


2nd Regional Bioenergy Policy Dialogue:  
Identifying priority areas for regional  
cooperation and action

# **Resource, Policy and Status and Prospect on Agricultural Bio-energy in China**



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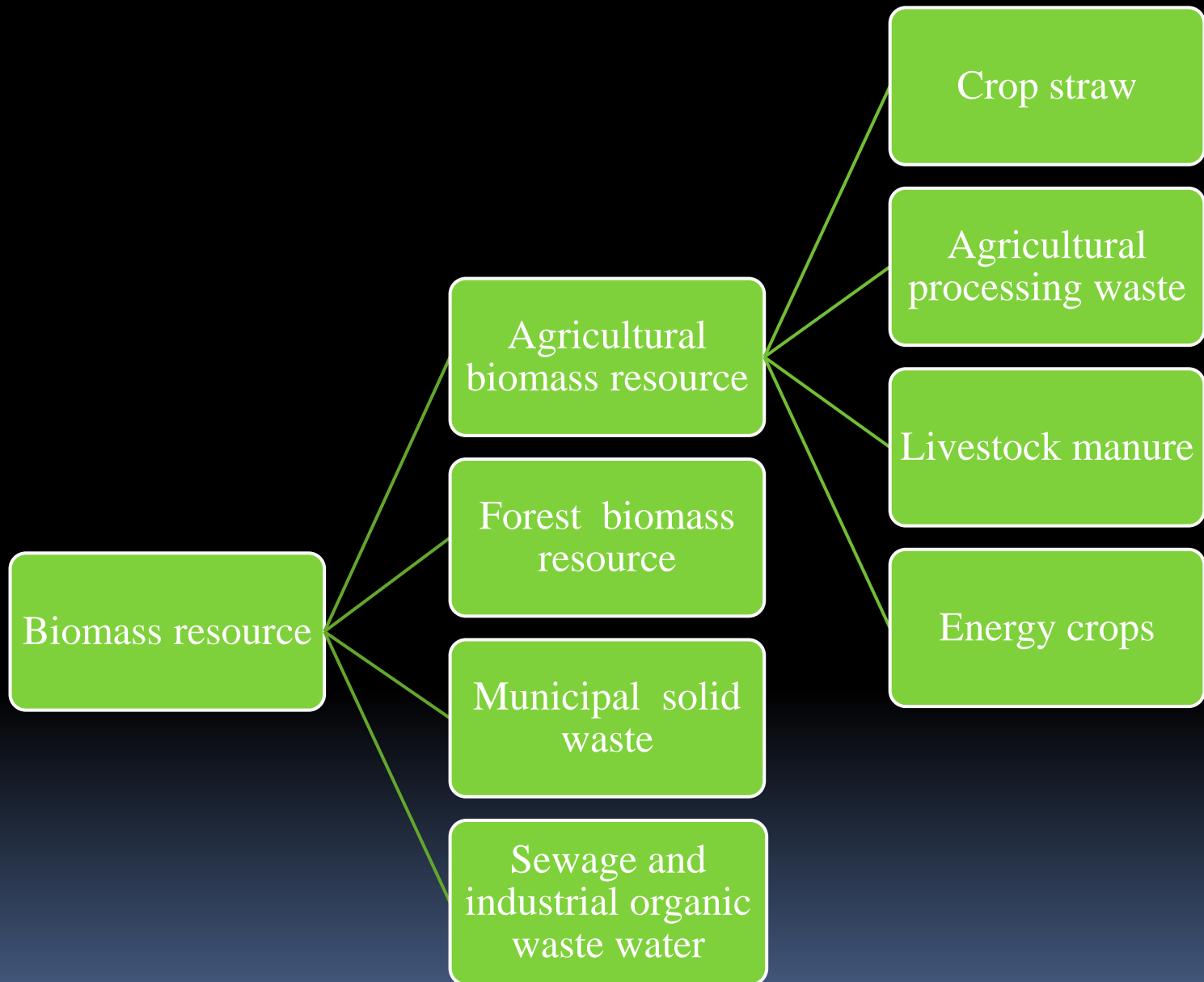
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# 1. Potential Evaluation on Bio-energy Resource





