International Seminar on Bioenergy & Sustainable Rural Development

Casa de Gobierno
Paseo de la República 1500 Col. Oviedo Mota

Morelia, México
26-28 June 2003

SEMINAR PROCEEDINGS (Excerpt)

ANES

The International Seminar of Bioenergy and Sustainable Rural Development was held in Morelia, Mexico, from June 26 to 28 2003. It was organized jointly by the Latin American Thematic Network on Bioenergy (LAMNET), the Center for Ecosystem Research (CIECO) from the National Autonomous University of Mexico, the Food and Agriculture Organization of the United Nations (FAO), the National Association for Solar Energy (ANES) and the State Government of Michoacan, Mexico.

LAMNET - Latin America Thematic Network on Bioenergy
Coordination: WIP, Germany
Coordinator/ focal contact point:
Dr. Rainer Janssen (rainer.janssen@wip-munich.de)

Updated information on this workshop is available at http://www.bioenergy-lamnet.org, http://bioenergia.oikos.unam.mx and http://www.anes.org.

Workshop Organisation Support

Lic. Claudia Sánchez, Center for Ecosystem Research (CIECO), UNAM, México

M.S. Laura Hernández, Center for Ecosystem Research (CIECO), UNAM, México

Biol. Alan S. Cervantes, Center for Ecosystem Research (CIECO), UNAM, México

Biol. Adrián Ghilardi, Center for Ecosystem Research (CIECO), UNAM, México

Rodolfo Díaz, Center for Ecosystem Research (CIECO), UNAM, México

Dr. Javier Aguillón, Instituto de Ingeniería, UNAM, México

M. Arq. Ana Rosa Velasco, National Association for Solar Energy (ANES), México

Ing. Francesco Cariello, ETA-Florence, Italy

Dr. Giuliano Grassi, European Biomass Industry Association – EUBIA

Ing. Anton Hofer, WIP-Munich, Germany

Dr. Peter Helm, WIP-Munich, Germany

Editor of Workshop Proceedings

Dr. Rainer Janssen, WIP, Germany

Dr. Omar Masera, Center for Ecosystem Research (CIECO), UNAM, México

Dr. Eduardo Rincon, National Association for Solar Energy (ANES), México

Dr. Gustavo Best, Food and Agriculture Organization of the United Nations (FAO)

Published by: WIP-Munich
Sylvensteinstr. 2
81369 Munich, Germany
Phone: +49 89 720 127 35
Fax: +49 89 720 127 91
E-mail: wip@wip-munich.de
Web: www.wip-munich.de

WORKING GROUP 3: GASIFICATION

International Seminar on Bioenergy and Sustainable Rural Development
- 5th LAMNET Project Workshop – Mexico 2003

DEVELOPMENT OF BIOMASS CONVERSION TECHNOLOGY AND INDUSTRY IN CHINA (ANNUAL REPORT 2002)

Prof. Wang Mengjie
Committe of Biomass Energy Conversion Technology
China Association of Rural Energy Industry (CAREI)
N° 11, Nongzhanguan Nanli, 100026 Beijing, China
Email: taitd@x263.net

Nowadays, development and utilization of renewable energy resources has good opportunities. Chinese Ministry of Agriculture (MOA) is promoting the "energy agriculture" policy, which focuses on biomass resources development.

Biomass resource in China is characterized by many variety, huge quantity and wide distribution. In terms of technological feasibility and economics, biomass that can be used for energy purposes is divided into 5 types: energy crops, agricultural straw, agricultural residue, forestry residue, human and livestock waste, industrial organic waste water, and urban organic waste. In China, biomass is the major source of household fuel for rural people with a long history. With the urbanization of rural area, intensivelization of agricultural production, and modernization of farmers' lives, because of its "renewability" and the development towards scaled, efficient, and clean utilization technology, biomass must play an important role in meeting energy demand, environmental protection and sustainable development.

