



## **Latin America Thematic Network on Bioenergy - LAMNET**

### ***9<sup>th</sup> LAMNET Project Workshop***

### ***International Workshop on Bioenergy Policies, Technologies and Financing***

***Ribeirão Preto, São Paulo, Brazil, 13 – 17 September 2004***

***Workshop Venue: Hotel JP  
Anhanguera Highway km 308, Ribeirão Preto, Brazil,  
[www.hoteljp.com.br](http://www.hoteljp.com.br)***

## **WORKSHOP SUMMARY**



## Introduction

The LAMNET “International Workshop on Bioenergy Policies, Technologies and Financing” took place in Ribeirão Preto, São Paulo, Brazil, from September 14<sup>th</sup> to 17<sup>th</sup>, 2004. The workshop was organised by WIP-Munich, Germany, in collaboration with ETA-Florence, Italy, the European Biomass Industry Association (EUBIA), Brussels, and the Brazilian National Reference Centre on Biomass (CENBIO), Brazil.

The 9<sup>th</sup> LAMNET Project Workshop was attended by 110 participants, from the academic, non-governmental, official, social, and private sector. The workshop included a variety of scientific contributions, prepared by LAMNET Members and invited speakers. These presentations are available at the LAMNET Project Website, <http://www.bioenergy-lamnet.org>. Besides these scientific contributions and topic-specific discussion rounds, the workshop included a guided visit to the International Sugar and Alcohol Industrial Fair FENASUCRO and a technical tour to the Companhia Energética Santa Elisa.

The visit of the International Sugar and Alcohol Industrial Fair (FENASUCRO), one of the largest technological events in the sugar and ethanol sector worldwide, included a visit of TGM - Turbinas Indústria e Comércio, a Brazilian company that manufactures efficient, low maintenance-cost steam turbines.

The technical tour took place at the Companhia Energética Santa Elisa, a sugar production facility that started production in 1933. Today, the Santa Elisa plant employs 4,000 workers and produces 500,000 tons of sugar and 210 million litres of alcohol per year. In May 2003, the Brazilian President Lula inaugurated the company’s new thermal plant that produces 60 MWh of electricity. Thereof about 30 MWh are transferred to the utility company serving 500,000 households with electricity. A significant increase in the sugarcane bagasse based electricity generation is realised through the introduction of innovative high-pressure boilers feeding two high temperature and high pressure multistage turbines of TGM-Turbinas operating at 510°C with an inlet pressure of 63 bar. This new line of turbines is especially designed and manufactured in order to improve efficiency levels in conventional or combined thermal cycles. Compared to the harvesting period 2002/2003, the electricity generation was quadrupled when the new thermal plant was put into operation.

## Tuesday 14<sup>th</sup> September

### Inauguration Session: Welcome, Bioenergy Strategies and Policies



Within the first session of the workshop, the Welcome Address of Prof. José Roberto Moreira, CENBIO, Brazil, included a general overview of the LAMNET project and an outline of events and publications. Prof. Moreira pointed out the efforts of the LAMNET members that led to significant progress and valuable results within the project. The current key focus of activities includes the enhanced electricity cogeneration from sugarcane, the expansion of the Flexfuel Vehicle market, as well as the future export opportunities of ethanol.

LAMNET inauguration session (from right: Prof. Moreira, Mr. Shalders, Dr. Janssen)

In his Inauguration Address, Armando Shalders Neto from the Government of São Paulo outlined the importance of bioenergy within the Brazilian energy mix. Since the introduction of PROALCOOL, the country's transport sector strongly relies on fuel ethanol as a direct substitute for conventional gasoline. The new challenge for Brazil is to introduce biodiesel to the national transport sector. For that purpose, a national and several regional programs will help to promote the production and utilisation of biodiesel in Brazil.

In his role as the LAMNET project coordinator, Dr. Rainer Janssen gave a review of the progress and results that were gained since the project kickoff in January 2002. His presentation included a short overview of the dedicated project workpackages and implemented project activities. As a direct outcome of LAMNET, Dr. Janssen introduced the PARTNERS FOR AFRICA project ([www.partners4africa.org](http://www.partners4africa.org)) that is coordinated by a consortium that comprises of three European and three African organisations. Finally, Dr. Janssen illustrated the key topics of the 9<sup>th</sup> LAMNET workshop and gave a preview of the planned excursions to the Energy Company Santa Elisa and the International Sugar and Alcohol Industrial Fair (FENASUCRO).