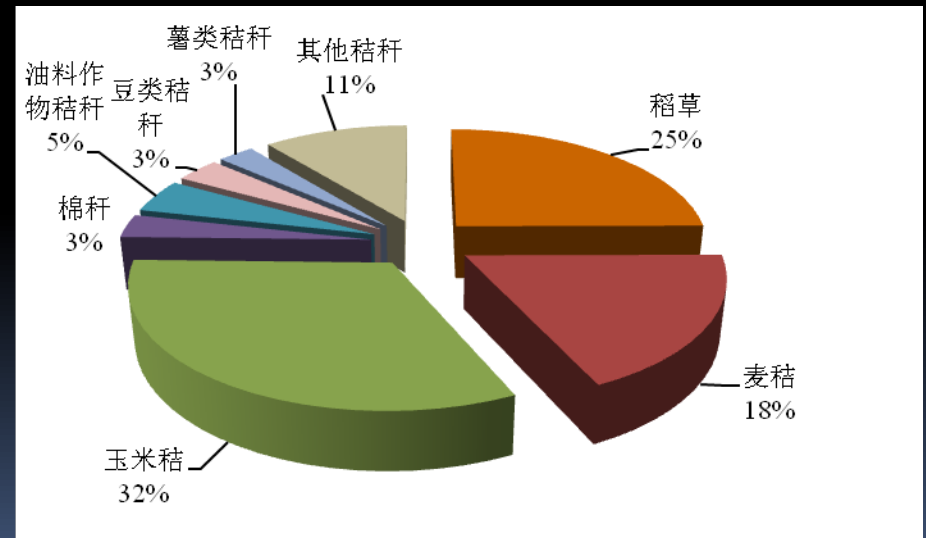
# 1. Crop straw

- The straw resource is decided by crop yield, agricultural production condition and natural condition. The quantity of straw resources is usually calculated based on the grain straw ratio of crops.
  - $\text{Total quantity of straw resource} = \text{crop production} * \text{ratio of straw to grain}$
- In China, we mainly estimate straw of rice, wheat, maize, soybean, potato, cotton and rape.



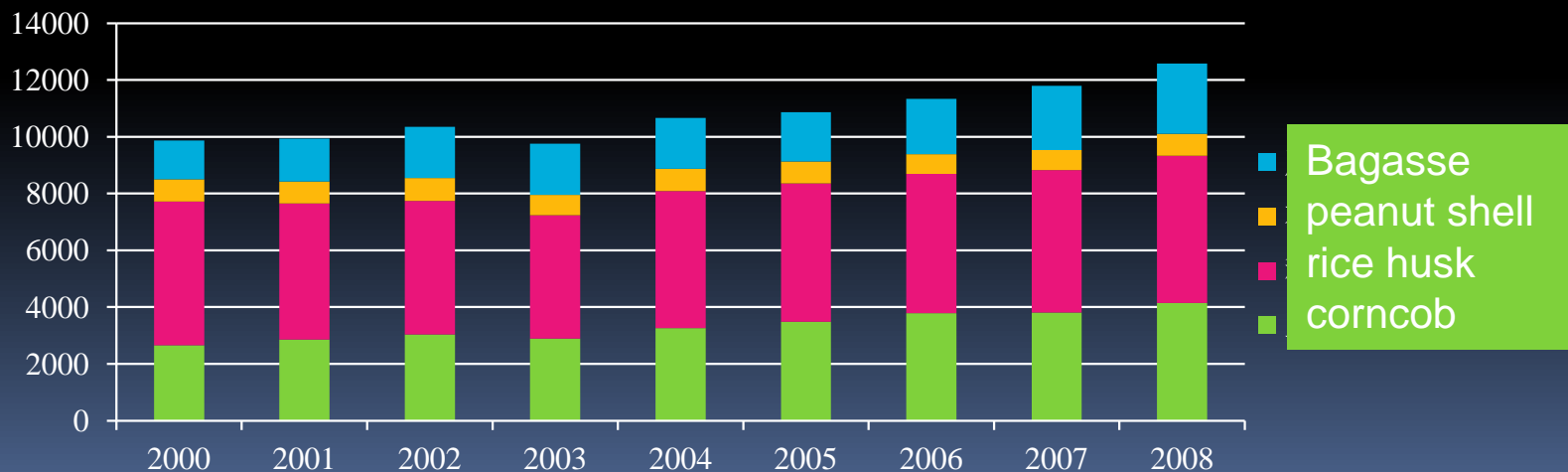
# Total production of straw in 2009

- In 2009, the theoretical output of seven main crop straw is 820 million tons.
  - rice straw accounts for 25.0% of the total amount;
  - wheat straw is 18.3%;
  - **maize straw is 32.3%;**
  - soybean straw is 3.3%;
  - potato straw is 2.7%;
  - cotton straw is 3.2%
  - rape straw is 4.6%



