

The Present Status and Prospect of Rural Energy in China

Hao Xianrong

The Division of Energy and Ecology,
The Department of Science, Education and Rural
Environment
Ministry of Agriculture, P. R. China

Feb.10,2010 Geneva

Outline

- The Present Status
- The Achievements
- The Current Problems
- The Prospects

I. The Present Status

- Policies, laws and regulations have been initially established
- The management system has increasingly improved
- The standard system has gradually taken shape
- There has been a remarkable increase in capital input
- International cooperation has been conducted widely

(i) Policies, laws and regulations have been initially established

- The Law in China have also made clear provisions on the development of rural energy.
 - *The Law on Renewable Energy*
 - *The Law on Energy Conservation*
 - *The Law on Agriculture*

Local Regulations

- "Hebei Provincial Management Regulation of New Energy Development and Utilization " (Apr 25,1997)
- "Gansu Provincial Construction and Management Regulation of Rural Energy" (Sep 28,1998)
- "Anhui Provincial Construction and Management Regulation of Rural Energy" (Oct 1,1998)
- "Hubei Provincial Management Method of Rural Energy"(Dec 16,1998)
- "Guangxi Zhuang Autonomous Regional Construction and Management Regulation of Rural Energy"(May 11,2001)
- "Sichuan Provincial Construction and Management Method of Rural Energy"(Jun 24,2002)
- "Zhejiang Provincial Promotion Method of Biogas Development and Utilization"(Feb 8,2005)
- "Hunan Provincial Regulation of Rural Renewable energy"(Mar 1,2006)
- "Shandong Provincial Regulation of Rural Renewable Energy"
- "Heilongjiang Provincial Development and Utilization Regulation of Rural Renewable Energy"(Mar 1,2008)

(ii). The management system has increasingly improved

- Rural energy management, extension and service systems have been established and improved throughout the whole country. Currently, there have been relatively complete management and extension, research and development, training and quality inspection systems across the whole country with 38,000 professional staffs, and 235,000 farmer technicians have been trained. This will serve as an ideal basis for our work.



(iii). The standard system has gradually taken shape

- The standard system of rural energy has constantly improved through strengthening foundation studies and constant technical innovations.
- There have been 105 standards subject to the management of the Ministry of Agriculture.

Establishment and Revise of Standards

- 105 items of standards have been established, 77 items promulgated
- 45 items related to biogas, 31 items promulgated
- 15 items related to biomass energy, 6 items promulgated
- 14 items related to solar energy, 13 items promulgated
- 10 items related to Conservation of firewood and coal, 10 items promulgated
- 9 items related to micro hydraulic engineering, 9 items promulgated
- 6 items related to small scaled wind electricity, 2 items promulgated
- 6 items related to new style liquid fuel, 5 items promulgated
- 1 item related to terminology

Some National and Industrial Standards on Household Biogas Digesters

- GB/T 3606-2001 Domestic biogas stove
- GB/T 4750-2002 The collection of designs for household hydraulic biogas digesters in rural areas
- GB/T 4751-2002 The standard for check and acceptance of the quality for household hydraulic biogas digesters in rural areas
- GB/T 4752-2002 The operation rules for construction of household hydraulic biogas digesters in rural areas
- GB 7636—87 Standard on design of distribution systems for household biogas digesters
- NY/T 90-1988 Technology rules of biogas fermentation for household in rural areas
- NY/T 344-1998 Household biogas lamp
- NY/T 465-2001 Household-scaled biogas & integrated farming system--Specification on design, construction and use for southern model
- NY/T 466-2001 Household-scaled biogas & integrated farming system--Specification on design, construction and use for northern model
- NY/T 858-2004 Biogas pressure meter
- NY/T 859-2004 Desulfurizer of household biogas
- NY/T 860-2004 Sealing coatings of household biogas digesters
- NY/T 1496.1-2007 Biogas transmission system for rural household-Part 1: Thermoplastics pipes
- NY/T 1496.2-2007 Biogas transmission system for rural household---Part 2: Thermoplastics pipe fittings
- NY/T 1496.3-2007 Biogas transmission system for rural household Part 3 : Thermoplastics valves

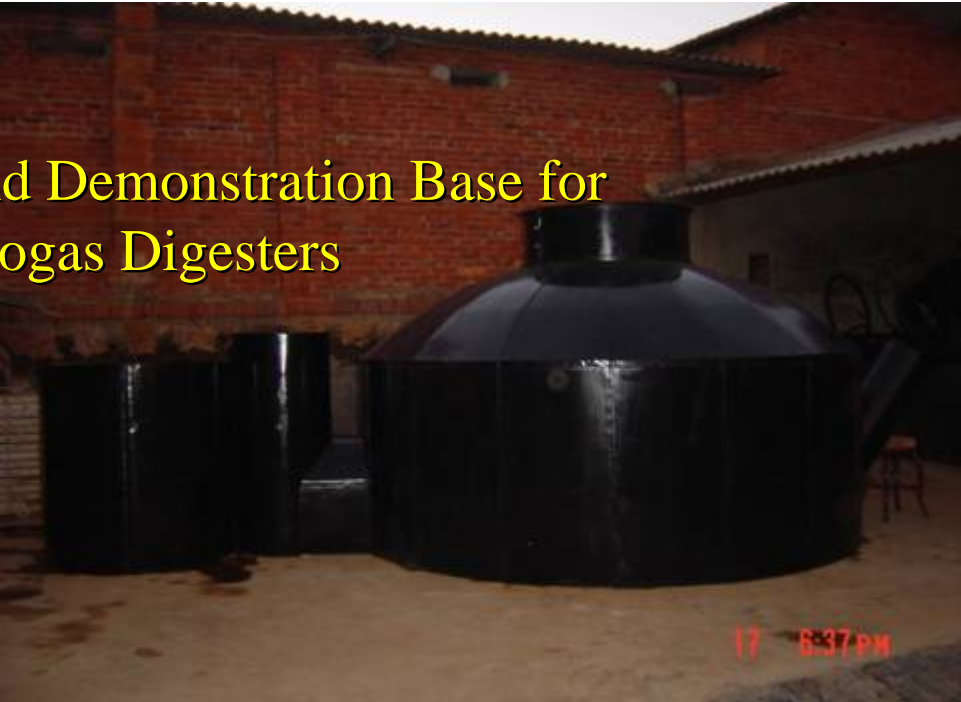
Some Industrial Standards on Biogas Engineering

- NY/T 667-2003 Classification of scale for biogas engineering
- NY/T 1220.1-2006 Technical code for biogas engineering Part 1:Process design
- NY/T 1220.2-2006 Technical code for biogas engineering Part 2:Design of biogas supply
- NY/T 1220.3-2006 Technical code for biogas engineering Part 3:Construction and acceptance
- NY/T 1220.4-2006 Technical code for biogas engineering Part 4: Operation and maintenance
- NY/T 1220.5-2006 Technical code for biogas engineering Part 5: Evaluation of quality
- NY/T 1221-2006 Technical specification for operation maintenance and safety of biogas plant in scale animal and poultry farms
- NY/T 1222-2006 Criteria for designing of biogas plant in scale livestock and poultry breeding Farms
- NY/T 1223-2006 Biogas-powered generating sets
- NY/T XXX-XXXX Criteria for designing of biogas plants for purification of urban domestic sewage (draft for approval)