### **Key Topic: Biodiesel Production and Utilisation**

Hofrat DI Manfred Wörgetter from the Austrian Bioenergy Centre presented the evolution of the European biodiesel sector and outlined the Liquid Biofuels task of IEA Bioenergy (Task 39). During the last decades, the evolution of the European biodiesel sector has been remarkable. Although in 1980 the research activities in the field of production and utilisation of oilseed derived products was not even taken seriously, trend reversal started in 1987 when France and Austria launched the commercialisation of biodiesel. Sponsored by public programmes, the first demonstration plants in Aschach (Austria), Compiègne (France) and Livorno (Italy) started production in 1988. While the biodiesel industry suffered from the decrease of crude oil prices at the beginning of the 1990's, the rising energy prices in the past revived the biodiesel market and supported its further development.

In 2002, the European biodiesel production reached a total of nearly 1.2 Mio. tons, which is equivalent to an increase of more than 37% compared to 2001. With a total production of 550,000 tons in 2002, Germany became the leading biodiesel producer, overtaking France with an overall production of 350,000 tons. While in Germany, further investment increased the overall production capacity to about 1.1 Mio. tons per year, France retained the given quota of tax-free biodiesel. Unlike this, the German government does not impose any limits in terms of biodiesel volumes that can benefit from adjusted taxation. This supporting attitude is mainly driven by Germany's intention to secure employment, regional development and the intention to reduce global and local pollution. In the past, Italy has also increased its biodiesel production to 220,000 tons. Austria follows with a production of 30,000 t in 2002, whereas the production capacity has been increased to even 100,000 tons in 2004. In the future, the newly released "Biofuels Directive" of the European Union asks for a market share of 5.75% biofuels in each member state by 2010. The permission of tax exemptions for biofuels will help to increase the production and utilisation of biodiesel in Europe.

In the second part of his presentation, Mr. Wörgetter outlined the Liquid Biofuels task of IEA Bioenergy (Task 39). IEA Bioenergy was set up in 1978 by IEA with the aim of improving cooperation and information exchange between countries that have national programs in bioenergy research, development and deployment. The work of IEA Bioenergy is carried out through a series of Tasks, each having a defined work program ([www.ieabioenergy.com](http://www.ieabioenergy.com)).

The objectives of the past Task 39 "Liquid Biofuels" period (2001-2003) were to work jointly with governments and industry to identify and eliminate non-technical barriers which impede the use of fuels from biomass in the transportation sector, and to identify technological barriers to Liquid Biofuels technologies ([www.forestry.ubc.ca/task39/](http://www.forestry.ubc.ca/task39/)).



Biodiesel production facility in Arnoldstein, Austria

## The up-take of Biodiesel in Brazil

### ***Biodiesel Industrial Production***

The Industrial Production of Biodiesel using the AGROPALMA process was presented by Mr. César Modesto Abreu from Agropalma do Brasil. The Agropalma Group started its palm oil and palm kernel oil production and extraction activities in 1982. Today it leads the palm oil production in Latin America, focussing on the entire production chain, from seedling to refined oil, vegetable fats and margarine.

The newly developed AGROPALMA process is exclusively patented and was invented by the Federal University of Rio de Janeiro. The produced Palm Diesel achieves and fulfills all existing prerequisites and standards for biodiesel. The palm oil produced by the Agropalma Group is recognized worldwide for its high quality with average acidity level as low as 2% compared to the 5% limit established by the international market for crude oil.

In 1997, the first palm oil refinery was established in Brazil. Since that time, Agropalma has evolved from the position as crude raw material producer to become the final product exporter, adding value to the segment leadership position. The refinery currently has a production capacity of 320 tonnes per day. A total of US\$ 108 million was invested up to June 1999. With future investment planning already approved, increasing the extraction mills capacity and refinery duplication, this amount is expected to reach US\$ 180 million by the year 2005.

### ***Biodiesel Industrial Production***

Professor Dr. Miguel J. Dabdoub from the Laboratório de Desenvolvimento de Tecnologias Limpas (LADETEL) of the University of São Paulo presented the technical aspects of biodiesel production



Citroen running on biodiesel-diesel blend (B30)

in Brazil. Potential biodiesel conversion yields of available feedstock are varying from 150 – 5,900 litre per hectare. Dr. Dabdoub furthermore presented the biodiesel production facility in Charqueda, São Paulo and the first commercial vehicle fleets from PSA Peugeot Citroen that are running on B30.

