# International Bioenergy Forum:
# China –EU Cooperation

September 28 – 30, 2003
Guangzhou Oriental Resort

## Conference Proceedings (Excerpts)

The International Bio-energy Forum met in Guangzhou, P.R. China from 28-30 September 2003 to discuss cooperative efforts in the field of bio-energy between China, the EU and supporting countries. This forum was organized jointly by the Ministry of Environment of Guangzhou, the Guandong University of Technology, the European Biomass Industry Association (EUBIA) and the Global Network on Bioenergy.

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# FORUM INAUGURATION

International Bioenergy Forum: China-EU Cooperation
4th LAMNET Workshop – Guangzhou, China 2003

## Industrial Cooperation in the Framework of the Global Bioenergy Network - LAMNET

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**Abstract**

A global network on bioenergy involving 48 expert institutions (Knowledge Centres and SMEs) from 24 countries has been established in order to promote the sustainable use of biomass in Latin America, Europe, China and Africa. This network supports the elaboration of recommendations for the development and implementation of policy options for the promotion of biomass and bioenergy as well as the identification of commercially available and reliable biomass technologies worldwide. In the field of bioenergy technologies a variety of opportunities for international co-operation, technology transfer and joint-ventures between OECD and non-OECD countries have been identified, and the network actively supports the establishment of initial business contacts. Additionally, members of the global network on bioenergy are involved in the preparation and set-up of national and international bioenergy policy programmes and initiatives aiming at increasing the share of bioenergy and other renewable energies in the global energy supply structure.

Keywords: bioenergy, global network, international cooperation, sustainable development

### 1. Introduction

Good management of resources, alleviating poverty and improving the socio-economic conditions of living as well as the identification of sustainable technical and economical schemes are key objectives for research and development efforts in emerging countries and successful partnerships of OECD countries with non-OECD countries from Latin America, Asia and Africa. Projects focussing on scientific co-operation and policy research in general and especially in the field of renewable energies are of great importance today, as the creation of suitable policy frameworks is required prior to the development of more advanced technologies in order to tackle the main challenges of sustainable development.
Therefore, scientific co-operation and the linkage of scientists, decision makers and entrepreneurs in thematic networks is expected to gain an ever increasing importance in the relation between OECD countries and countries from Latin America, Asia and Africa. In order to contribute to these objectives the project 'Latin America Thematic Network on Bioenergy – LAMNET' is funded by the European Commission in the framework of the specific research and technological development programme 'Confirming the International Role of Community Research'.

## 2. LAMNET - A Global Network on Bioenergy

The project 'Latin America Thematic Network on Bioenergy – LAMNET' succeeded in setting-up a trans-national forum for the promotion of the sustainable use of biomass in Latin America, Europe, China and Africa. Currently, the global network LAMNET consists of 48 institutions (Knowledge Centres and SMEs) from 24 countries worldwide, thereby involving a large number of members with excellent expertise in the field of biomass [Janssen et al. (2002)].

LAMNET supports the elaboration of recommendations for the development and implementation of policy options for the promotion of biomass and bioenergy as well as the identification of commercially available and reliable biomass technologies worldwide.

The web site of this global network on bioenergy was established early in 2002 under **www.bioenergy-lamnet.org**. It provides detailed information on the objectives, activities and scientific publications of this trans-national forum as well as the contact details of all network members. Additionally, links are provided to other organisations and companies engaged in the field of bioenergy.

Further dissemination activities of the LAMNET project include the publication of a periodic newsletter
(2 issues per year), a project database providing information on the energy demand and resources in Latin America and other emerging economies as well as the organisation of several bioenergy workshops.

One week prior to the World Summit on Sustainable Development (WSSD) in Johannesburg a workshop on 'Biomass, Rural Energy and the Environment' was organised in Durban as a joint event of the three thematic networks CARENSA, SPARKNET and LAMNET, which are funded by the European Commission Fifth Framework Programme for Research. This workshop aimed at strengthening synergies and initiating future co-operation of the three multi-stakeholder networks in order to promote sustainable energy for development by assessing energy demand and resources, expanding the institutional knowledge base, and by creating a broad-based discussion forum to evaluate innovative policy options.

The 3rd LAMNET project workshop in São Paulo and Brasilia, 2-4 December 2002, on 'Bioenergy Policies and Innovative Bioenergy Technologies' included a session on ethanol-based fuel cells and a technical tour to the Copersucar Technology Center (CTC), one of the world's most advanced research and development centres in the sugar and ethanol sector (Figure 1).

