Center for Energy and Environmental Protection.MOA

Energy Technology R &D Needs Of Emerging Economies Workshop

Overview and Outlook of Agricultural Bio-energy Development in China

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Outline

1. Overview
2. Achievements
3. Outlook

1. Overview

Energy Production and Consumption

2006~2010

Year	Production					Consumption				
	Total 10^9 tce	Coal	Oil	NG	Hydro, Nuclear, Wind	Total 10^9 tce	Coal	Oil	NG	Hydro, Nuclear, Wind
2006	2.32	77.8%	11.3%	3.4%	7.5%	2.58	71.1%	19.3%	2.9%	6.7%
2007	2.47	77.7%	10.8%	3.7%	7.8%	2.80	71.1%	18.8%	3.3%	6.8%
2008	2.60	76.8%	10.5%	4.1%	8.6%	2.91	70.3%	18.3%	3.7%	7.7%
2009	2.75	77.3%	9.9%	4.1%	8.7%	3.06	70.4%	17.9%	3.9%	7.8%
2010	2.969	76.5%	9.8%	4.3%	9.4%	3.25	68.0%	19.0%	4.4%	8.6%

Source: National Bureau of Statistics of China

Energy Production and Consumption

2010

Series	Production		Import		Consumption	
	Amount	Annual growth rate	Amount	Annual growth rate	Amount	Annual growth rate
Coal (10^9 t)	3.24	9%	0.146	40.9%	3.340	10.1%
Electricity (10^{12} kwh)	4.14	13.3%	--	--	4.19	14.6%
Oil (10^9t)	0.2	6.9%	0.239	17.5%	0.449	12.3%
NG (10^9 m^3)	94.48	12.1%	***LNG 93410⁴t 44***	75% *The 1st time*	110.0	20.4%

Source: National Energy Administration of China

China has abundant resources of agricultural biomass resources:

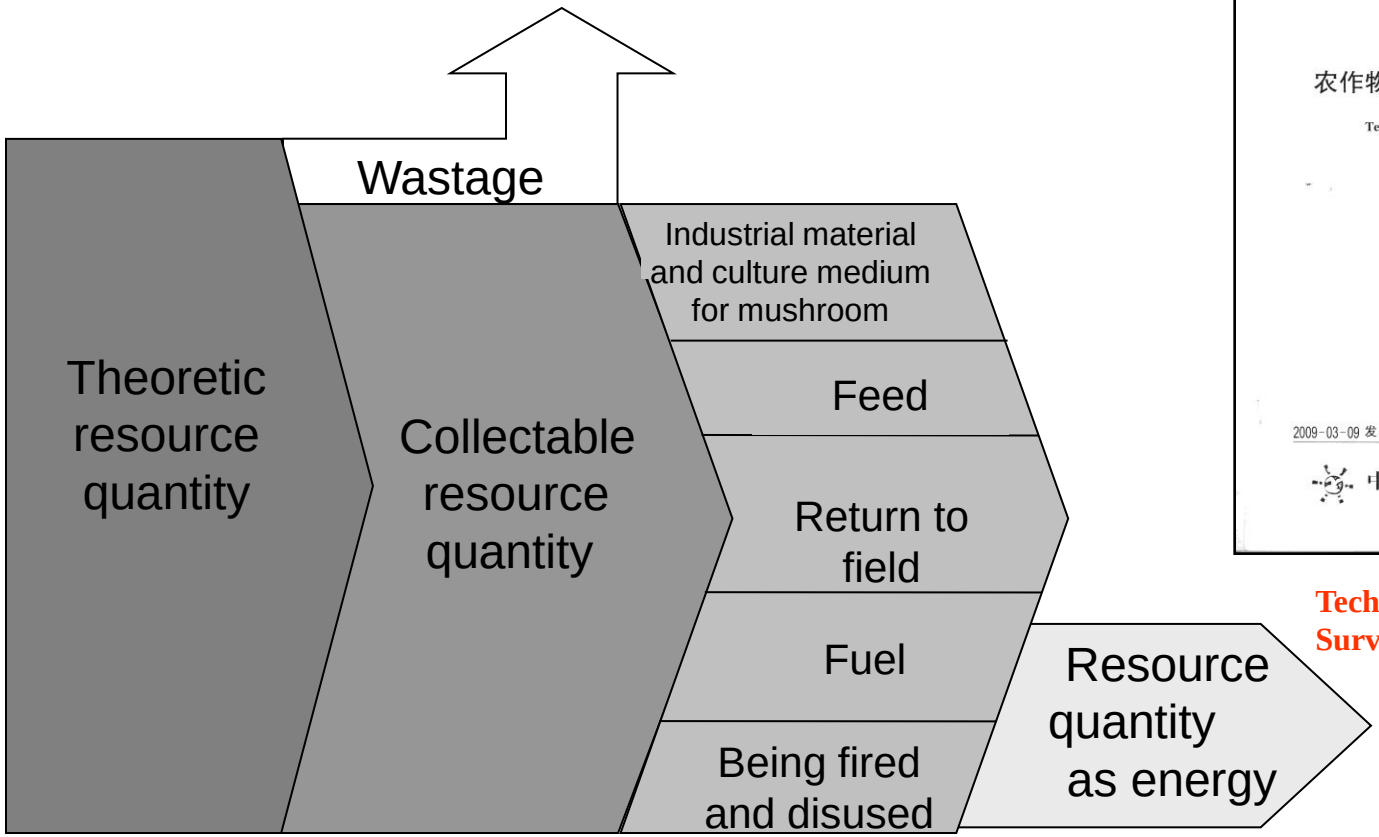
(1) Crop Straw
(2) Animal waste
(3) Energy Crops
(4) Agriculture Products Processing Waste