Some Industrial Standards on Bioenergy

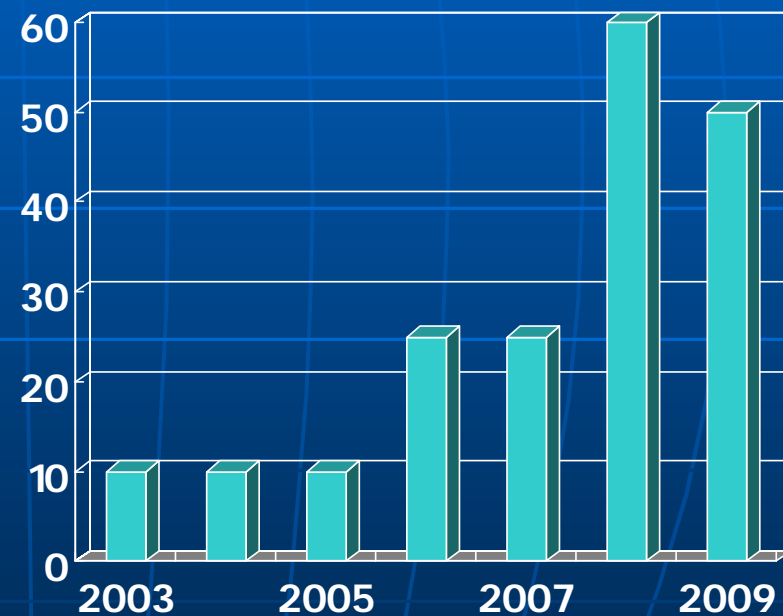
- NY/T 12-1985 Test Method for Heat Quantity of Biomass Fuels [being revised]
- NY/T 443-2001 Technical Condition and Acceptance Check Criterion for Gas Supply System Using Straw Gasification [being revised]
- NY/T 1017-2006 Test Method for Straw Gasification Device and System
- NY/T 1701-2009 Technical Code for Research and Evaluation of Crop Straw Resource
- NYJ/T 09-2005 Construction Standard for Centralized Supply Station Using Biomass Gasification
- 04144 Stove using Straw[draft for approval]
- 2006-31 Technical Condition for Pelletized Fuels Using Biomass[draft for approval]
- 2006-32 Technical Condition for Pelletizing Equipment Using Biomass[draft for approval]
- 2008 Test Method for Thermal Property and Soot Emission of Household Biomass Stoves [being formed]
- 2009-174 Terminology of Biomass Briquette Fuels[being formed]
- Technical Condition and Construction Code for fire pits
- Test Method for Biomass Briquette Fuel Processing Equipment [being formed]
- Sampling Method for Biomass Briquette Fuels[being formed]
- Sample Preparation Method for Biomass Briquette Fuels[being formed]
- Test Method for Biomass Briquette Fuels[being formed]

Standardized Training and Demonstration Base for Household Biogas Digesters



(iv). There has been a remarkable increase in capital input

- ✓ Input during the Ninth Five-year Plan period totaled RMB 55.41 million Yuan
- ✓ Input during the Tenth Five-year Plan period totaled RMB 3.534 billion Yuan
- ✓ Input since 2006 has reached RMB 16 billion Yuan
- Input in 2006 was RMB 2.5 billion Yuan
- Input in 2007 was RMB 2.5 billion Yuan
- Input in 2008 was RMB 6 billion Yuan
- Input in 2009 will be RMB 5 billion Yuan



(v) International cooperation has been conducted widely

- China has been strongly promoting multi-level and all-round opening-up, and also actively promoting bilateral and multilateral technical cooperation. China MOA has conducted fruitful cooperation with UNDP, UNESCAP, GEF, WEC, ADB, WB, EU, ASEAN and a number of other international organizations, and the Netherlands, the US, Germany, the UK and other countries.

Key International Cooperation Projects

- China-Netherlands Cooperation Project of Promoting West China Comprehensive Development and Utilization of Rural Renewable Energies (2003-2007) has been implemented in 14 villages of Gansu, Sichuan, Hubei and Hunan Provinces with 5.3 million Euros of Netherlands government
- Phase I of ADB Loan Project of Household Biogas (2003-2008) has been implemented in Shanxi, Henan, Hubei and Jiangxi Provinces with USD 33.121 million of ADB loan.
- Phase II of ADB Loan Project of Medium & Large Scaled Biogas Engineering is scheduled to start in 5 provinces in 2010 with USD 80 million of ADB loan.
- The World Bank Loan Project of China New Rural Eco-homestead has provided USD 100 million of loan to Guangxi, Yunan, Anhui and Chongqing.

2008 International Seminar on Rural Biomass Energy jointly organized by ADB and Chinese MOA



Established a cooperation mechanism of ASEAN Plus Three Forum on Biomass Energy



减少水体污染及缓解气候变化 牲畜废物管理东亚项目经验国际研讨会

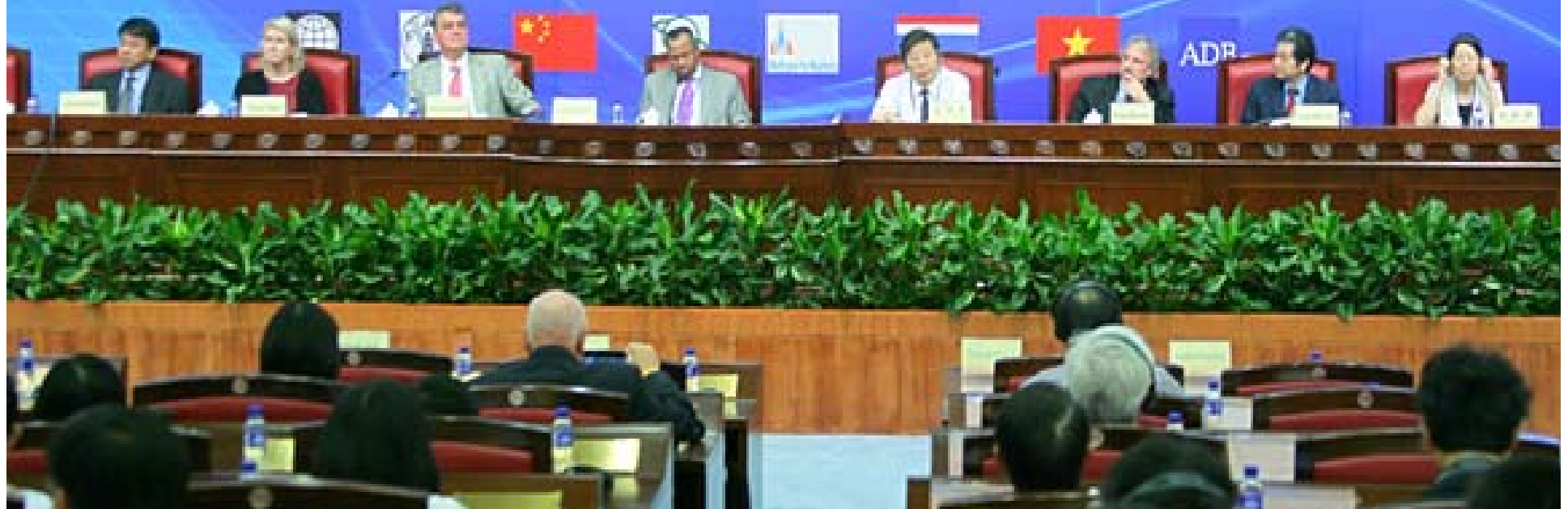
International Conference on Water Pollution Reduction and Climate Change Mitigation
Experience from Livestock Waste Management in East Asia Project