**Figure 1**: Visit at the Copersucar Technology Center


In 2003, the LAMNET network is continuing all activities in order to strengthen this trans-national forum for the promotion of biomass and bioenergy in Latin America, Europe, Africa and China. It will thereby contribute to the establishment of modern energy supply systems which are fully in line with today's crucial goals of poverty eradication and sustainable development.
The next LAMNET project workshop will take place in Morelia, México, in the framework of an International Seminar on Bioenergy and Sustainable Rural Development (26-28 June 2003). For the first time this international seminar will bring together in México more than 60 bioenergy specialists from the academic, governmental and industrial sector. The seminar is co-organised by the Universidad Nacional Autónoma de México (UNAM) – Instituto de Ecología, the Asociación Nacional de Energía Solar (ANES), the Food and Agriculture Organization of the United Nations (FAO), the State Government of Michoacán and the LAMNET project.

## 3. International Cooperation on Bioenergy Technologies

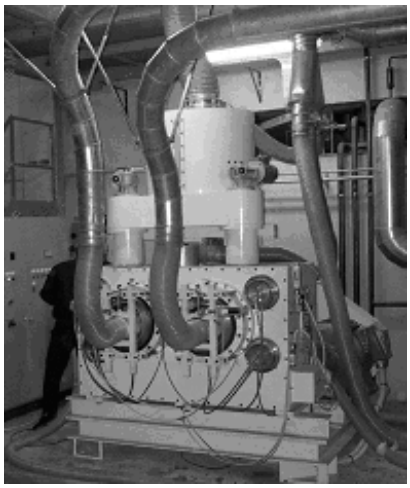
Within the framework of the LAMNET project it is one of the main objectives to identify currently available, efficient, cost-competitive and reliable bioenergy technologies which provide opportunities for the conversion of biomass to energy services in Latin America, Europe, Africa and China. Relevant technologies and systems are selected on the basis of maturity of the technology, cost-effectiveness, simplicity of maintenance, social acceptability and the impact on development. Moreover, opportunities for international co-operation, technology transfer and joint-ventures between OECD and non-OECD countries in the field of bioenergy technologies are identified and promoted by the LAMNET network. Within the framework of the LAMNET project the establishment of initial business contacts is supported through advice and recommendations by expert network members.

The LAMNET project is particularly focused on the promotion of small-scale, decentralised bioenergy technologies as their penetration is expected to be much easier in terms of the supply of biomass resources and the investment level [Grassi et al (2002a)]. Information documents describing bioenergy projects and technologies, which include a detailed technological and economical analysis, are elaborated by the European Biomass Industry Association (EUBIA) in the framework of the LAMNET project. Currently, information documents are available on biomass pellets and briquettes, micro-distilleries for ethanol production and modern bioenergy village complexes.

### *Pelleting technology for the South African sugar industry*

On the occasion of the 2nd LAMNET project workshop on biomass, rural energy and the environment organised by WIP-Munich and Illovo Sugar Ltd. in Durban, South Africa, the Managing Director of network member Illovo Sugar, Mr. Don Macleod, stated that the production of energy from both sugar cane bagasse and molasses is a known technology and therefore sugar by-products can contribute to the global movement towards sustainable ”green energy” whilst also improving the return to producers of sugar. Mr. Macleod showed strong interest in new technologies providing opportunities to improve the energy generation capacity. The pelletising technology for a variety of biomass feedstocks is an important step in providing energy from bagasse on a year-round basis and the workshop contributions on this subject are of specific interest to the Illovo group.

**Figure 2**: Pelletiser machine, Italy



Within the framework of the LAMNET project a cooperation agreement between Illovo Sugar and a European manufacturer of innovative pelleting technology (Figure 2) has been initiated and samples of South African sugar cane bagasse have been compacted at the European pelleting facility. Currently, the produced bagasse pellets are being scientifically investigated at Illovo Sugar in order to verify the future potential of this biomass technology for the southern African region.