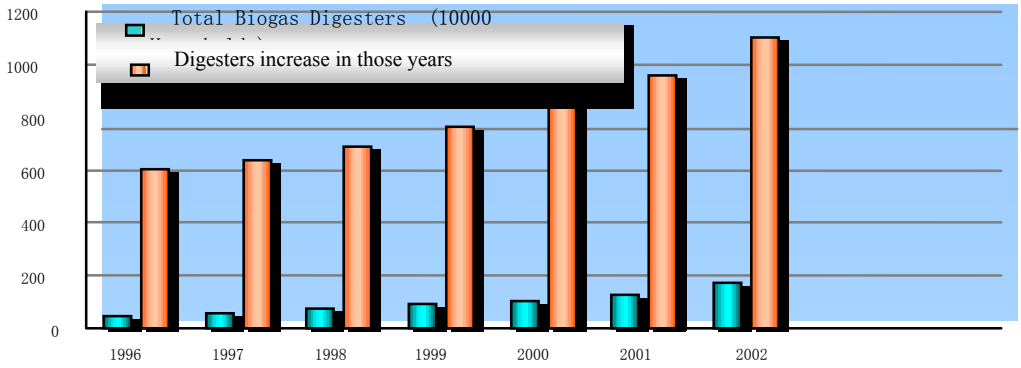
Presently, technologies on biomass conversion widely used in China include: biogas, straw gasification and central supply, gasification and electricity generation, direct combustion for heating, briquetting, and bio-fuel, etc.

1. Biogas industry plays an important role in rural energy and environment construction in China

1.1 Biogas industry develops into a new stage

In 2002, the central government invested 410 million RMB Yuan on rural energy construction. Local investment on rural energy also increased, more than 10 provices, such as Hebei, Liaoning, Hunan, Guangxi, Hainan, and Yunan, provided special fund for biogas dissemination. The total amount of local investment on small commonweal projects was 180 million RMB Yuan. In 2002, 1.7 million households became new biogas users, and there were 11 million biogas digesters in China, increased by 45.4% since 1999 (see figure 1). In 2002, there were 1859 large- and medium-scale biogas plants, which is purposed on treating wastes from large livestock farms, increasing 5000 compared with 2001. The total capacity was 870,000 m^3, which produced biogas of 230 million m^3 and treated 46.56 million tons of waste water per year. 15,000 biogas digesters for household waste water treatment were built in 2002(estimated), adding up to 111,000 in China. The total capacity was 4.34 million m^3, which treated 360 million tons of waste water per year.

Figure 1: Installed Biogas Digesters in China (1996 – 2002)



1.2 New features and trend of biogas industry

Currently, biogas industry comprises of design and construction, biogas appliance production and supply, and after service. The production capability can meet the demand of construction of 300 large- and medium-scale biogas plants and 1.5 million biogas digesters and accessories.

- Strategy of "leading enterprises and brand products" has made good achievement.

  Jiangxi Provincial center for Rural Energy and Environmental Protection Technology Development and its instrument factory increased their sales by 50% in 2002, and became the enterprise in the field with the widest market coverage. With its advantage on capital, technology, and management, Beijing Hebaiyi Ecological Energy Science and Technology Develop Company was named the only □□enterprise for household biogas digester accessories by the Ministry of Agriculture. The largest gas apparatus enterprise in China, Zhongshan Huadi Gas Apparatus Company setup the Department of Biogas Apparatus Development. Because of its advantage on capital and technology, the company rapidly developed biogas stoves and accessories with good performance/price ratio.

- The product is upgraded and quality improved

  Based on its advantage on research, production, and technology, Luohe Yuli Instrument Company selected biogas barometer as its new point and developed metal membrane barometer. Jiangxi Provincial center for Rural Energy and Environmental Protection Technology Development produced erosion-proof biogas transmission component. Beijing Hebaiyi Ecological Energy Science and Technology Develop Company developed adjustable cleaners that combines dehydrate, desulfate, pressure control, and pressure display together. Most of the enterprises that manufacture biogas stoves were paying attention to the product quality, design of stove structure, and improvement of product appearance.

- Technics and engineering technology is improved

  Construction of household biogas digesters has been industrialized and commercialized. Researches on large- and medium-scale biogas plant, equipment and post-treatment technology has made new achievement. Tsinghua University developed the 3-generation anaerobic fermentation techniques: ECSB and internal circulation reactor.

ECSB has been practically used in China, and reached the world leading level. Institute of Biogas Science of Ministry of Agriculture, Shanghai Mingxing Energy conservation and Environmental Protection Engineering Company, Hangzhou Energy and Environment Engineering Company, Beijing Academy of Environmental Protection, Center for Energy and Environmental Protection Technology Development of Ministry of Agriculture, Department of Environmental Science and Engineering of Tsinghua University, and Beijing Meihuaboda Environmental Engineering Company are capable to design large- and medium-scale biogas plants. Besides, research and development of biogas generators also made good achievement.

- Level and capability of after service are improved incessantly

Government bidding and purchase has promote the enterprise cooperation and the industry development, and therefore guarantee users' rights. Some strong enterprises catch the good opportunity to establish and perfect their own sale and after service system while supply biogas stoves into the market, which has dramatically improved the level of after service. In the process of promoting industrialized management of household biogas digesters, some new management patterns such as township biogas association were created.