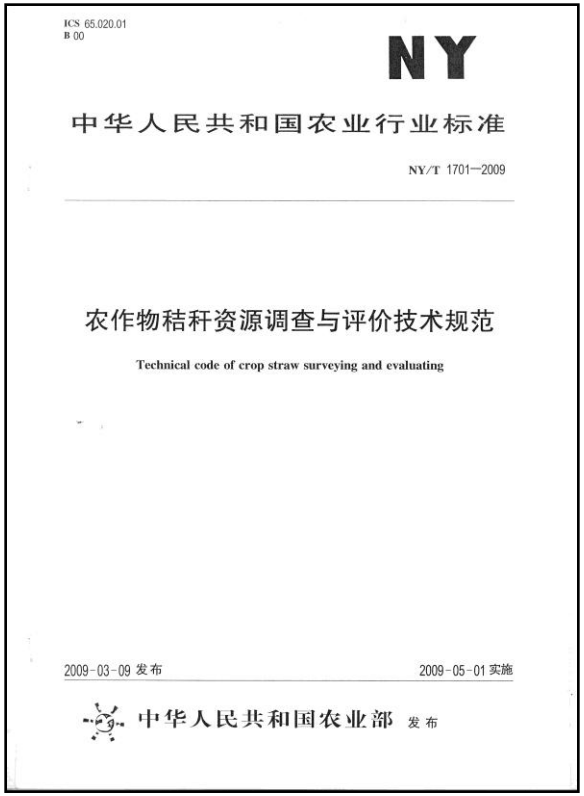
(1) Crop Straw

On Jan 21st, 2011, MoA issued《National crop straw resources surveying and evaluation report》.

Report shows that Chinese total collectable resource of crop straw is about 687 million tons, including 265 million ton corn stalks, 205 million ton rice straw, 150 ton million wheat straw.

Crop Straw Resources Evaluation Method

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中华人民共和国农业行业标准

NY/T 1701—2009

农作物秸秆资源调查与评价技术规范

Technical code of crop straw surveying and evaluating

2009-03-09 发布　　2009-05-01 实施

中华人民共和国农业部 发布

Technical Code of Crop Straw Surveying and Evaluating (NY/T1701-2009)