### *Bioenergy technologies for the Cuban sugar industry*

The Cuban LAMNET members Dr. Paulino Lopez Guzmán, Bioenergy Development Programme – Ministry of Sugar, and Julio Torres Martinez, Cuban Observatory for Science and Technology reported that the bioenergy sector in Cuba is almost entirely focussing on bagasse as a residue of the sugar cane processing industry and that 80% of the available agricultural land in Cuba is cultivated with sugar cane. This constitutes an enormous resource of biomass, but unfortunately Cuba has so far not exploited this enormous potential in an efficient way. Therefore, international cooperation on innovative bioenergy technologies for an efficient exploitation of sugar cane bagasse, such as High Pressure Steam Turbines, Biomass Integrated Gasification Combined Cycle (BIGCC) and Bagasse Pelleting Technologies, are of great strategic benefit for the Cuban sugar cane industry.

A strategic alliance between the Cuban network members and the European Biomass Industry Association has been accomplished and a technology cooperation agreement, including the installation of pilot pellet production facilities, between the Cuban Ministry of Sugar and a European manufacturer of pelleting equipment has been initiated.

### *Ethanol based fuel cell technologies for Brazil*

On the occasion of the 3rd LAMNET project workshop in Brazil a session was organised on the two basic principles for the realization of ethanol based fuel cells, i.e. the direct electrochemical conversion [Iwasita (2002)] of ethanol and the reforming of ethanol to hydrogen [Rampe et al. (2000)]. Renowned international experts in the field of fuel cells discussed the future potential of this promising technology, especially for countries in Latin America.

It was agreed upon that fuel cells will contribute to the world's future cleaner energy supply by exploiting their high efficiency and low pollution levels. Thereby, the introduction of bio-ethanol based fuel cells will have to take advantage of the existing bio-ethanol infrastructure in Brazil providing a suitable fuel supply with a low level of contaminants. Nevertheless, extended research on the micro-contaminants in bio-ethanol has to be performed to ensure safe operation of the fuel cells. Furthermore, ethanol fuel cells, both direct conversion or via reforming, are currently still in the R&D stage. Especially the charge transfer in direct ethanol fuel cells still needs to be optimised and further research is required in order to find a suitable catalyst. Although commercialisation of ethanol based fuel cells is therefore not expected in the very near future, there is a great opportunity for cooperation between countries developing innovative fuel cell technologies and Brazil with its long term experience in the production and processing of bio-ethanol (Figure 3).

**Figure 3**: Fuel Cell Vehicle, Germany


### *Bioenergy technologies for rural development in China*

Bioenergy has an essential strategic and practical significance for China, as the exploitation of biomass resources involves rural development, energy development, environmental protection, resource conservation and the ecological balance. Therefore, China is striving to obtain support from international organisations, foreign governments and scientists and shows strong interest in cooperation to promote technological progress.

Within the framework of the LAMNET project a strategic alliance between the network members from China and the European Biomass Industry Association as well as other bioenergy experts from Europe and Latin America has been established in order to identify opportunities for technology transfer and joint-ventures in the field of modern bioenergy technologies [Grassi et al (2002b), Grimm et al. (2002)].

***Cooperation on bio-fuels production: Latin America - Europe***

The European Commission has recently adopted an action plan and Directives to foster the use of alternative fuels for transport, starting with the regulatory and fiscal promotion of biofuels. The Commission considers that the use of biofuels (such as ethanol) derived from agricultural sources is the technology with the greatest potential in the short to medium term. This action plan outlines a strategy to achieve a 20% substitution of diesel and gasoline by alternative fuels in the road sector by 2020.

In order to take advantage of these policies supporting the large-scale introduction of biofuels in Europe, a cooperation agreement has been initiated between representatives of the German and the Brazilian sugar industry sector on the occasion of the 3rd LAMNET project workshop in Brazil. Thereby, it is envisaged that the long-term experience of the Brazilian network members in the field of ethanol production from sugar crops [Correa Carvalho (2002)] will serve to stimulate and benefit the potential set-up of bio-ethanol production facilities and the distribution infrastructure in European regions.

## 4. Policy Options for the Promotion of Bioenergy

In order to identify opportunities for co-operation activities between OECD countries and countries from Latin America and Africa in the field of bioenergy, the LAMNET project monitors the development of national energy policy frameworks as well as the preparation and set-up of bioenergy policy programmes and initiatives in selected countries. In the following, recent national policy initiatives promoting the sustainable use of biomass are presented which facilitate the involvement of companies and multi-lateral organisations from OECD countries:

***Brazilian energy initiative to the World Summit on Sustainable Development***

An ambitious proposal for a revolution in the planet's energy matrix was brought to the Johannesburg Summit on Sustainable Development by Brazil. The Brazilian Energy Initiative, conceived by Prof. José Goldemberg, São Paulo State Secretary of the Environment, calls for extended use of alternative sources like solar, wind, geothermal, tidal, biomass and small hydroelectric facilities [Goldemberg (2002)]. Its goal is to raise the share of these sources from 2.2% today to 10% by 2010.