Currently, new vehicle engines, running with B100, are under development. In this context, it is necessary to develop new sealing materials and injection pumps that can resist pure biodiesel utilization. The major diesel engine producers of Latin America (Ford, Land Rover, Massey Ferguson) are also interested in developing new biodiesel engines. In order to improve the biodiesel production and utilization, LADETEL will further develop biodiesel production processes and biodiesel fuel technologies.

### ***Biodiesel Policies***

Mr. Antonio René Iturra from the Ministry of Science and Technology (MCT) presented the Brazilian biodiesel history, as well as current strategies and policies in the field. With Directive 702 of the MCT, Brazil has implemented research and technology development activities for a national biodiesel program. In 2003, an Interministerial Workgroup evaluated the feasibility of biodiesel in Brazil and set recommendations for a biodiesel program. After the implementation of the first biodiesel specifications (ANP 255/03), the country in 2004 set the permission to utilise 2 percent biodiesel admixture to regular diesel (B2). Finally, on 6 December 2004 Brazil's National Biodiesel Program PROBIODIESEL was announced ([www.biodieselbrasil.com.br](http://www.biodieselbrasil.com.br)). The program aims to develop technologies for the production, utilisation and industrialisation of biodiesel in Brazil.

### **Afternoon Session: Bioenergy for Sustainable Rural Development**

In his Keynote Address, Mr. Oswaldo Lucon from the Secretary of Environment of the State of São Paulo, addressed the issue of energy for rural sustainable development. Starting with an overview of worldwide primary energy consumption, Mr. Lucon outlined the importance of renewable energy resources for the future energy supply. With respect to the Brazilian energy matrix, Mr. Lucon emphasised the advantages of bioethanol and biodiesel for transport purposes and energy generation. The Brazilian ethanol learning curve and the current prices for ethanol prove, that economies of scale and technological advances can lead to increased competitiveness of renewable alternatives with respect to conventional fossil resources. Mr. Lucon stated that supportive and sound Government programmes can cause positive environmental, economic as well as social development in emerging economies.

An overview on European technologies and expectations for the future use of bioenergy was presented by Dr. Herbert-Peter Grimm from WIP-Munich. Dr. Grimm highlighted the benefits of modern biomass applications (i.e. sustainability, reduction of GHG gases and other emissions, regional and rural development) and presented state-of-the-art bioenergy technologies for solid, liquid and gaseous biofuels. Anaerobic digestion was portrayed as a well proven technology for the production of gas from liquids, containing solid biomass in small quantities (e.g. manure, sewage sludge). Moreover, Dr. Grimm presented the SteamCell technology that can generate both heat and power in an ideal combination. The capability of this technology includes a heat production of 2 to 25 kW and a electricity generation of 0.5 to 6 kW, comparable to conventional boilers.

Rural Renewable Energy development and promotion policies in China were presented by Mr. Tian Yishui from the Center for Energy and Environment Protection of the Chinese Ministry of Agriculture. His presentation included energy production and consumption figures, as well as an overview of available renewable energy resources and current development plans. Besides bioenergy, the National Renewable Energy Development Plan of China includes hydropower, wind and solar energy and sets guidelines and directives in the whole field of renewable energy. The implementation of economic incentives, as well as R&D activities and information campaigns are part of the Chinese Renewable Energy Development Plan. In September 2003, the Environment and Resource Protection Committee of the People's Congress has started to draft renewable energy laws that support the exploitation and utilization of renewable energies in China.

Mr. Denis Tomlinson from Illovo Sugar Ltd, South Africa presented the future prospects of bioenergy utilisation in the South African sugar industry. Mr. Tomlinson outlined the South African White Paper on Renewable Energy and Clean Energy Development that sets the target to achieve a renewable energy contribution of 10,000 GWh to the final energy matrix by 2013. The Government's long term plan is to establish a renewable energy industry that provides modern energy carriers as a complement to fossil fuels. Thereby, the vision is to create an energy economy in which modern renewable energy increases its share of energy consumed and provides affordable access to energy throughout South Africa. The sugar industry plans to utilise the excess bagasse at sugar mills to generate electricity to the grids, operated by the national utility Eskom. Furthermore, the development of voluntary trade in renewable energy certificates (TRECs) is a prospective goal for South Africa.