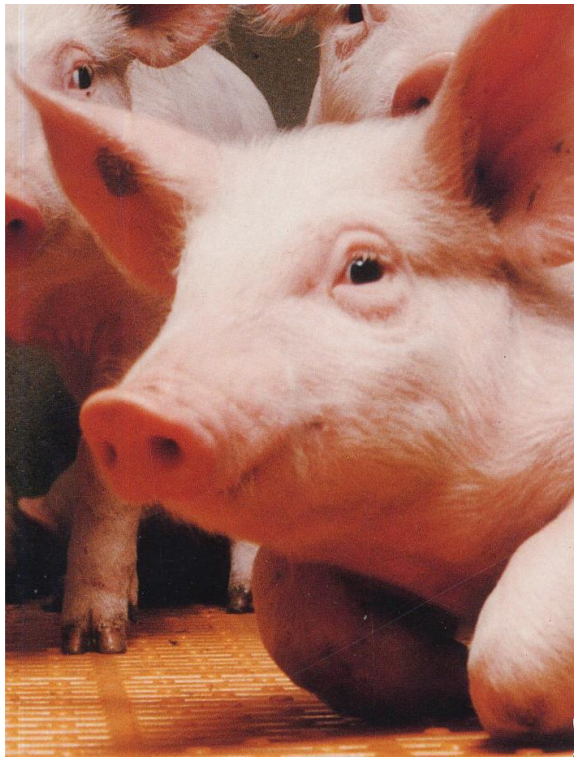
So far, utilization rate of crop straw in China is 69%. Among it, 211 million tons used as feed account for 30.69%; 129 million tons used as fuel account for 18.72%; 102 million tons used as fertilizer account for 14.78%; 15 million tons used as edible fungus binder account for 2.14%; 16 million tons used as industry material for paper making account for 2.37%.

Collectable resource 6.87 ※ (unutilized 31%+fuel18.72%）

=342 million tons

(2) Animal waste

“The first national survey of pollution sources Bulletin” shows 243 million tones of manure as well as 163 million tones of urine is to be produced annually from industrial livestock and poultry farming, including intensive farms, farming communities and specialized farming households, excluding household farming.



According to different farming scale and type, rural household's scatter breeding and intensive farms(including farming communities) are two types of Chinese livestock and poultry farming model.

Intensive farm means that farming scale is
more than 50 annual live pig commodity amount,
more than 2000 annual broiler commodity amount,
more than 500 annual layer amount of livestock on hand,
more than 5 annual dairy cow amount of livestock on hand,
more than 10 annual beef cattle commodity amount.

Total amount of manure and urine = breeding stock × emission factor × 365 days

Daily emission factor of livestock and poultry

Animal species	Manure kg·unit^{-1}	Urine kg·unit^{-1}	total amount of manure and urine kg·unit^{-1}
Live pig	1.38	2.12	3.5
Dairy cow	25~35	30	55~60
Beef cattle	20	25	45
broiler	-	-	0.05~0.1
layer	-	-	0.11

(3)Energy Crops

Herbaceous energy crops such as Sweet Sorghum, Cassava, Sweet Potato, Rape and so on, are suitable for planting in China.

Sweet Sorghum

According to National cultivated land reserves survey evaluation of land resource survey by Ministry of Land and Resources(2000-2003), China has 7.344 million hectare national cultivated land reserves resource.

Based on area, type, light and heat condition of cultivated land reserves resource, biological nature of energy crop, requirement of environment condition, development status etc, considering factors such as protection of the ecological environment, dynamic equilibrium of cultivated land, water resources, urbanization, adaptability of and energy crop, and yield increasing, it will take development strategy step by step, and gets the potential of fuel ethanol development of using cultivated land reserves resource.

Development potential of using cultivated land reserve resource

Area	Northeast Region	North China Region	Loess Plateau Region	Mongo Xinjiang Region	Eastern Region	Southern Region	South west Region	Total
Cultivated land reserves resource (10 thousand hectare)	55.9	12.5	88.4	382.2	13.33	12.4	32.3	624.93
Appropriate energy crops	Sweet Sorghum	Sweet Potato	Sweet Sorghum	Sweet Sorghum	Sweet Potato	Cassava	Cassava	
Ethanol production per unit area (tons per hectare)	3.75	3.03	3.75	3.75	3.03	2.66	2.66	
2010 Using proportion (%)	10	10	10	10	10	10	10	
2010 Development Potential (10 thousand tons)	22	27	145	21	6	16	18	255
2020 Using proportion (%)	50	50	50	50	50	50	50	
2020 Development Potential (10 thousand tons)	112	133	725	106	53	138	89	1355

P.S. Yield is conservative estimated considering it is cultivated land reserve resource.