主办单位: 世界银行 联合国粮农组织 中国农业部 全球环境基金 亚洲市场化组织
泰国农业部 越南自然资源与环境部 亚洲开发银行 广东省人民政府

Sponsored by: World Bank, Food and Agriculture Organization (FAO), China (MOA),
Global Environmental Facility (GEF), Market to Markets (M2M),
Thailand (MOAC), Vietnam (MONRE), Asian Development Bank (ADB),
People's Government of Guangdong Province, P.R.China

承办单位: 广东省农业厅 广东省财政厅
广东省环境保护厅 广东省卫生计生厅

Organized by: Department of Agriculture of Guangdong Province, P.R.China
Department of Finance of Guangdong Province, P.R.China
Department of Environmental Protection of Guangdong Province, P.R.China
Department of Health of Guangdong Province, P.R.China



II、 The achievements

- For the past over 30 years, the Ministry of Agriculture has focused on the comprehensive development and conservation of rural energies with the priority of biogas, biomass energy and solar energy. Each year, an energy amount equivalent to 103 million tons of standard coal is saved, CO₂ emission is cut by 240 million tons, and COD emission is cut by 760,000 tons.

i. Rural biogas has maintained healthy and steady development

- Through years of construction and development, rural biogas development has entered a new stage characterized by equal attention on construction and management and pluralistic development. By far, remarkable achievements have been attained: the quantity of rural biogas construction keeps increasing, the investment structure keeps optimizing, the service systems are gradually improved, the functions of biogas are being further expanded, the biogas industry is developing quickly.

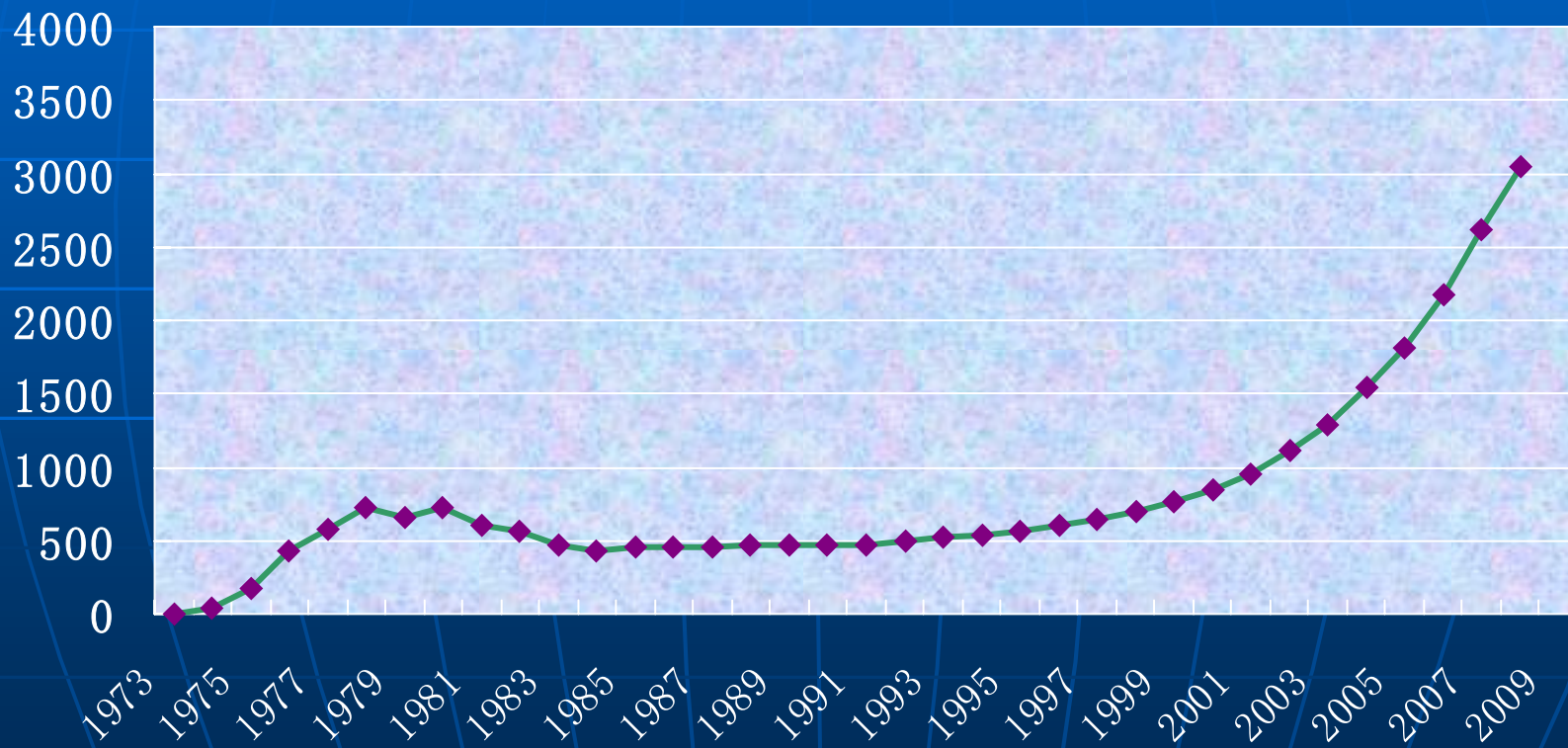
i. Rural biogas has maintained healthy and steady development (cont'd)

- In recent years, China has published a series of guiding documents promoting the development of rural biogas. In particular, since the end of 2008, rural biogas has been included in the national package plan addressing the international financial crisis, expanding domestic demand and reviving the economy.