- System of biogas industry standards is improved

Improvement of system of biogas standards has basically met the demand of development of biogas construction. Standards for Design, Construction, and Use of North Model of Household Rural Energy Engineering, Standards for Design, Construction, and Use of South Model of Household Rural Energy Engineering, and the National Standards for Household Biogas Stoves GB3606-83, which fully reflect the upgrade of biogas stove technology, have been issued and implemented. Other relevant standards are to be issued or being worked. Institute of Biogas Science of Ministry of Agriculture and Center for Biogas Product and Equipment Quality Test of Ministry of Agriculture have been doing a lot of work on the formulation, modification, and extension of biogas-related standards.

1.3 Planning of Biogas Construction Development provided good opportunities to biogas industry development

The 2003-2010 Biogas Construction Plan in Rural Area of China, formulated by the Ministry of Agriculture, clearly stated that the government will actively promote the development of biogas industrialization, which provided excellent opportunities to the industry development. According to the plan, 11 million household biogas digesters will be constructed by the end of 2005, and then there will be totally 20 million in China: 1/10 of rural households will be biogas users. In 2010, 50 million rural households (20% of the total) will use biogas as daily fuel. Meanwhile, the government will support the construction of large- and medium-scale biogas plant in "vegetable basket" livestock feeding base in the suburbs of cities in East coastal area and some other large and medium cities. 2500 biogas plants are to be constructed by 2005, which can supply biogas to 300,000 households; 5000 in 2006-2010, supplying 600,000 households. Implementation of such a great plan will strongly promote the progress of biogas technology and enable the biogas industry go to a new stage.

2. Biomass technology made good progress

2.1 Framework of standard system has been established, and relevant standards are gradually formulated

Biomass resource here mainly refers to crop straw. From the view of current situation of biomass utilization in China, some of the biomass technology has not been mature enough to be widely applied. The technical limitation and management problem are serious for them to be applied in large scale. Further experiments are necessary to decrease conversion cost and improve the quality of products. At present, a framework of standardization system has been established. Perfection of industrial standards ensures the biomass utilization to develop in order.

2.2 Products variety is diversified and technology advanced

With the urbanization of rural area, intensivation of agricultural production, and modernization of farmers' lives, because of its "renewability" and the development towards scaled, efficient, and clean utilization technology, biomass must play an important role in meeting energy demand, environmental protection and sustainable development. Presently, technologies on biomass conversion widely used in China include: biogas, straw gasification and central supply, gasification and electricity generation, direct combustion for heating, briquette for fuel, and bio-fuel, etc.

The existing village-level straw gasification and central supply plants can normally supply fuel gas to 100~1,000 households. The thermal conversion efficiency is more than 70%, the thermal value of fuel gas more than 4600kJ/Nm^3, and CO and O_2 content is less than 20% and 1%, respectively. Compared with old straw gasification system, the new ones have better performance, especially for carbonization gasification systems, and operation is more steady. However, the problems of low thermal value and high tar treatment cost are still existing.

China is researching and developing two types of biomass gasification system for electricity generation: fixed bed gasification and electricity generation system, and fluidized bed gasification and electricity generation system.

Biomass direct combustion is used for heating and drying. As a effective approach to consume large amount of crop straw, this method has promising prospect.

The prominent problem of biomass briquetting machine is that the press screw and sleeve do not have enough long life.

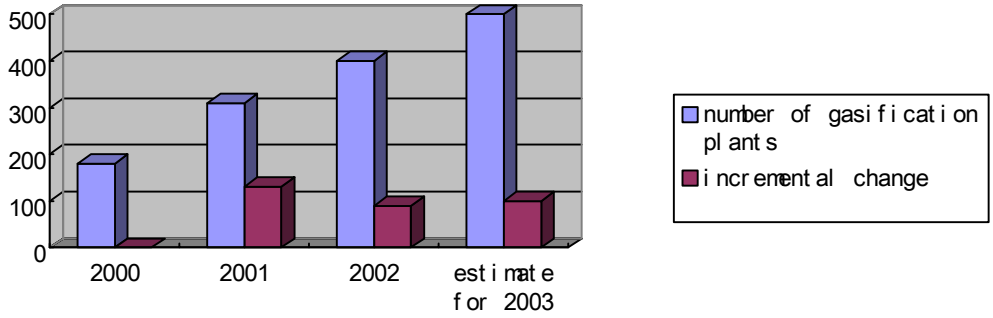
Technology on biological liquid fuel from biomass is now a research project funded by the State Planning Commission and Ministry of Science and Technology.