Mr. Germán Aroca from the School of Biochemical Engineering at the P. Universidad Católica de Valparaíso presented the status of bioenergy development in Chile, focusing on electricity generation, liquid biofuels and biogas. Currently, the major issue in Chile is to promote and improve knowledge about the opportunities and benefits of bioenergy. In the future, bioethanol from lignocellulosic materials, biodiesel and rape oil are promising options to substitute liquid fossil fuels. Furthermore, biogas from landfill, effluent treatment plants and marine biomass will help to utilise the available biomass resources for renewable energy production. Finally, Mr. Aroca highlighted upcoming and ongoing renewable energy CDM projects in Chile and illustrated the large potential of biogas generation from marine biomass in Chile.

## **Wednesday 15<sup>th</sup> September**

### **Morning Session: Innovative Bioenergy Technologies and Applications**

A technical and economical analysis of biofuels for transport purposes was presented by Dr. Giuliano Grassi, Secretary General of the European Biomass Industry Association - EUBIA. As a consequence of the strong growth in the transport sector, the production and implementation of alternative transport fuels is required in order to secure the fuel supply and to alleviate the environmental impacts that are caused by fossil fuel utilisation.

Dr. Grassi presented the most common biofuels for transport and outlined the EU Directive 2003/30/CE that asks for a biofuel contribution of 5.75 percent in 2010. Even though the Directive could become mandatory in 2006, the penetration of biofuels will strongly depend on the competitiveness in comparison with conventional fuels. Dr. Grassi underlined, that among all biofuels, bioethanol appears to be the most promising fuel for the future. The main goal of EUBIA is thereby the sustainable and rapid development of European bioenergy industries and the promotion and deployment of innovative bioenergy technologies and transfer activities.

In his contribution Prof. Joseph Miller from the Federal University of Paraíba outlined the potential of ligno-cellulose as a sustainable substitute for petroleum, natural gas and petrochemistry, providing energy and industrial organic chemicals. Prof. Miller presented principal products and prime raw materials from petroleum and natural gas that can be substituted in a sustainable way as well as recent developments and future growth of the involved technologies and industries.

## Innovative Bioenergy Technology Utilisation in Brazil

### ***Bioethanol production from cellulose***

Dr. Manoel Regis Leal from Copersucar presented an innovative process for the hydrolysis of sugar cane bagasse, the Dedini Rapid Hydrolysis Process (DHR). This new process introduces a solvent in order to dissolve lignin and to change the structure of the cellulose-hemicellulose-lignin complex. With this, the chemical reactions can be accomplished at a lower temperature and pressure rates, while the saccharification reaction is faster and sugar decomposition can be minimized. Dr. Regis Leal stressed, that the DHR process can be implemented in both independent plants and mill integrated plants. Compared to the conventional ethanol process design, the new DHR process increases the overall ethanol output by 11.6 percent.

### ***Vegetable coal briquettes***

The production of vegetable coal, using an innovative briquetting process was presented by Mr. Leonardo Nardoto Conde from Bioenergy Brazil. He outlined the reduction of weight and required



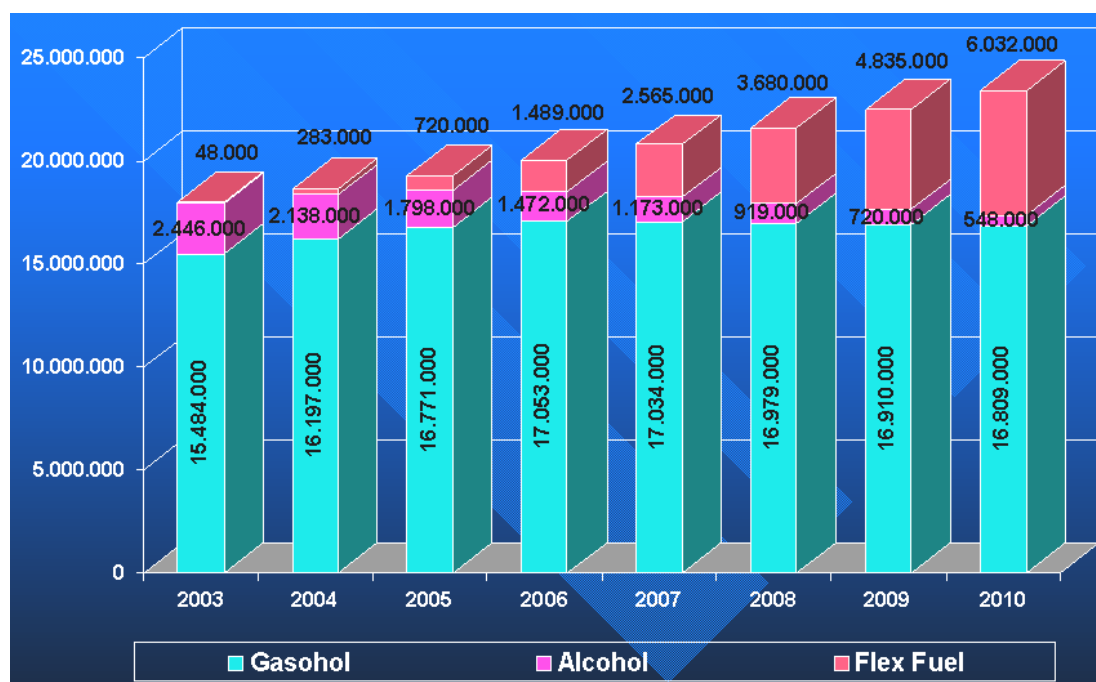
storage space that can be achieved by briquettes. Starting with the first prototype in 1986, the continuous development of the production process recently led to the innovative briquetting technology that uses a metal container furnace. The durability of the furnace was improved significantly while the production efficiency was increased. Furthermore, the implementation of the container furnace brings better labour conditions for the employees and increases the automation and standardisation compatibility.