The LAMNET co-ordination partner Prof. José Roberto Moreira from the Brazilian Biomass Reference Centre (CENBIO) was involved in the elaboration of the technical background document on biomass [Moreira (2002)]. These technical papers served to quantify the world capacity to obtain significant amounts of energy by the year 2010 from new and renewable energy sources. It is shown that through the use of 300 million hectare of land it is possible to fulfil the total global energy demand by using the most advanced agricultural and industrial technologies. The document concludes with a list of practical actions promoted by the Brazilian Energy Initiative that, if implemented, would allow most of the 102 sugarcane growing countries to rely on energy from sugarcane in the short-term and would initiate the creation of a large-scale global bio-ethanol market with significant impact on several OECD countries:

**Figure 4**: Distillation Column

Source: Copersucar, Brazil

- Immediate increase of the ethanol production (Figure 4) by reducing the export of molasses and its use as feedstock for animal feeding.

  This action can be applied in about 150 sugar producing countries. The production of 100 kg sugar generates molasses for the production of at least 15 litres ethanol. From the production of 120 Mt sugar from sugarcane and sugar beet it would therefore be possible to produce 18 $Mm^3$/yr of ethanol, an amount sufficient to replace 0.7% of the total fuel consumption in the world within few years.

- Immediate conversion of a share of the sugarcane production from food to fuel.

  This action can be carried out in 102 countries. The present world sugar production from sugarcane is around 100 Mt/yr while the international market turns out to be approximately 30 Mt/yr. Additionally, several sugar producers have large stocks that are not being commercialised due to the risk of a further price reduction. Therefore, a reasonable decision would be to divert 10% of the sugarcane to ethanol production. This means 10 Mt of sugar, yielding 7 million $m^3$/year of ethanol, one or two years after the decision is taken. This is the maximum time required to install industrial facilities, whereas blending a few percent ethanol in gasoline is an easy task and can be initiated in a few months. Around 6 million $m^3$/yr equivalent of gasoline (representing 0.3% of the global fuel consumption) can be replaced by this practical action.

### *Brazil: PROINFA programme*

The major objective of the PROINFA programme (Program to Foster Alternative Sources of Electric Power) is to raise the share of electric power generated by independent producers in the Brazilian market. The programme's first phase calls for the central utility Electrobras to sign electricity purchase contracts for the construction of 3 300 MW new capacity (Wind, SHP, Biomass) by 2006. These contracts will ensure the purchase of electricity from alternative sources over a fifteen-year period and this commitment is a way of guaranteeing subsidies that will cover the competitive differential of small producers. PROINFA will assure subsidies to producers of electric power from alternative sources until they can supply 10% of the national energy matrix. From that point on it is foreseen that these producers will have sufficient know-how and effective market share to compete in an open market.

The PROINFA programme, which is an integral part of the Brazilian Law 10438 already signed by the Brazilian President, is scheduled to be implemented in 2003. It will create opportunities for foreign investors which are planning to engage in the construction and operation of renewable energy based electric power generation facilities.

### *P.R. China: Bioenergy focus of the 10th Five-Year-Plan program*

On the occasion of the 2nd project workshop in South Africa, Prof. Wang Mengjie, China Association of Rural Energy Industry, pointed out the vast potential of biomass resources in China (straw: 720 million t/year; firewood: 127 million t/year; livestock waste: 130 t/year; urban waste: 120 million t/year) which up to date are not utilised in an efficient way [Wang (2002)]. The Chinese Government always emphasised the importance of the bioenergy, and the Ministry of Science and Technology regards the development of biomass utilisation technologies as key and preferable research projects. The focus of the current 10th Five-Year-Plan Program will therefore be on the solution of technological difficulties and the demonstration of applicable technologies, including biomass gasification and electricity generation systems, ethanol from cellulose wastes, ethanol from sweat sorghum juice and biomass fast pyrolysis.

