, he said.

According to Oliveira, Brazil should open up its eyes more to the world and not only think about its internal energy market. In China, for example, 89% of industries use polluting coal and, in Spain, the rate amounts to 81%. “It is they who will need renewable energies in the future and the Brazilian market could produce and export what they need. The pulp industry, which possesses many forests, can boost business in new areas, such as this”, he concludes. 