Comparison of required space for fuel wood and biomass briquettes

The presentation of Mr. Marcos R. Escobar from Co. Paulista de Força e Luz – CPFL described the current situation of bioenergy producers in Brazil. CPFL Energy is the largest energy company with a market share of 12 percent, about 5.5 million clients and 4,000 employees. The company's overall capacity of 812 MW in 2002 is planned to be increased to 1,989 MW in 2009. Energy production from biomass has been increased steadily and reached a total of 1,600 GWh in 2004. Finally, Mr. Escobar underlined the importance of co-generation units to provide an efficient energy back-up for Brazil.

Dr. José Dilcio Rocha from Bioware Brazil presented biomass-to-energy projects. The company Bioware deals with the energetic use of biomass residues and ecologically friendly and efficient thermoconversion technologies. Furthermore, Bioware carries out implementation projects for new technologies, processes and industrial plants. This includes training activities, consulting services and support in different fields related to the subject. In Brazil, the company has pioneered the application of the fast pyrolysis process in reactors of bubbling fluid bed reactors to produce bio-oil and charcoal powder. Bioware is operative in many industry segments such as chemical, petrochemical, energy, sugar and alcohol forestry and organic waste recycling, currently seeking new technologies and raw materials to increase their productivity and profitability.

The future perspectives of Flexfuel Vehicles in Brazil were presented by Mr. Henry Joseph Junior from the Brazilian Automobile Manufacturers Association – ANFAVEA. In 2003 the first Flexfuel Vehicles were introduced to the Brazilian market. Since that time, the new transport technology is spreading throughout the Brazilian automobile industry. It is the dual fuel engine, powered with gasoline and/or alcohol, giving the consumer total liberty in choosing one of the fuels, or mixing them in any proportion. By today the manufacturers Volkswagen, Ford, Fiat and GM have introduced 19 car models on the Brazilian market. It is expected that around 600.000 or 30% of the car sales in Brazil during 2004 will be Flexfuel cars. By the end of 2007 even 67% of the overall car sales are believed to be equipped with the Flexfuel technology.



Brazilian light vehicles fleet forecast

Marcia Leite Drachmann presented the activities of Petrobras Brazil in the field of biodiesel. Petrobras was established in October, 1953 with the objective of executing the activities of the oil sector in Brazil on behalf of the Federal Government. The former Petr leo Brasileiro S/A began its activities with assets transferred from the former National Council of Petroleum (CNP). Eversince, Petrobras is committed to sustainable development and the improvement of energy efficiency, linked to mitigation of climate changes.

Due to the high interest from the Brazilian Government for implementing biodiesel in large scale, Petrobras is planning to significantly participate in the whole biodiesel chain, including production, distribution, transport and commercialization. The necessity of further developments of involved technologies, especially those concerning ethanol separation and specification are most important for Petrobras. Therefore, the company is currently establishing partnerships with various bioenergy enterprises that are involved in the biodiesel sector.