## 2. Agricultural processing waste

- Agricultural processing waste is mainly from grain processing mills, food processing mills, sugar mills and wine plants, such as rice husk, corncob, peanut shell, bagasse and cottonseed husk. In 2008,
  - the total output of rice husk is about 51.81 million tons.
  - the total output of corncob is 41.48 million tons.
  - the total output of bagasse is about 24.83 million tons.



Changing figure of agricultural processing waste from 2000 to 2008

### 3. Livestock manure

China's livestock breeding styles can be divided into rural household scatter and scale breeding.





# Manure quantity of livestock in 2006

item		Amount of livestock on hands	( 10 <sup>8</sup> ton ) Bung quantity		Gas
		( 10 <sup>4</sup> )	total	Solid manure	( 10 <sup>8</sup> m <sup>3</sup> )
Whole country	pig	49440.74	9.02	3.61	568.44
	fowl	536000	2.35	2.35	582.22
	cow	1363.17	1.84	1.34	52.84
	cattle	12032.85	13.18	8.78	378.15
total			26.39	16.08	1581.66

# (1) Rural household scatter feed

- there are 90 million households feeding pigs, 15.7 million households feeding cattle, 85 million households feeding chickens, and 26 million households feeding sheep in rural area of China. **It's about 148 million houses can be developed into rural household biogas.**
- The number of household biogas will be 139 million and 130 million until 2015 to 2020 respectively, biogas output will be 53.9 billion m<sup>3</sup> and 50.2 billion m<sup>3</sup>.



## (2) Scale breeding

The scale breeding farms of pig, cow and chicken are 4.26 million, livestock manure quantity is 1.12 billion tons, which can produce 67 billion m<sup>3</sup> biogas.





## 4、 Energy crop

In China, the energy crops can be used to produce bioethanol mainly include sweet sorghum, sugar cane, types of potatoes, sugar beet, rape, Castor-oil plants etc.

# Sweet sorghum

- The planting scale of sweet sorghum is small and disperse, which is mainly in north China.
- China has cultivated new varieties like Chuntian, Yuantian and Liaotian series.





# Cassava

- Cassava is planted in Guangxi, Guangdong, Hainan, Yunnan and Fujian province in China. The area in 2006 was 265.8 thousand ha; and the yield was 4.318 million tons, the area in Guangxi province is the largest, then is Guangdong province.
- China has developed varieties of Huanan and Nanzhi series and introduced KU50, Luoyong72 series from Thailand successfully.



# Sugarcane

- In 2006, the planting area of sugarcane was 1.5 million ha and output was 99.784 million tons, sugar production was 10 million tons and gooey production was 3.4 million tons.
- China has cultivated a series of new varieties used for both sugar and energy, successfully.





# Sweet potato

- In 2006, the planting area of sweet potato was 4.7 million ha, produced about 100 million tons of sweet potato.
- About 8 ton sweet potatoes (starch content is 18-30%) can produce 1 ton fuel ethanol.
- Because sweet potato is harvested and processed in autumn and winter, so it is easily frosted and decayed after harvest unless stored correctly, which is about 20%.



# Reserve arable land resource

Investigation of national arable land reserve was carried out in a new round of the survey for land resources 2000~2003 organized by ministry of land and resources, completing survey of arable land reserve for 31 provinces in separate years.

The survey showed that, land resources reserve at national level was totally 7.344 million ha. Among which, tamable land reserve was 7.017 million ha, 95.54% to the land resources reserve, reclaimable arable land reserve was 0.327 million ha, only 4.46% to the land resources reserve.

# Potential of fuel ethanol production on arable land reserve

		North-east area	Northern area	Loess Plateau	Mongolia-Xinjiang	Yangtze River area	Southern area	South-west area	total
Arable land reserve (10 <sup>4</sup> Ha)		45.3	57.1	87.9	369.6	69.7	12.4	32.1	702
Energy crops		Sweet sorghum	Sweet sorghum, sweet potato	Sweet sorghum	Beet, sweet sorghum	Sweet potato	cassava	Sweet potato	
2020	Unit ethanol (t/ha)	3.92	3.92	3.92	3.92	5.64	6.62	5.64	
	Using rate(%)	50	50	50	50	50	50	50	
	Developing potential (10 <sup>4</sup> t)	89	112	172	724	196	41	90	1425



## Cassava - increase output

As the largest production area, planting area and total output of cassava in Guangxi comprises two thirds of domestic total. The cassava planting areas have reached 269.5 thousand ha and cassava yield (converted to grain) got 1.8million tons in 2005.