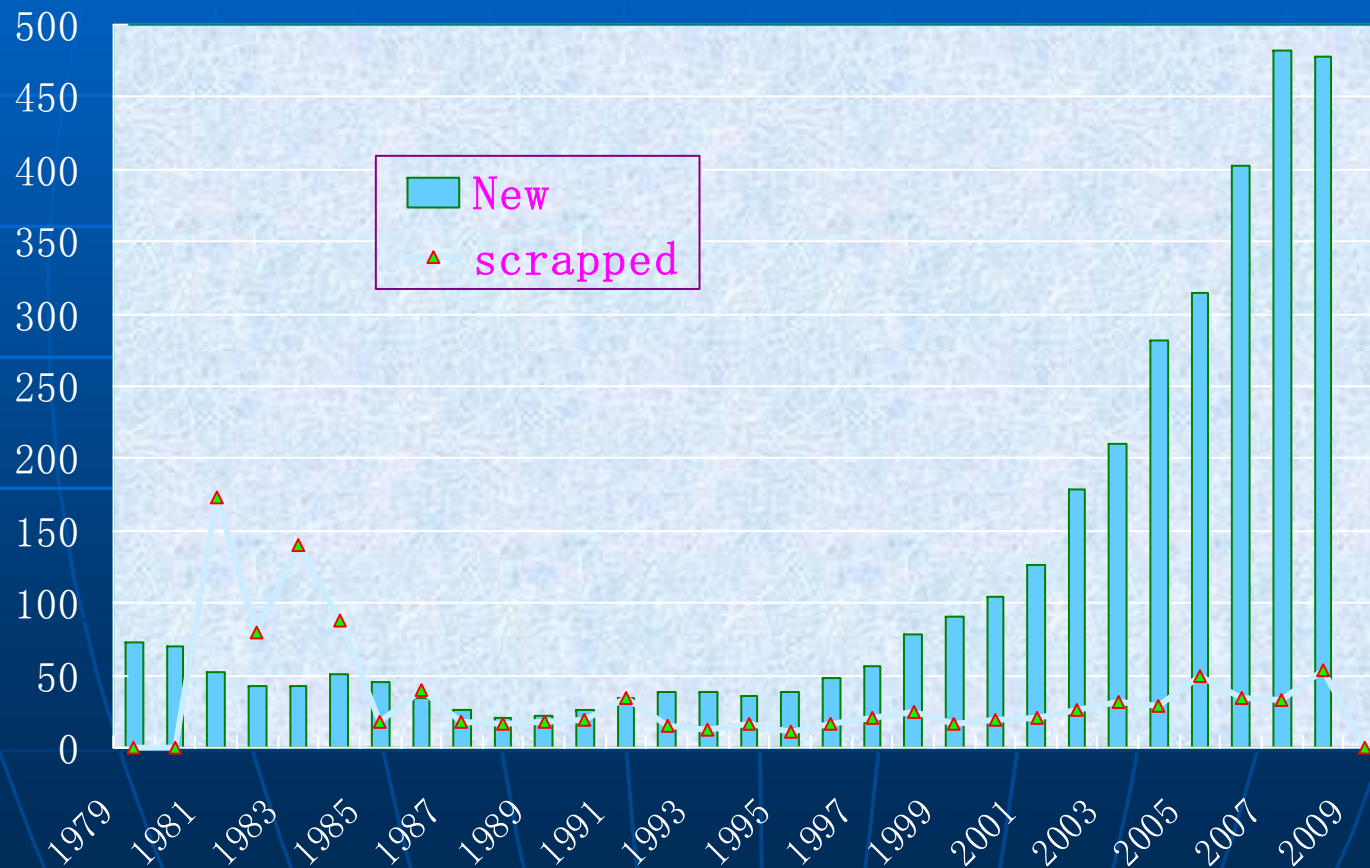
i. Rural biogas has maintained healthy and steady development (cont'd)

- By the end of 2008, there has been 30.5 million household biogas tanks and 39.5 thousands biogas projects in China. Among them:
 - 2761 large-scale biogas projects (capacity of over 300m³ per single device)
 - 12,900 medium-scale biogas projects (capacity of 50-300m³ per single device)
 - 23,900 small-scale biogas projects (capacity of over 20-50m³ per single device)

Historical Development of Household Biogas



Comparison between New Users and scrapped of Household Biogas





The Energy Ecological Modes linked by household biogas

- ✓ “Three in One” Energy Ecological Mode
- ✓ “Four in One ” Energy Ecological Mode
- ✓ “Five in One” Energy Ecological Mode

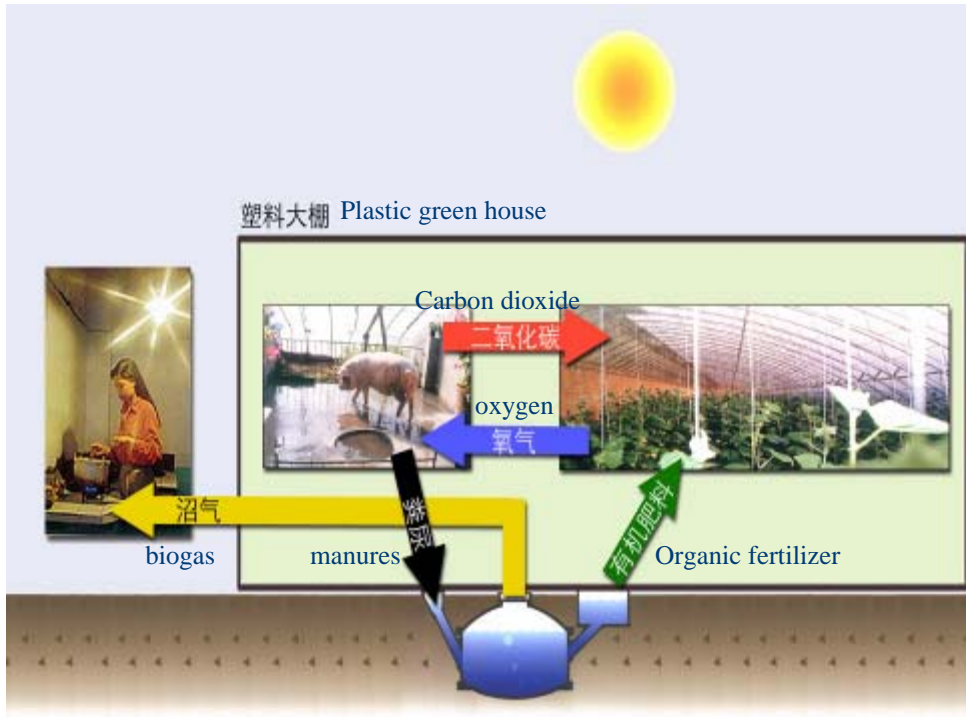
The “Three in One ” Energy Ecological Mode in the South

- The users need to make use of nearby conditions such as highland, water, and courtyard, build livestock and poultry houses, biogas tanks, and orchards, and integrate the construction of biogas tanks with that of pigsty and toilets, which will make up of a courtyard economic system linking breeding, biogas, and planting. This mode is aimed to form benign ecological cycles and increase the peasants’ income.



The “Four in One” Energy Ecological Mode in the North

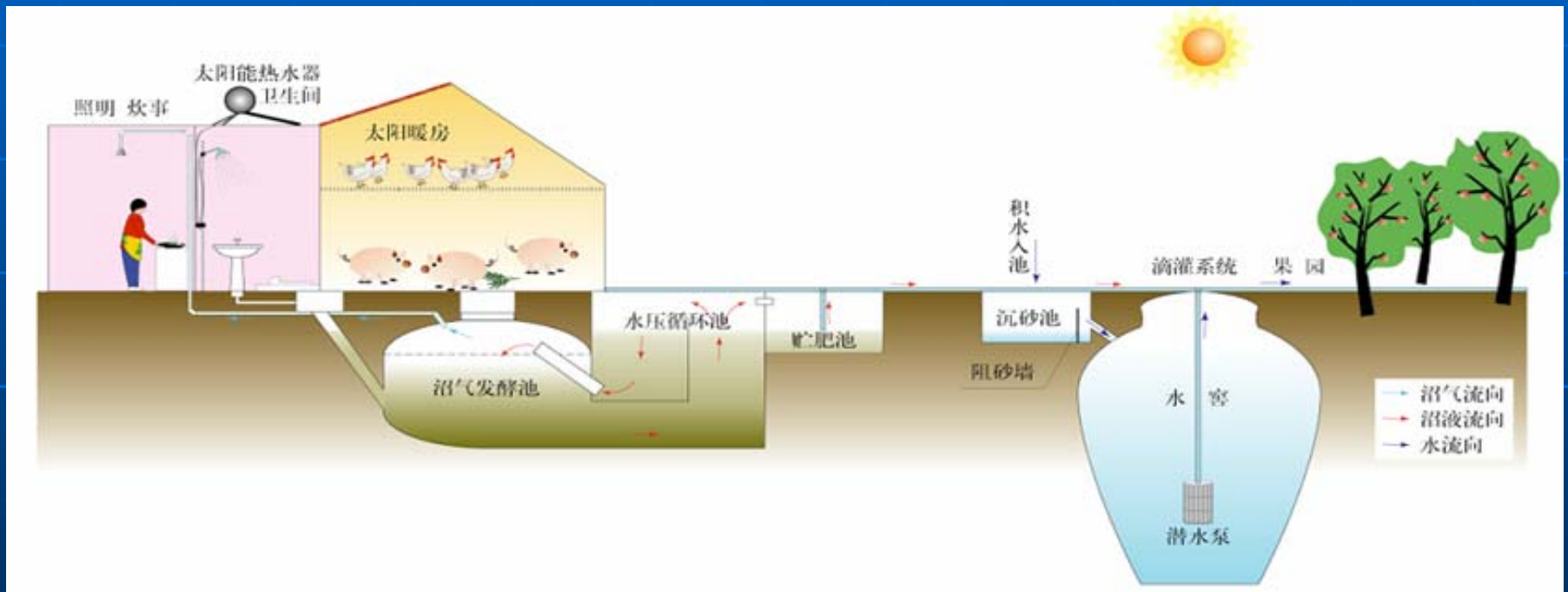
- The user needs to build a sunlight greenhouse in his rural courtyard, a underground biogas tank in one end of the greenhouse, and a pigsty as well as a toilet on the biogas tank. He may plant vegetables or fruits in the greenhouse.
- Driven by solar energy and connected by biogas, this mode combines crop production and animal husbandry, which will form benign ecological cycles and increase the peasants' income.