In order to realise the ambitious goal to significantly increase the application of innovative bioenergy technologies, China is striving to obtain support from international organisations, foreign governments and scientists and shows strong interest in cooperation to promote technological progress. Within the framework of the LAMNET project close collaboration links are established with the Chinese LAMNET members from the Ministry of Agriculture and the Ministry of Science and Technology.

### *Colombia: National Alcohol Program for Colombian gasolines*

Recently, a promising initiative for the promotion of bioenergy was launched by the Colombian Government. The Congress of the Republic of Colombia on June 19th 2001 approved a new law, which mandates the use of bioethanol from sugar cane in Colombian gasoline and diesel fuel oil in order to improve the quality of these fuels and decrease emission levels. This law follows the example set by the Brazilian Proalcool programme (Figure 5) and it is an example to the world of how a congress of a developing country takes an advanced initiative to promote the use of renewable fuels for the development of a new agro-industrial industry leading to the creation of a significant number of new employments.

**Figure 5**: Bioethanol-gasoline blend sold at Brazilian gas station


The new law will allow private industry (national and international) to start production of bioethanol to be blended with gasoline (10% volume) in the year 2006, thereby saving 6 million tons of CO2 per year. The LAMNET member CORPODIB (Corporation for the Industrial Development of Biotechnology and Clean Technology) has been actively working in this project during the last seven years. It has elaborated the feasibility study and the implementation plan, and will follow the project during its implementation stage [Echeverri (2002)].

For the implementation of this National Alcohol Program in Colombia private investors are invited to participate in the production of fuel ethanol in an open market. In order to guarantee attractiveness for foreign investors the Colombian Government grants tax exemption for bio-ethanol, and the discount cash flow rate of return for investors is estimated to exceed 20 percent.

### *Costa Rica: Bioenergy focus of the National Plan for Development*

Within the framework of the LAMNET project the potential for ethanol production and utilization in Costa Rica was investigated. Due to the fact that the Costa Rican economy has been strongly affected by external shocks caused by the international oil market in the past, the Government is very interested in the exploitation of ethanol and other biofuels. The recent Costa Rican President Mandate in the National Plan for Development (2002-2006) includes the substitution of MTBE (methyl tertiary butyl ether) in gasoline by ethanol or similar options for the utilisation of biofuels.

For the implementation of this mandate, the public authorities have organized a group of representatives from the Ministry of Agriculture, RECOPE, the Ministry of Environment and mayor interest groups. Currently, the terms of reference for a pioneer study are being developed and the LAMNET member CINPE is joining the group as part of the University Academic Consortium [Vargas (2002)]. The mayor aim of this study is the quantification of the potential substitution of MTBE by bio-ethanol, as well as the investigation of the technical and economic implication of this substitution process.

### *Cuba: Energy Development Program – Cuban Ministry of Sugar*

The large energy potential of sugarcane biomass can be taken advantage of in Cuba as well as most of the Caribbean countries, if modern technologies are used for the production of electricity and alcohol. For this, a profound technological change is required affecting not only the sugar factories, but also agricultural and harvesting practices. The production of electric energy and alcohol from sugar cane can help to alleviate the dependence of Caribbean countries on imported oil and contribute to the mitigation of GHG emissions. But the persistent lack of funds in these developing countries proved to be an obstacle to the introduction of modern technologies until now. Therefore, a regional or local production of the required equipment is necessary in order to reduce the cost of the technological change.

When the Cuban Development Program for National Energy Sources was formulated in 1993, the importance of the Sugar Agroindustry for the development of the National Electroenergetic System (NES) has been analysed. Currently, the Cuban Observatory for Science and Technology, in partnership with the LAMNET members, Centre for World Economy Studies (CIEM) and the Cuban Ministry of sugar (MINAZ), is investigating the main implications concerned with the transformation of the Sugar agro-industry into a modern, flexible and more decentralized NES, which is able to satisfy Cuban electricity needs while avoiding or reducing GHG emissions. The study which is supported by the LAMNET project entails an analysis of technical, economical and social problems related to the introduction of the profound technological changes turning the sugarcane agro-industry into a reliable, competitive and environmentally friendly source of electricity and liquid fuel [Torres (2002)].

### *Senegal: Regional strategy for sustainable cooking fuels*

Traditional energies such as firewood, charcoal and agro-forestry residues dominate the national energy balance in the Sahelian countries. Thereby, wood is mainly used in rural areas whereas charcoal and petroleum are almost exclusively used in urban areas [Fall (2002)]. Today, this non-sustainable energy supply poses serious threats to forest ecosystems as well as to the food supply for the Sahelian population.