Take Guangxi for example, if the yield of 45 ton/ha is achieved, 10.2 million tons of cassava and 1.36 million tons of fuel ethanol can be increased.



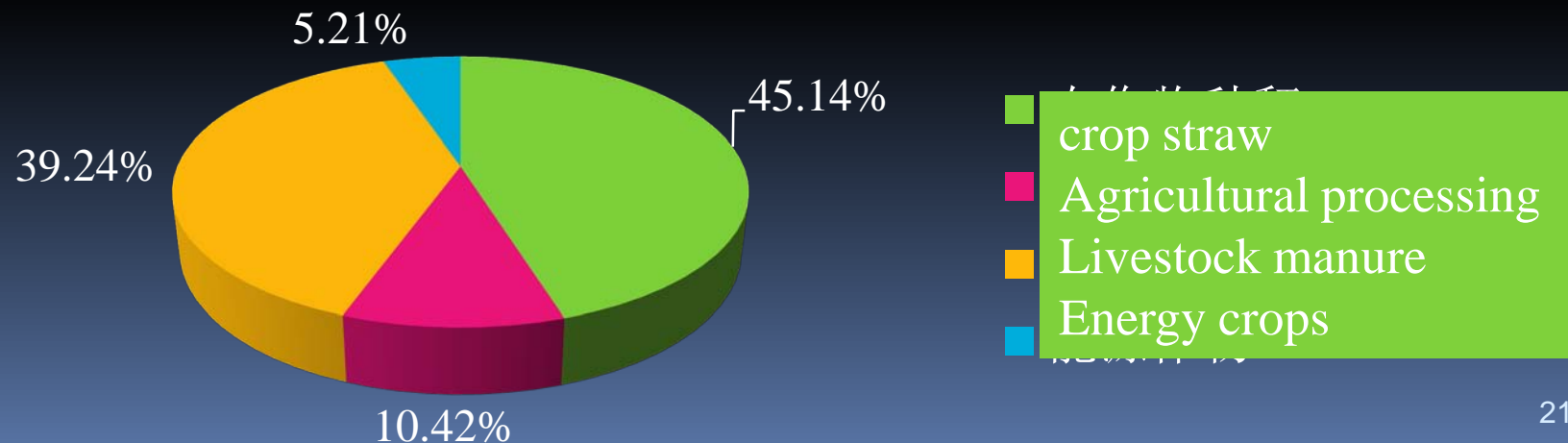
# Sweet sorghum – substitute planting

Average yield of sweet sorghum grain was almost equivalent to normal sorghum. Planting sweet sorghum in the sorghum lands will not greatly affect grain production.

The total planting area of sorghum was 570 thousand ha in 2006. If 50% is substituted by sweet sorghum, the stems ethanol production will increase 1.07 million tons.

# Total quantity of agricultural biomass resource

Variety	Theoretic resource output	Energy utilization resource output	Equal to tce (100 million tons)
crop straw	680 million tons	215million tons	1.05
Agricultural processing waste	126million tons	6.3million tons	0.30
livestock manure	4512million tons	158.17billion m3 biogas	1.13
energy crops	7 million ha	20 million tons bioethanol	0.20
total			2.9





# Conclusions

- The agricultural biomass resource is very abundant in China, the potential will get 290 million tce by 2020.
- China's agricultural biomass resource mainly includes crop straw, livestock manure and agricultural processing waste, which will be the developing emphasis in the future.
- If using arable land reserve, taking substitute planting and improving unit yield, the developing potential of fuel ethanol will be 20 million tons in 2020.