The “Five in One” Energy Ecological Mode in the Northwest

- Digester, toilet, solar energy warm pigsty, water cellar and garden irrigation facilities form an integral system.
- Digester is the core of this mode in the Northwest. Linked by the highly efficient digester, the rural organic fertilizers and domestic energy will form an organic whole which may result in a benign ecological circulation system in which biogas is supported by feeding, fruits are supported by biogas, and fruits and feeding enjoy concerted development.

Sketch Map of the “Five in One” Energy Ecological Mode in the Northwest



Beijing DQY 10000 m³ Chicken Excrement
large-scale Biogas Project



Pig Farm Wastes Biogas Project of Zhejiang Jiahua Corp. Ltd



Luoniushan Biogas Project in Haikou, Hainan



Substantial progress has been made in the development of rural biogas CDM project

- Household biogas CDM methodology has been developed for the first time
- The household biogas CDM methodology developed independently by Chinese experts: “Methane recovery methodology in agricultural activities of peasant households/small scale farms” has been recognized by CDM Executive Council

China has successfully registered two biogas CDM projects

- On February 19 2009, the household biogas CDM project in Enshi, Hubei was successfully registered. Covering 8 counties and 33000 biogas peasant households, the project will cut CO₂ emission by 58400 tons each year.
- Each household may get RMB 174 Yuan of income from emission reduction on an average basis. Among them: 60% will be given to the peasant households, 18% will be used to provide technical service, and 22% will be used to conduct supervision and management.

The farmer household biogas eco-homestead in Enshi, Hubei Province



China has successfully registered two biogas CDM projects

- On April 27 2009, the biogas CDM project of Shandong Minhe Animal Husbandry Co., Ltd. was successfully registered.
- The project constructed 26,400 m³ (8×3300 m³) of biogas fermenting installation, and may cut CO₂ emission by 86,800 tons each year. The annual income from emission reduction is RMB 7 million Yuan, and the buyer is the World Bank.

Biogas Power Generation Project of Shandong Minhe Animal Husbandry Co., Ltd.



2. The technology in utilization of straw for energy has gained initial effects

- By the end of 2008, there have established 856 central gas supply stations of straw gasification (coal gas); 138,400 household straw biogas stations, 150 centralized gas supply systems of straw biogas; and 54 straw densification and briquetting sites.

Centralized Gas Supply Stations of Straw Gasification



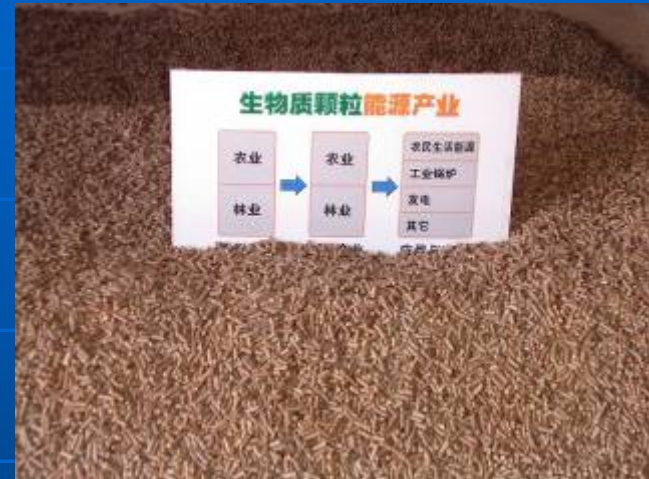
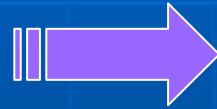
Household Straw Biogas Demonstration Project (Hunan Province)



Overview of the Centralized Straw Biogas Station in Decheng District, Dezhou of Shandong Province



Straw Briquette Fuel Technology



Straw Briquette Fuel



3. Firewood/coal-saving furnaces, stoves and kangs have attained remarkable results in emission reduction

- Since 1983, the Ministry of Agriculture has undertaken the promotion of firewood/coal-saving stoves. By the end of 2008, the Ministry has promoted a total of 146 million firewood/coal-saving stoves, 20.5 million energy-saving Kangs (a kind of heated bed used in northern China), 33.42 million energy-saving furnaces.

Old traditional types of household stoves

- Farmers traditionally used low-efficient open stoves, traditional stoves and coal stoves.
- Those stoves produce heavy smoke but low heat efficiency, and consume more coal, firewood and time in cooking.



Key innovational technology of firewood/coal-saving furnaces, stoves

- By improving the structure of combustion chamber and installing bottom ventilator, stove door, grate, fire ring, flashboard and chimney, firewood/coal-saving furnaces, stoves and kangas have rational structure, complete combustion, better heat preservation, and convenient, clean and sanitary use, and thermal efficiency is greatly improved.
 - Thermal efficiency of Stoves increases to 25% from lower than 10%
 - Thermal efficiency of kangas increases to 45% from 30%
 - Thermal efficiency of furnaces increases to 35% from 20%