(4) Agriculture Products Processing Waste

Agricultural waste after harvest crop processing, including rice husk, corn cob, peanut shells, bagasse, cotton seed hulls and etc, mainly comes from grain processing plants, food processing plants, sugar mills and breweries. Agricultural waste has large quantity, and relatively concentrated producing area. Also, it could be easily collected and treated.

Rice husk is the largest by-product during rice processing, accounting for 20% of paddy weight. In 2008, China produced about 51.81 million tons rice husk.

Corn cob is corn ear stripping corn grain, accounting for 75%-85% of corn ear weight. In 2008, China produced about 41.48 million tons corn cob.

Bagasse is sucrose processing waste, and the ratio of bagasse to sucrose is 1:1. In 2008, China produced about 24.83 million tons bagasse.

China has abundant agricultural biomass resource which could be used to produce bio-energy, in order to make up shortage of energy supply.

In September 2009, President Hu Jintao announced that “China will vigorously develop renewable energy, the proportion of non-fossil fuels in primary energy consumption could reach 15% by 2020” at UN Climate Change Summit.

In March 2011, the National People’s Congress approved China's 12th Five-Year Plan and the outline of the plan was released to the public, which clearly declared that clean energy such as biomass energy should be developed vigorously. This is the only way for China to adjust energy strategy, ensure energy security, protect the environment, cope with climate change and fulfill international commitments, which are related to the overall situation of political, economic and social development.

2. Achievements

（1）Policy，Regulation and Incentives

（2）Bio-energy Technologies

（3）International Cooperation

（1）Policy, Regulation and Incentives

Law in China has clear provisions on biomass energy development, such as:

- The Law on Agriculture
- The Law on Renewable Energy
- The Law on Energy Conservation

National Policies:

- Medium and Long-Term Development Plan for Renewable Energy in China, 2007
- Agricultural Biomass Industry Development Plan, 2007
- Suggestions on Promotion of Comprehensive Utilization of Crop Straws, 2008;
- Management Method on Subsidy of Utilization of Crop Straw, 2008
- …

Local Policies:

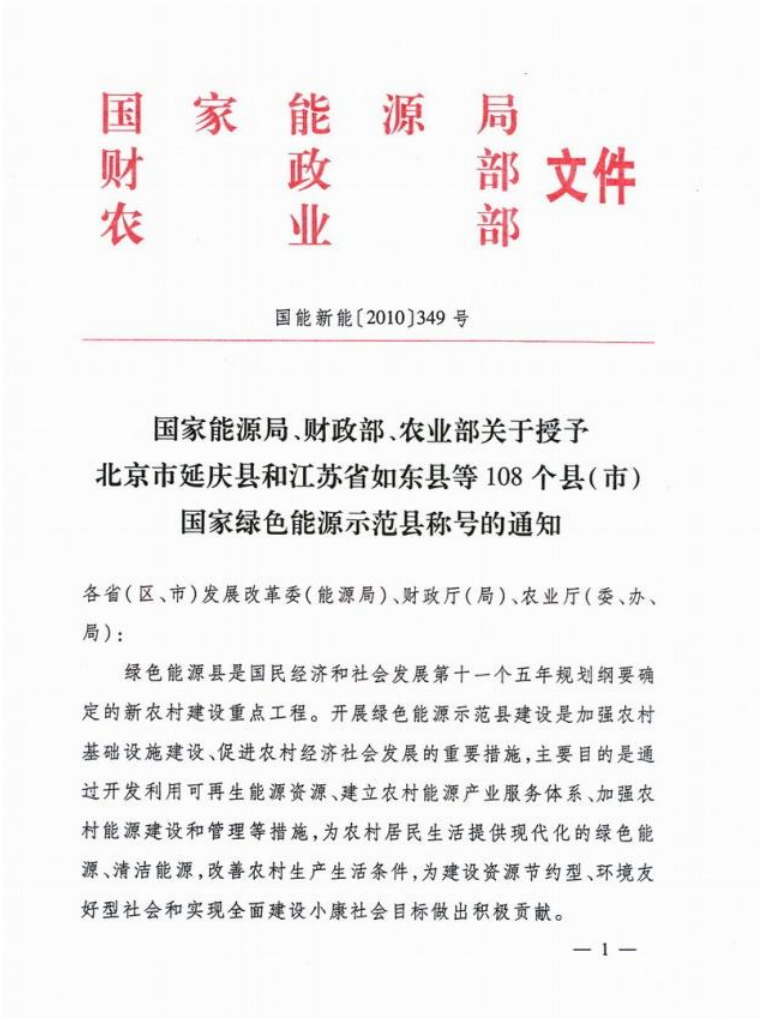
- ✓Hebei Provincial Management Regulation on New Energy Development and Utilization, 1997
- ✓Gansu Provincial Construction and Management Regulation on Rural Energy, 1998
- ✓Anhui Provincial Construction and Management Regulation on Rural Energy, 1998
- ✓Guangxi Zhuang Autonomous Regional Construction and Management Regulation on Rural Energy, 2001
- ✓Zhejiang Provincial Promotion Method on Biogas Development and Utilization, 2005
- ✓Hunan Provincial Regulation on Rural Renewable energy, 2006
- ✓Shandong Provincial Regulation on Rural Renewable Energy, 2007
- ✓Heilongjiang Provincial Development and Utilization Regulation on Rural Renewable Energy, 2008
- ✓Hubei Provincial Regulation on Rural Renewable Energy, 2010
- ✓Sichuan Provincial Regulation on Rural Energy, 2010