2.3 Industrialization process is seeking turning point

In recent years, industrialization of biomass conversion technology in China made a good achievement, and some enterprises and research organization able to conduct technology development, equipment production, and plant construction occurred. The involved fields are: biological liquid fuel from biomass, biomass gasification, biomass briquetting and fuel gas drying, biomass direct combustion boiler, etc. In particular, companies in the field of biomass gasification equipment production and technological service developed very fast, and industrialization and socialization of small-scale biomass boiler has achieved good progress.

By the end of 2002, there were more than 400 biomass gasification and central supply plants in China, which produced 150 million m^3 of fuel gas per year and involved equip manufacturing output of 900 million RMB yuan (Figure 2). There are more than 40 companies and research institutions able to undertake the design and construction of crop straw gasification and central supply plants in China. There are 15 biomass gasification and electricity generation plants in operation. 5 organizations are able to design and construct biomass gasification and electricity generation plants. Among them, Guangzhou Energy Institute of Chinese Academy of Science is the best.

Figure 2: Installed Gasification Plants in China (2000 – 2003)



Biological liquid fuel mainly refers to bio-ethanol. China has issued national standards: *Denaturalized Fuel Ethanol* and *Vehicle Ethanol Gasoline*. The State Planning Commission has approved 4 demonstrative projects, in Heilongjiang Province (200,000 tons per year), Jilin Province (600,000 tons per year), Henan Province (300,000 tons per year), and Anhui Province (60,000 tons per year), respectively. These projects produce fuel ethanol from old grain, and petroleum industry use the ethanol to produce vehicle ethanol gasoline and sell in local gas station.

Trend of Gasification Plant Development in China

Chinese Academy of Agriculture Engineering and Beijing Taitiandi Energy Technology Development Company are undertaking a National 863 Project “Fuel Ethanol from Sweat Sorghum”. The technology uses sweat sorghum as raw material and produce fuel ethanol through biological conversion technology. The project is established on the base of biomass conversion technology, agricultural residue recycling technology, and ETBE (non-pollution ethanol gasoline additive) conversion and synthesis technology. Straw briquetting machine developed by Henan Agriculture University has been manufactured in certain scale. Beijing Laowan Biomas Science Company has developed efficient biomass grain fuel automatic combustor and a series of stoves, characterized by high efficiency and environmental protection.

Development of renewable energy technology and industry in China has made good achievement under the help of international organizations such as UNDP, FAO, UNIDO, ESCAP, WORLD BANK and cooperation with other countries. We are willing to carry out better and more effective cooperation with Latin countries to serve the whole world.

LAMNET Project Coordination

WIP
Sylvensteinstr. 2
81369 Munich
Germany
Coordinator: **Dr. Rainer Janssen**
Phone: +49 89 720 12 743
Fax: +49 89 720 12 791
E-mail: rainer.janssen@wip-munich.de
Web: www.wip-munich.de

LAMNET Coordination Partner

ETA – Energia Trasporti Agricoltura
Piazza Savonarola, 10
50132 Florence
Italy
Contact: **Ms. Angela Grassi**
Phone: +39 055 500 2174
Fax: +39 055 573 425
E-mail: angela.grassi@etaflorence.it
Web: www.etaflorence.it

LAMNET Coordination Partner

EUBIA – European Biomass Industry Association
Rond Point Schuman, 6
1040 Brussels
Belgium
Contact: **Dr. Giuliano Grassi**
Phone: +32 2 28 28 420
Fax: +32 2 28 28 424
E-mail: eubia@eubia.org
Web: www.eubia.org

LAMNET Coordination Support Point South America

CENBIO – Centro National de Referência em Biomassa
Avenida Prof. Luciano Gualberto 1289
05508-900 São Paulo
Brazil
Contact: **Prof. Dr. José Roberto Moreira**
Phone: +55 115 531 1844
Fax: +55 115 535 3077
E-mail: Bun2@tsp.com.br
Web: www.cenbio.org.br

LAMNET Coordination Support Point Central America

Universidad Nacional Autónoma de México
Instituto de Ecología
AP 27-3 Xangari
58089 Morelia, Michoacán, México
Contact: **Dr. Omar Masera**
Phone: +52 55 5623 2709
Fax: +52 55 5623 2719
E-mail: omasera@oikos.unam.mx
Web: www.oikos.unam.mx

Steering Committee

Contact: **Dr. Peter Helm**
E-mail: peter.helm@wip-munich.de

This Thematic Network is funded by the European Commission, DG Research, (Project No. ICA4-CT-2001-10106).