Firewood/Coal-Saving Furnaces, Stoves and Kangs



New High-Efficiency Low-Emission and Energy-Saving Stoves



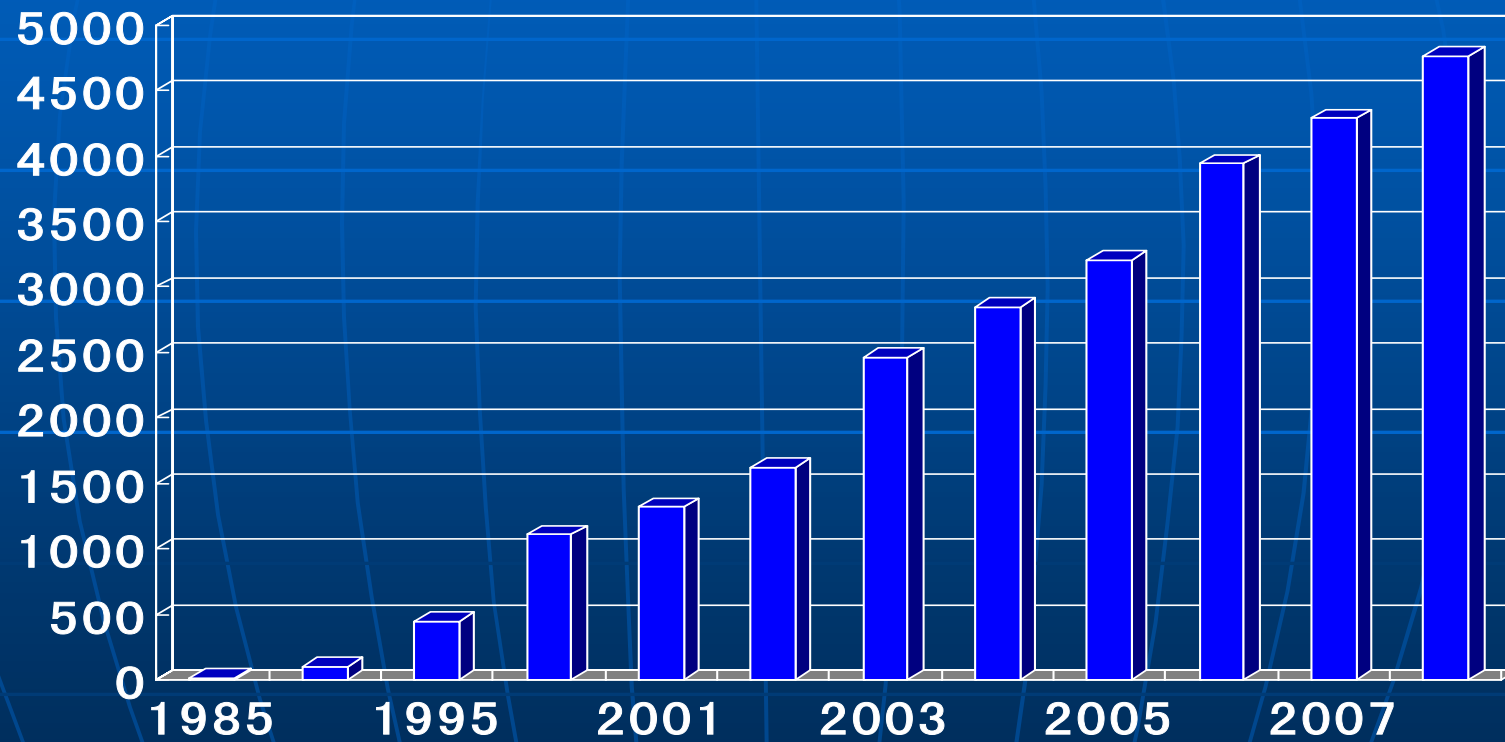
New Biomass Stoves



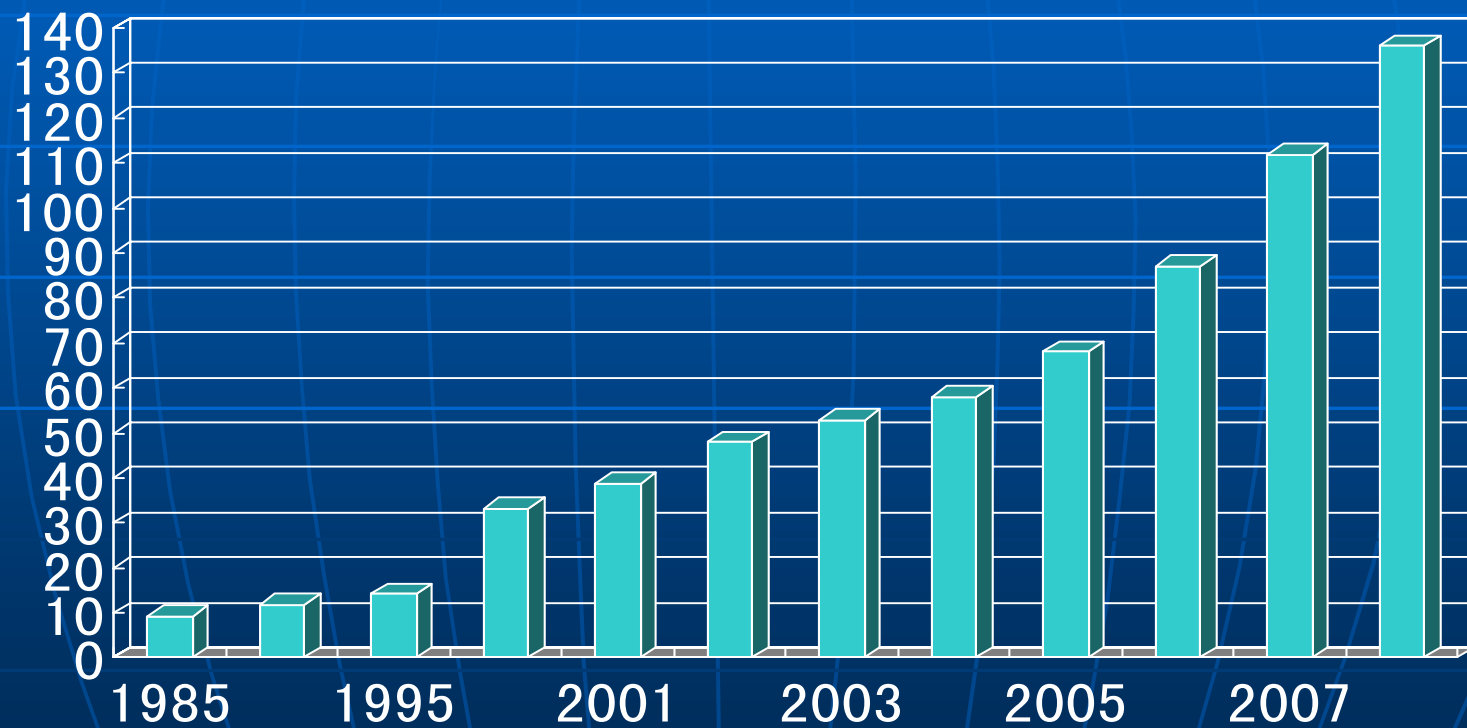
4. Clean and sanitary rural small scaled energy utilization equipment

- By the end of 2008, 47.59 million m² of solar water heaters, 15.9 million m² of household solar houses, 600 thousand m² of solar school buildings, 1.36 thousand sets of solar stoves, 227.9 thousand sites of solar PV power generation, 113 thousand sets of small scaled wind power generators and 54.9 thousand sets of micro-hydro power generators have been promoted in rural areas.

solar water heaters (ten thousand m²)



