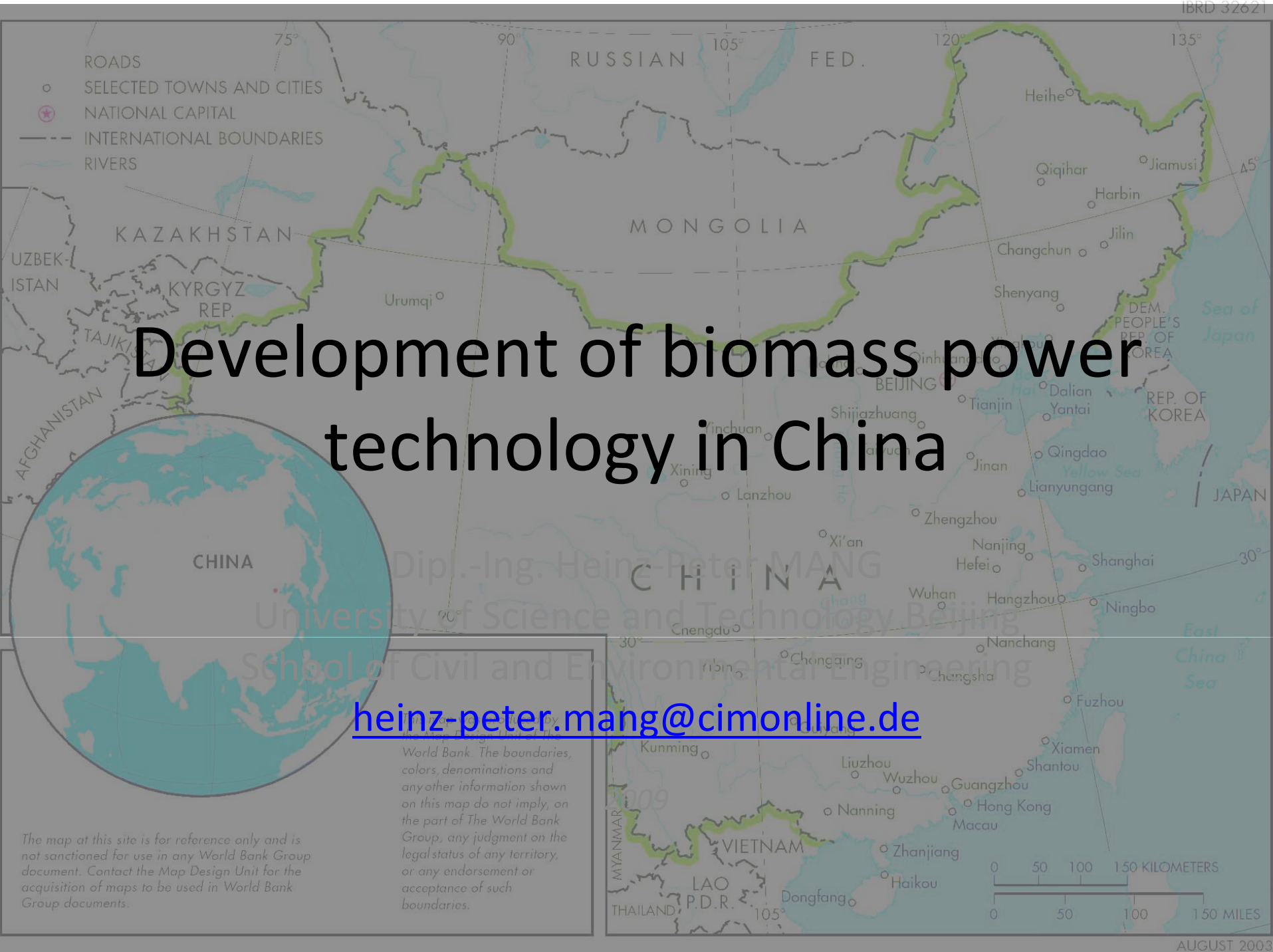

Development of biomass power technology in China

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Biomass power generation in China

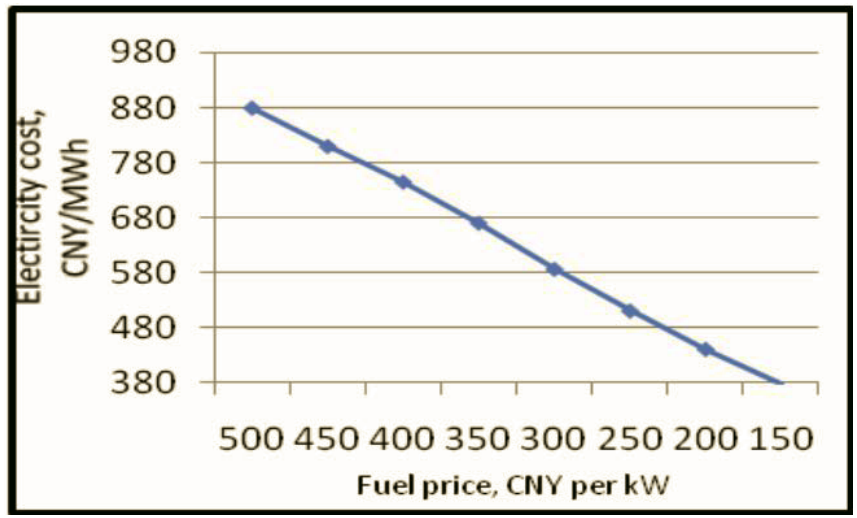
1. Situation of China's large scale biomass energy production facilities from a technology point of view,
2. Number and capacity of biomass power plants in operation,
3. Dry biomass handling processes in China,
4. Outlook on Chinese biomass energy generation capacity,
5. Most suitable provinces for construction of biomass power facilities。