Within the LAMNET project it is envisaged to establish cooperation schemes between scientists, decision makers and entrepreneurs from Sahelian and OECD countries in the field of bioenergy applications in order to alleviate major health, social and environmental problems currently afflicting the region such as the deforestation of vast areas of the land and respiratory diseases due to indoor charcoal use.

### *Republic of South Africa: White Paper on Renewable Energy and Clean Energy Development*

Honourable Narend Singh, KwaZulu-Natal Minister of Agriculture and Environmental Affairs, acknowledged the role of the 2nd LAMNET workshop as an input to the United Nations World Summit on Sustainable Development in Johannesburg intending to turn the world away from a self-destructive course in which the economic and other activities of humankind threaten to deplete the natural resources and destroy the basis of human existence. He stated that South Africa represents a microcosm of the challenges to be addressed by the WSSD, as it is unique in having a developed industrial economy, with all its challenges of sustainability caused by over-consumption of vast quantities of the planet's natural resources such as oil, gas, timber and metals, virtually side by side with an under–developed rural economy with all the evils of erosion, contamination of water resources, destruction of natural foliage, over-stocking and exhaustion of the soil's fertility through unscientific cropping.

For sustainable development a balance is required between environmental/conservation, economic and social interests adjusted appropriately to suit every particular circumstance, and it is generally the role of Government to serve as a catalyst and regulator, in partnership with the private sector wherever possible. With respect to the supply of green energy in the province of KwaZulu-Natal Honourable Singh pointed out the opportunity provided by the sugar and timber industry as well as the production of alcohol fuel and bio-diesel from biomass resources such as sugar cane, sunflower seeds and the Jatropha plant. In conclusion, he stated that the near future may well be bright for energy from biomass as the demand in South Africa will exceed electricity generation capacity within three to five years, and decisions will have to be made about new generation, while a White Paper on Renewable Energy and Clean Energy Development requires a five percent increase in the use of Green Electricity by 2012.

This White Paper supplements the Government's policy on energy which pledges 'Government support for the development, demonstration and implementation of renewable energy sources for both small and large-scale applications'. The White Paper sets out the Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa.

The 10-year target for renewable energy laid out in the South African White Paper aims at 'An additional 10 000 GWh renewable energy contribution to final energy consumption by 2012, to be produced mainly by biomass, wind, solar and small hydro'. The South African authorities acknowledge that the financial resources for the realisation of this ambitious target will have to come from a combination of South African and international resources. International co-operation, technology transfer and joint-ventures are therefore strongly encouraged by the South African Government.

## 5. Conclusions

Within the framework of the global bioenergy network LAMNET a variety of opportunities for international co-operation, technology transfer and joint-ventures between OECD and non-OECD countries have been identified in the field of bioenergy technologies. These opportunities include the application of innovative bioenergy technologies (i.e. biomass pelleting, biomass integrated gasification combined cycle, ethanol production from alternative sources, fast pyrolysis and bio-ethanol based fuel cells) in the Brazilian, South African and Cuban sugar cane industry as well as for rural development in the P.R. of China. Additionally, the long-term experience of the Brazilian network members in the field of ethanol production and infrastructure can be exploited to achieve the goals of an action plan recently adopted by the European Commission aiming at a 20% substitution of diesel and gasoline by alternative fuels in the European road sector by 2020.
Further opportunities for co-operation activities between OECD countries and countries from Latin America and Africa in the field of bioenergy are identified by the LAMNET project through the direct involvement of LAMNET members in the development of national energy policy frameworks as well as the preparation and set-up of bioenergy policy programmes and initiatives. Recent programmes to promote the sustainable use of bioenergy are implemented in Brazil (PROINFA programme), Colombia (National Alcohol Programme), Costa Rica (National Plan for Development), Cuba (Energy Development Program), the Republic of South Africa (White Paper on Renewable Energy and Clean Energy Development) and the P.R of China (Bioenergy focus of the 10th Five-Year-Plan).

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## Acknowledgements

The project Latin America Thematic Network on Bioenergy (LAMNET) is funded by the European Commission in the framework of the specific research and technological development programme ‘Confirming the International Role of Community Research’ under the contract ICA4-CT-2001-10106.

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