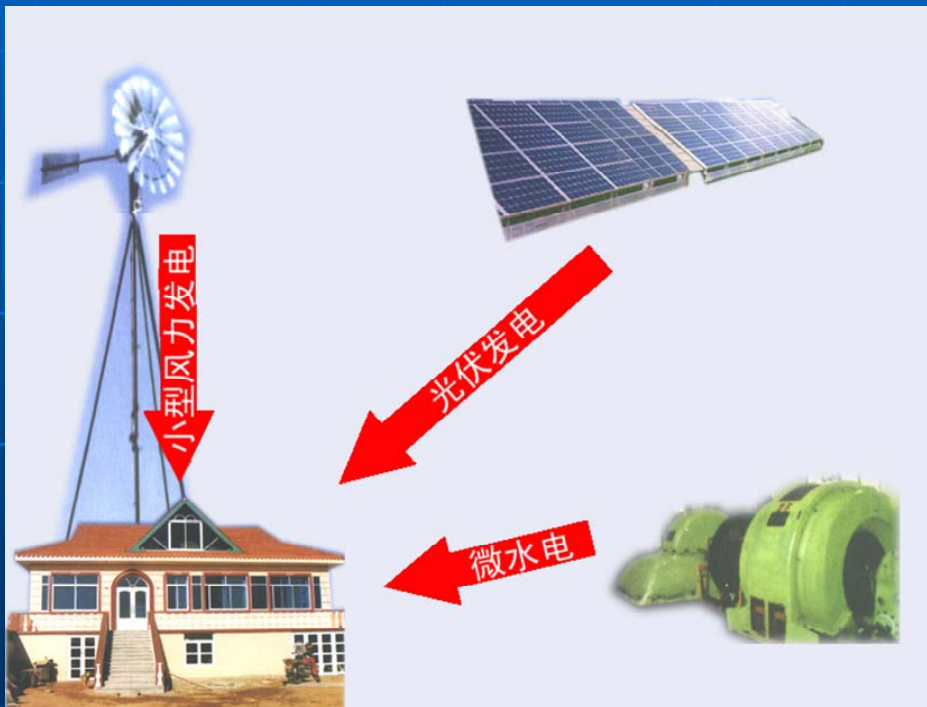
Solar stoves (ten thousand sets)



solar engineering



The small scaled wind power and micro-hydro power generation



5. Progress has been made in the energy crop industry

- The main crops that are suitable for producing ethanol include sweet sorghum, cassava and sugar cane, etc.
- Crossbred sweet sorghum varieties suitable for saline land have been cultivated
- A number of fine cassava varieties have been cultivated and introduced
- A group of new energy sugar cane varieties and sugar cane varieties for both energy and sugar have been cultivated

Sweet Sorghum

- China has cultivated the “sweet series” and other crossbred sweet sorghum varieties suitable for saline land and developed the technology of “making ethanol from sweet sorghum stalk”;
- Aside from 300-400 kg of foodstuff, each Mu of sweet sorghum may produce over 4 tons of stalks which contain 16-20% of sugar. 1 ton of ethanol fuel may be produced from every 16-18 tons of sweet sorghum stalks.

High Sweet Sorghum in huachuan, Heilongjiang Province



Cassava

- China has cultivated the Huanan series of varieties and the Nanzhi series of varieties, and successfully introduced KU50, Rayong 72 and a number of other fine cassava varieties;
- By using fine cassava varieties, strengthening field management and ensuring appropriate irrigation and fertilizers, the output may reach 3-5 tons per Mu;
- The starch content of fresh cassava is 30%-35%, and 1 ton of fuel ethanol may be produced from about 7 tons of fresh cassava.

Sugar Cane

- China has cultivated a number of new energy sugar cane varieties and sugar cane varieties for both energy and sugar that have been approved (appraised) at state and provincial levels;
- We have screen out the 1484, 1603 and 1724 strains that are suitable for fermentation of clear sugar cane juice and the 3#strain of active dry yeast.

III. The Current Problems

- Inconsistency between technology extension and new technology development
- Inconsistency between construction speed and management and service
- Imbalance development speed among different style rural energy technologies
- Imbalance of area development

IV. The Prospect

- Resource Potentials
- Working Approach
- Key Points in Work

i. Resource Potentials

- China enjoys rich rural bioenergy resources and huge potentials for further development and utilization.

The resources mainly include:

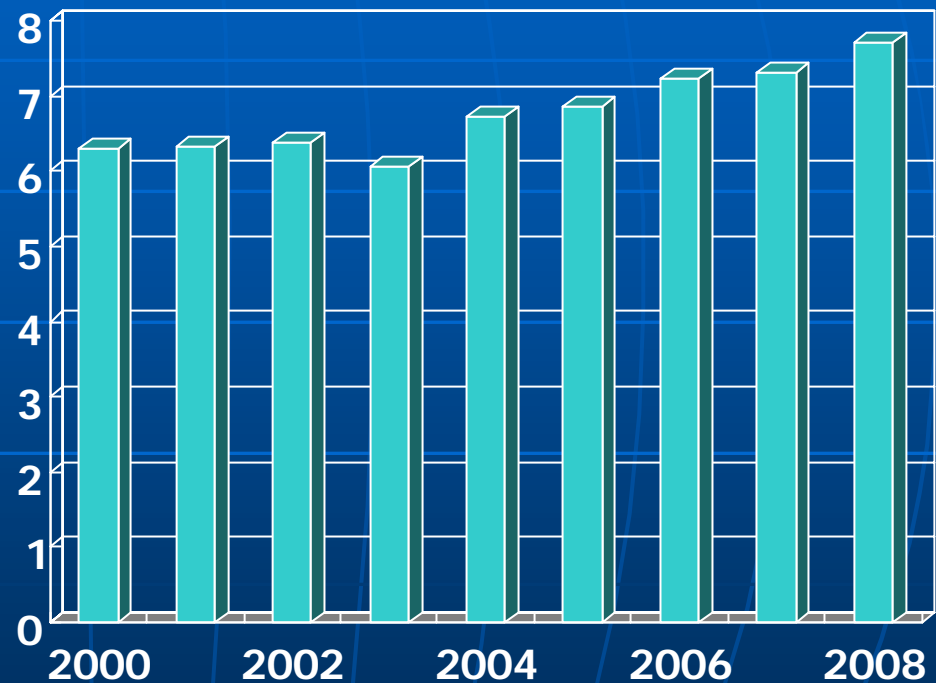
- Crop Straws
- Livestock and Poultry Excrement
- Energy Crops

1. Crop Straws

- Since China is a large agricultural country, its straw resource is abundant in quantity, diversified in variety, and widely distributed.