### Bioenergy International Cooperation, Technology Transfer and CDM

The aims and achievements of the Cane Resources Network for Southern Africa (CARENESA) were presented by Dr. Frank Rosillo-Calle from the Imperial College London. The main objectives of CARENESA include the assessment of potential bioenergy production from sugar cane and the promotion of sustainable development in South Africa. Specific network objectives are focused on agriculture, industry and markets as well as potential impacts and integration scenarios. Main challenges identified are the increase of productivity and the reduction of conversion costs. Furthermore, Dr. Rosillo-Calle emphasised the importance of strengthening the R&D sector in order to promote technical cooperation and innovations in the biomass sector.



Mr. Xiao Mingsong from the Chinese Association of Rural Energy Industry – CAREI presented the current status of biofuel development in China. In order to achieve greater energy self-sufficiency and to reduce the expenditures for oil imports, China intensively researches the implementation of appropriate biofuels. Several bioethanol plants have been built, such as the new Jilin Fuel Ethanol Plant. With a final capacity of 600,000 tons per year, i.e. 2.3 million litres per day, the plant will be the world's largest bioethanol production facility. The plants start-up and continuous operation is fully satisfactory and the demand for the produced bioethanol will be guaranteed by the decision of the Jilin and other provincial governments. It is planned to replace pure gasoline with gasohol, an E10 gasoline-ethanol blend, at all filling stations in the respective Chinese provinces.



Bioethanol production facility in Jilin, P.R. China

The global potential of power crops was presented by Dr. Nasir El Bassam from the International Research Center for Renewable Energy in Germany. In many countries, vegetable oils, biodiesel, biogas and bioethanol have already been successfully introduced. Due to the good characteristics regarding storage, transport, conversion and the positive energy balance, biomass represents the largest and most sustainable alternative to substitute fossil fuels within the future energy matrix. In order to fully exploit the future benefits, it is necessary to identify available power crops. Plant breeding and genetic engineering as well as the optimisation of the whole production and utilisation chain need to be considered. Furthermore, it is necessary to improve available conversion technologies and to disseminate results via networking activities on biomass and biofuels.

Mr. Norbert Vasen from ETA-Renewable Energies, Italy, presented the exchange of biofuel experience between Brazil and the EU. The most prominent motivation for technology cooperation are the innovative technologies of the biomass industry. Furthermore, the realisation in concrete projects and the transfer of experience can help to bring success to international cooperation activities. The development of feasibility studies and the evaluation of financing schemes could help to further develop the biofuel sector in Brazil and the EU.

An overview of the current world's carbon market was given by Mr. Marco Monroy from MGM International Brazil. The company's objectives are the identification, design, negotiation, as well as execution and support of CDM projects. MGM International believes that even though the CDM currently faces some obstacles, the CDM market will be fully developed in the near future and the number of implemented CDM projects will significantly increase. Thereby, successful CDM experience can be gained long before 2012 when the first commitment period ends. This would encourage both Annex 1 and non-Annex 1 countries to make further commitments to mitigate climate change.

## Thursday 16<sup>th</sup> September

### Guided Visit to the International Sugar and Alcohol Industry Fair (FENASUCRO)

FENASUCRO is the main event in the sugar and ethanol sector worldwide. Since 1993 the event brings together suppliers of equipment and services for sugar mills as well as alcohol and sugar distilleries. The aim is to stimulate the technological development, encourage the trade and give an impulse for future business. FENASUCRO 2004 was attended by 320 exhibitors who presented the whole spectrum of technologies and services, related to the sugarcane and ethanol industry. About 35,000 visitors from Latin America and other countries of the world visited the event.



Participants of the guided visit to FENASUCRO

## Friday 17<sup>th</sup> September

### Technical Tour - Companhia Energética Santa Elisa

The LAMNET workshop in Riberão Preto included a technical tour to the Companhia Energética Santa Elisa, a sugar production facility that started production in 1933. After continuous development and expansion, today, the Santa Elisa plant employs 4,000 workers. The annual production reaches 500,000 tons of sugar and 210 million litres of alcohol.

In Mai 2003, President Lula inaugurated the company's new thermal plant that produces 60 MW of electricity per hour. Thereof about 30 MWh are transferred to the utility company serving 500,000 households with electricity. A significant increase in the sugarcane bagasse based electricity generation is realised through the introduction of innovative high-pressure boilers feeding two high temperature and high pressure multistage turbines of TGM operating at 510°C with an inlet pressure of 63 bar. This new line of turbines is especially designed and manufactured in order to improve efficiency levels in conventional or combined thermal cycles. Compared to the harvesting period 02/03, the electricity generation was quadrupled when the new thermal plant was put into operation.



High pressure boilers at the Companhia Energética Santa Elisa

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