Rules for the Implementation of the Law on Renewable Energy

The relative management regulation on renewable energy generation:

- Trial Measures for the Administration of Price and Cost Allocation of Renewable Energy Power
- Interim Measures on Special Fund Management for Development of Renewable Energy
- Notice on Improving the Price Policy of Agroforestry Biomass Power Generation, 2010
  - benchmark electricity price 0.75 Yuan RMB/kwh

Green Energy Demonstration County



国家能源局
财政部 文件
农业部

国能新能〔2010〕349号

国家能源局、财政部、农业部关于授予
北京市延庆县和江苏省如东县等108个县（市）
国家绿色能源示范县称号的通知

各省（区、市）发展改革委（能源局）、财政厅（局）、农业厅（委、办、局）：

绿色能源县是国民经济和社会发展第十一个五年规划纲要确定的新农村建设重点工程。开展绿色能源示范县建设是加强农村基础设施建设、促进农村经济社会发展的重要措施，主要目的是通过开发利用可再生能源资源、建立农村能源产业服务体系、加强农村能源建设和管理等措施，为农村居民生活提供现代化的绿色能源、清洁能源，改善农村生产生活条件，为建设资源节约型、环境友好型社会和实现全面建设小康社会目标做出积极贡献。

— 1 —

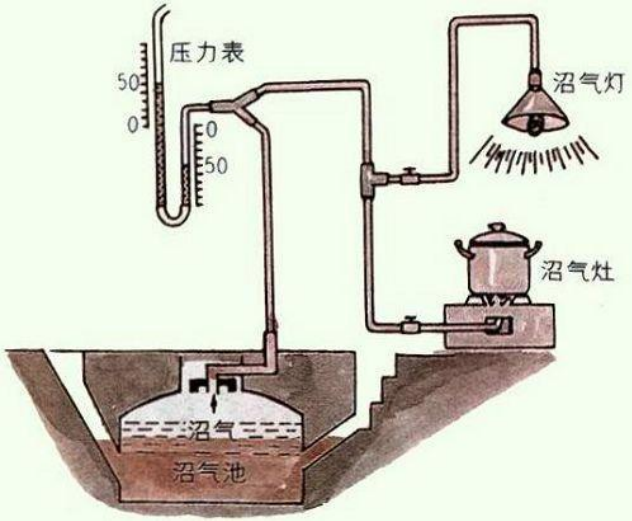
- 108 Counties was awarded the **Green Energy Demonstration County** by NDRC, MOF and MOA, Oct 2010
- 25 Million CNY in form of national subsidy
- Target Fields: Biogas, Gasification, Densified Biofuel, Rural energy service system
- Duration: 2011~2013

（2）R& D of Bio-energy Technologies

(2.1) Biogas sector has developed fast.

Till the end of 2011:

- 41.70 million rural household biogas digesters installed in China.
- 81.0 thousand agricultural waste biogas projects constructed and established the biogas capacity of 17.1 billion m^3 per year.