## **2. China's bio-energy policies and regulations**





# Renewable Energy Law


The law was implemented on 1, January, 2006 and revised on 26, December, 2009. It mainly established:


- gross aim system
  - renewable energy power coercive to network system
  - renewable energy power sales price to network system
  - cost allocation system
  - special fund system
- 






# Implementing regulations of renewable energy law

- The relative management regulation on renewable energy generation
  - Interim Rules on generation price of renewable energy and cost allocation
  - Interim rules on management of special developing fund of renewable energy
- 




## Implementation measures on bio-energy development and biochemistry financial support policy

- Elastic deficit subsidy for the bioenergy companies
- Subsidy for bioenergy material planting base
- Bioenergy demonstrating subsidy
- Revenue preference to the bioenergy companies



The notify on relative problems about performing income tax preferential catalog of resource comprehensive utilization enterprises

The enterprises use the resources listed in catalog as main material to produce the product listed in catalog from Jan 1, 2008. The income tax can be reduced 90%.

- Crop straw and husk
  - products: substituting product for wood, electricity, thermal and fuel gas
  - Technical standard: 70% material is from the listed resource
- 

# Interim rules on crop straw energy utilization subsidy management

- The supporting objects are the enterprises which engage in producing straw energy such as straw densified biofuel, gasification, carbonization.
- The subsidy requirements for the enterprises:
  - registered capital should above 10 million Yuan
  - Energy utilization of crop straw satisfy the local straw utilization plan
  - The quantity of straw consumption should be more than 10 thousand tons
  - The straw energy product has been sold and has steady users .

# Medium and Long-Term Development Plan for Renewable Energy

- ✓ By 2010, China's renewable energy consumption accounts for 10% of total energy consumption, which will be 16% by 2020;
- ✓ Resolve power problems of all the population without electricity;
- ✓ Basically solve the fuel shortage in rural area in about 10 years;
- ✓ The main developing fields of bio-energy are biomass power generation, biogas, densified fuel and liquid biofuel .

# Developing Goals

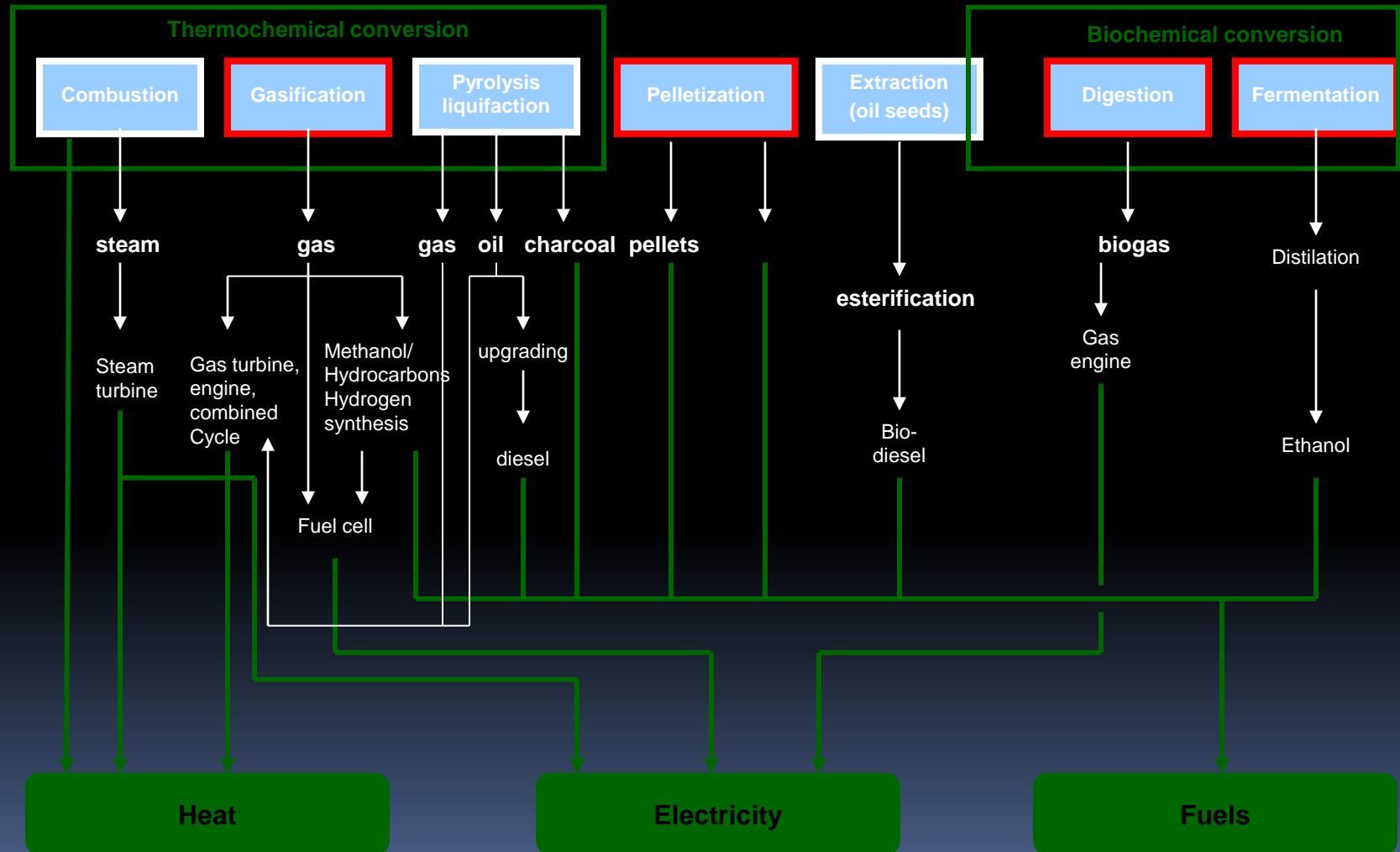
item	unit	2010	2020
Rural household biogas	Ten thousand	4000	8000
Middle –large scale biogas project		4700	10000
Biomass solid fuel	Ten thousand tons	100	5000
Fuel ethanol	Ten thousand tons	200	10000
Biodiesel	Ten thousand tons	20	200