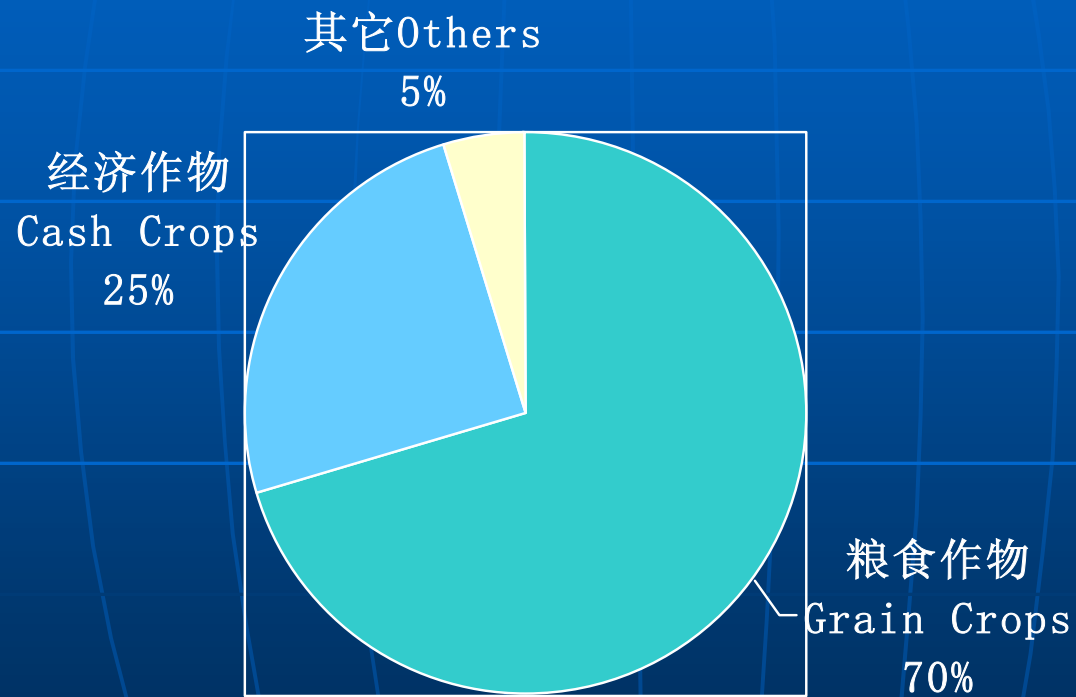
Output of Straw between 2001 to 2008

- The total amount of China's crop straw resource in 2007 was 770 million tons.

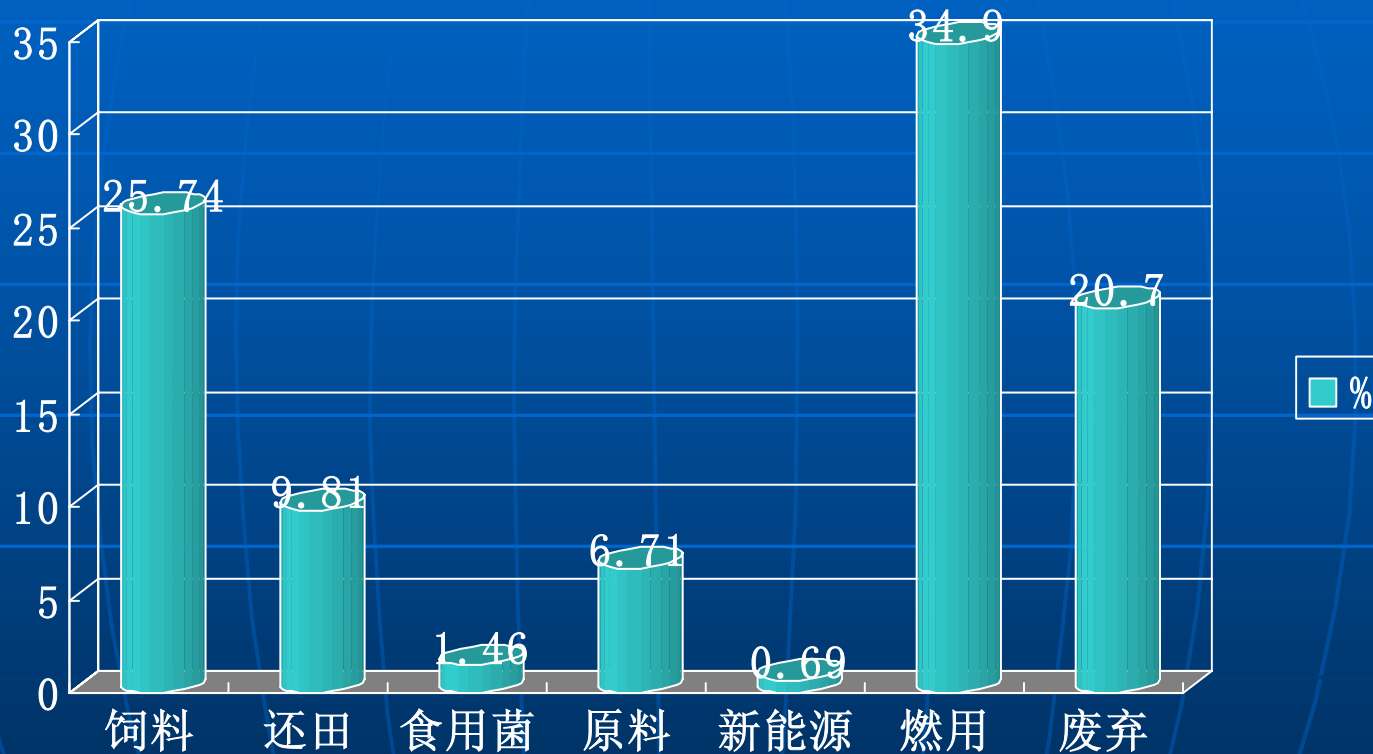


资料来源：中国统计年鉴2009
Source: China Statistical Yearbook 2009

Composition of Straw Resource



Current Status of Straw Utilization



Feed/Returned to Soil/Edible Mushrooms/Raw Material/New Energy/Combustion/Wasted

Crop Straws Enjoy Huge Potentials for Further Development

- The above diagram indicates that 55.6% of crop straws are either used for combustion or wasted each year. Therefore, there are huge potentials for further resource utilization, especially utilization for energy.

2. Livestock and Poultry Excrement

- At present, China has approximately 4.26 million large-scale farms for pigs, cattle, and chicken. The total inventory of livestock and poultry amount to about 610 million hog units. The amount of livestock and poultry excrement resource is 1.12 billion tons, which will theoretically produce 67 billion cubic meter of biogas.

3. Energy Crops

- According to the characteristics of the existing land resources and agricultural production in China and integrating with adjustments in agricultural structure and energy structure, reasonably utilize saline land, wasteland and other land resources and appropriately plant sugar cane, sweet sorghum, cassava and other energy crops.

ii. Working Approach

- Adhering to the rural energy development road with Chinese characteristics
- Adhering to the principle that the development of biomass energy shall not compete for grains with people or compete for land with crops.
- Adhering to the development of biomass energy through fully utilization of agricultural and rural wastes including livestock & poultry excrement and straws

iii. Key Points in Work

- Conduct technical innovation and vigorously press ahead with energy conservation and emission reduction
- Redouble the efforts in training and improve management and service standards
- Strengthen international exchanges and learn from international experiences

1. Conduct technical innovation and vigorously press ahead with energy conservation and emission reduction

- Actively organize and conduct technical innovation, scientifically promote the development of rural biogas, conduct technical demonstrations of utilization of straw for energy according to local conditions; conduct upgrading of firewood/coal-saving furnaces, stoves and kangas, vigorously promote high efficiency and low emission furnaces, stoves and kangas; moderately develop energy crops, accelerate the development of fibrin and ethanol technologies; promote the resource utilization of straws and excrements, accelerate the technology extension of solar energy and wind energy, and further press ahead with the work on agricultural and rural energy conservation and emission reduction.

2. Redouble the efforts in training and improve management and service standards

- Maintain a people-oriented attitude and take a number of measures to redouble the efforts in training, establish and improve highly skilled construction teams, scientific and standard designing teams and management teams with effective support, improve the overall working standard and ensure the healthy, steady and sustained development of rural energy.

3. Strengthen international exchanges and learn from international experiences

- We would like to continue to strengthen the cooperation with relevant international organizations and countries, learn from and exchange international rural energy development policies, advanced technologies and management experiences, and conduct technical exchange and cooperation in all respects.



Thank you very much
haoxr@agri.gov.cn