北京德青源鸡场日处理鸡粪212吨，产沼气1.9万m^3，发电能力1.6MW，年减排$CO_2$8万吨。

Biogas Plants

- Raw materials
  - Animal manure, crop straws and mixed agricultural wastes
  - Intensive livestock manure is the main raw material
- Process technologies
  - Animal manure: CSTR, USR, PFAR…
  - Crop straws: CSTR, MCT, CTP, STP …
  - Mixed materials: CSTR



Biogas Plants

Biogas utilization

- farmers' cooking
- power generation
- vehicle fuel

9000 m^3/d vehicle fuel, Anyang, Henan Province

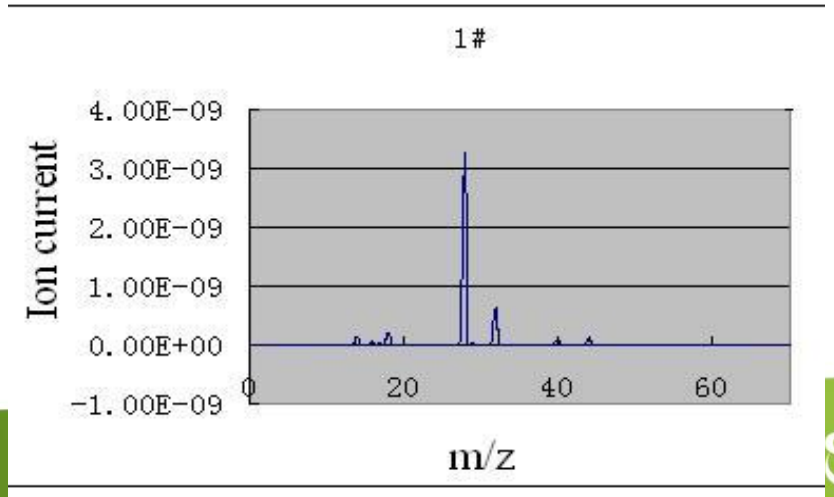
1MW, Mengniu, Innner Mongolia

2MW, Deqingyuan, Beijing

3MW, Minghe, Shandong Province

(2.2) Straw densified fuel technology is expanding

- Crop straw can be made into pellet and briquette fuels with high energy efficiency and low emission of pollutants by mechanical compaction.
- The density **0.8-1.4g/cm^3**
  Heat value **16000KJ/kg**
- Convenient for storage and transportation.



The solid biofuel industry has established

- Currently, there are around **100 biopellet plants** in agriculture area to produce **3 million tons** of pellets and briquets, each plant with the annual production capacity of more than 10,000 tons.
- The standard system of biomass densified fuel is establishing, and **15** MOA.

Biofuel for district heating

Data from Chinese Academy of Agriculture Engineering

Producers using crop residue as feedstock can get subsidy if they meet the following requirements：

- Registered capital should above 10 million RMB
- Crop residues for energy use should meet the local straw utilization plan.
- The utilization of crop residues should be more than 10 thousand tons per year.
- Biopellets and biobriquets have been sold to steady clients

.