### **3. The developing status of China's bio-energy industry**



# Conversion technology route of biomass





# Biogas industry develops fast

- By the end of 2010, the number of rural household biogas has been developed into 38 million, the annual biogas output is 13 billion m<sup>3</sup>.
- The number of agricultural waste biogas projects is 56.5 thousand, the annual biogas output is 450 million m<sup>3</sup>.
- The government has increased 8 billion Yuan to build rural household biogas from 2008.



# Straw-fired Power Generating technology

By the end of 2009, there are 173 biomass power generation projects and 50 projects have been startup formally and the total installed capacity was 1.07 million kW.



Shan county , Shandong prov

# Straw biogas technology

- Straw biogas technology is a new technology which use straw as the fermentation raw materials, first add the straw composite agents in it to make retting treatment, and then inoculated with the methane gas produced objects into the pool.
- Effectively solve the raw material "bottleneck" problem in biogas promotion process, so farmers without feeding pigs can also use clean energy.
- In 2009, MoA started 16 straw biogas central gas supply projects in 12 provinces.



# Straw densified biofuel technology

- The manufacture and application of biomass pellet molding equipments has formed some scale. The main types include Screw, Piston, etc.
- The densified biofuel includes briquette, pellet, etc.
- The actual great progresses were achieved after year 2000. Equipments for solid pelletizing fuel production and applications, which mostly transformed from feed equipment, were developed to considerable scale. But as a whole biomass solid pelletizing fuel plants are in the demonstration stage.







# Fuel ethanol

- During the *10<sup>th</sup> five year plan*, fuel ethanol plants using aged grain as feedstock were established in Henan, Anhui, Jilin and Heilongjiang province, the total annual producing capacity achieved to 1.02 million tons.
- A fuel ethanol plant using cassava as feedstock was built in Guangxi in January 2008, with year capacity of 200 thousand tons. On April 15, ethanol gasoline for vehicles was available all over Guangxi province.



# Biodiesel

- Currently, the biodiesel production plants mainly use waste oil from the restaurant industry and the leftovers of saponification oil as raw materials. Most is sold as solvent or directly supplied to some companies using as dynamical fuel.
- NDRC has recently approved biodiesel projects of 60,000 tons/year in the Nantong of China Petrochemical Corporation, a plant of 50,000 tons/year in Guizhou branch of China Petrochemical Corporation and a plant of 60,000 tons/year in Hainan branch of China National Offshore Oil Corporation.

## 4. Prospect on China's Bio-energy

- Rural households' biogas projects and biogas projects on farms have successful technologies and great market potential, are the developing focus to supply fuel for rural users in the recent future.
- Biomass solid fuel, straw biogas technology, bio-fuel ethanol and biodiesel technology with the great market potential under the conditions of demonstrations are the developing focus in the middle stage.
- Ethanol production by cellulose degradation and Fischer-Tropsch synthesis technology are the long-term developing focus.



**Thanks!**