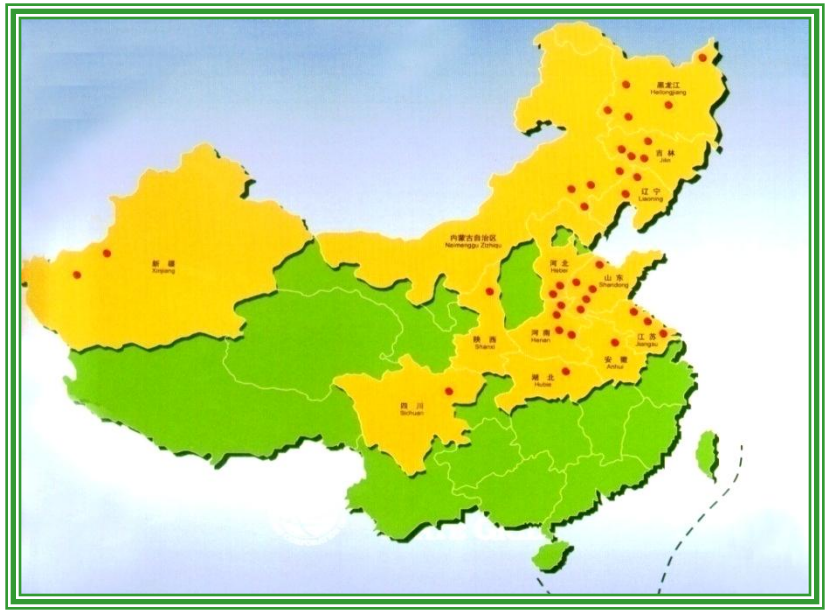
Pellet stove

Green House

vegetable green houses are heated by biopellets

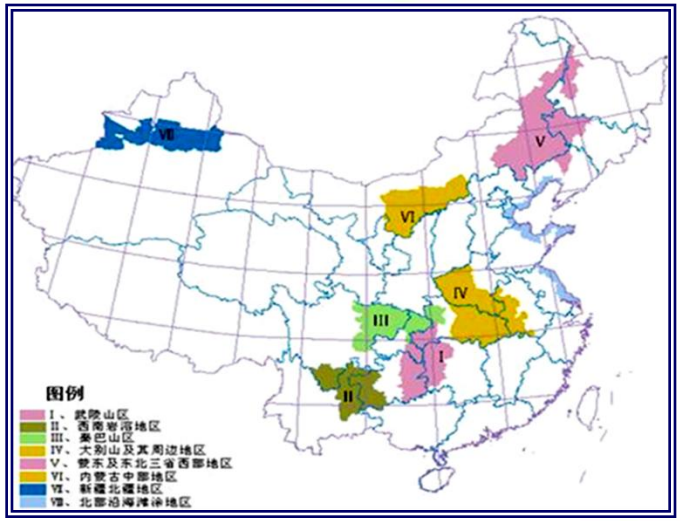
(2.3) Biomass power generation technology is well-developed

By the end of 2010, the installed capacity of biomass power generation is about 5.5 million kW.



(2.4) Non-grain ethanol begin to industry and achieve major technological breakthroughs

- Constrained by grain output, China no longer develop grain-based production of ethanol fuels in recent period.
- A bio-ethanol plant based on cassava fermentation was built in Guangxi in January 2008, with capacity of 200 thousand tons per year. By 15th April in the same year, ethanol gasoline for vehicles was available all over Guangxi.
- At present, annual capacity of biofuel ethanol production reached 1.62 million tons.



Cellulosic ethanol

- The first cellulosic ethanol industrialization pilot in China was established by Tianguan Group in 2007 with capacity of 3000 tons per year.
- Till now, the technology is still immature and the cost is higher. Market acceptance of cellulosic ethanol technology depends on technology breakthrough and cost decrease.

（3）International cooperation

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, FAO, 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, Yunnan, Anhui and Chongqing.

3. Outlook

In recent years, people pay more attention on technology development and application of biomass energy. With the development of new technologies and methods, biomass energy industry has developed rapidly.

Current Problems and Trends:

➢ Biogas fields:

Current Problems：

- Biogas availability is decreasing
  - household-scaled biogas: poor running or even deserted
  - biogas plants: underutilized attributed to poor economic benefits
- Inferior equipment technology and low level of industrialization
- Utilization of biogas residues and slurries
- Policies and incentives need to be improved, and subsequent service abilities must be strengthened
  - focus on construction and little attention to management
- Faulty market impacts on integrated benefits of biogas plants

Biogas fields:

Development Prospects：

- Developing aims: economies of scale, industrialization, and commercialization

– Raw material will be diversified.

– Utilization of biogas products will be greater focused on efficient, high-value, and comprehensive ways.

– The operation and management model of biogas plants will be specialized.

- **Biomass thermal utilization fields:**

According to Mid and Long Term National Renewable Energy Development Plan, by 2020, 50 million tons of biopellets/briquets will be produced annually.

R&D of biomass collection, storage, transportation system and high efficient biomass burner.

- **Biofuel ethanol fields:**

select and plant high yield, good quality and strong resistance energy crop in a large area; industrial-scale ethanol production equipment and technology using sweet sorghum; ethanol production technology with degradation of cellulose, research and development of low-cost and high efficient hydrolase.

- China has resources and technical potentials for large-scale development of biomass energy, which is helpful to ensure energy security as well as sustainable social and economic development in the future.
- The development of biomass energy industry will provide more employment opportunities, improve rural production and living environment and promote rural economic development.


Thank you !