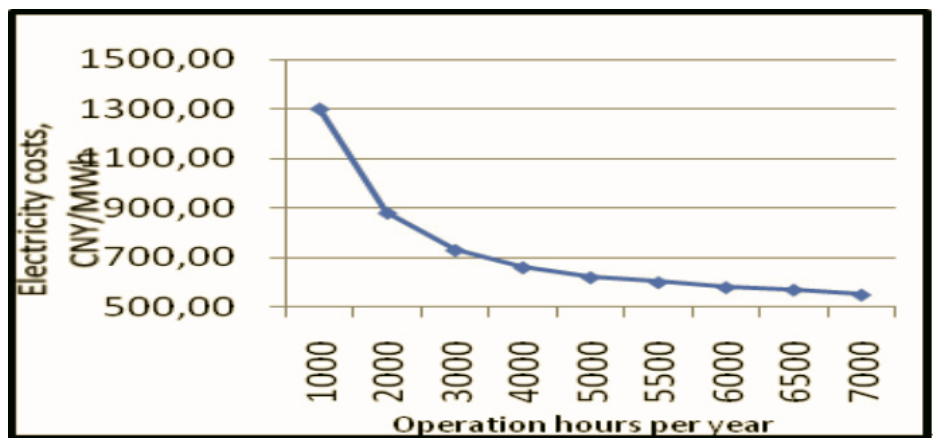
Development of biogas and biomass power technology in China

BIOMASS POWER GENERATION IN CHINA

Situation of China's large scale biomass energy production facilities from a technology point of view

- The average electricity production cost of Chinese thermal biomass power projects is above 550 CNY/MWh.
- With the annual target of only 5,500 operation hours and feedstock prices of 300 CNY/t, achieving 8 % FIRR, the electricity price should be raised to at least 700 to 800 CNY/MWh.





The major types of the biomass boilers currently adopted in China

1. Technology imported from Denmark
2. Domestic CFB boiler
3. Domestic water-cooling vibration grate boiler
4. Reconstruction of small thermal power unit

Feeding device not for all kinds of straw

Technical issues/problems related to the operation of the biomass plants especially for domestic boilers

- Corrosion, tar removal and efficiency of the power generation. The know-how of using Chinese agriculture residues shall be accumulated with long operation hours and improvement during the implementation of the technology.

Technical issues/problems related to the operation of the biomass plants especially for domestic boilers

- Biomass feeding system, ash removal and combustion stability and materials of the pre-heaters and super-heaters shall be carefully investigated.

Technical issues/problems related to the operation of the biomass plants especially for domestic boilers

- Automation level of control is relative low. One of the reasons is that the labor cost is much higher in Europe compared to China. In order to reduce the investment cost, it is likely that owner of the biomass plant would like to accept the low automation solution for the operation plant by involving more operator staff.

Number and capacity of biomass power plants in operation

No.	Project	Province	Current Status	Commission time	Capacity MW	Biomass feedstock
1	NBE Shanxia	Shandong	Operating	2006.12	1×25	Cotton stalks & forest residues
2	NBE Weixian	Hebei	Operating	2007.3	1×24	Cotton stalks & forest residues
3	NBE Chengan	Hebei	Operating	2007.3	1×24	Cotton stalks & forest residues
4	NBE Gaotang	Shandong	Operating	2007.3	1×30	Cotton stalks & forest residues
5	NBE Kenli	Shandong	Operating	2007.3	1×25	Cotton stalks & forest residues
6	NBE Sheyang	Jiangsu	Operating	2007.5	1×25	Cotton stalks & forest residues
7	NBE Wangkui	Heilongjiang	Operating	2007.11	1×25	Cotton stalks & agro residues
8	NBE Liaoyuan	Jiling	Operating	2007.11	1×25	Cotton stalks & agro residues
9	NBE Junxian	Henan	Operating	2007.12	1×25	Wheat & corn stalks
10	NBE Luyi	Henan	Operating	2007.12	1×25	Wheat & corn stalks
11	NBE Juye	Shandong	Operating	2008.4	1×12	Cotton stalks & forest residues
12	NBE Fugao	Henan	Operating	2008.4	1×12	Cotton stalks & forest residues
13	NBE Bachu	Xiangjiang	Operating	2008.9	1×12	Cotton stalks & bush
14	NBE Haishan	Liaoning	Under construction	?	1×12	?
15	NBE Chifeng	Inner Mongolia	Under construction	?	1×12	?
16	Jiatao Jinzhou	Hebei	Operating	?	2×12.5	Wheat & corn stalks, forest residues
17	Rudong	Jiangsu	Operating	?	1×25	Rice & wheat stalks
18	Huadian Shiliquan	Shandong	Operating	?	140	Coal, wheat & corn stalks
19	Xinhua IGCC	Jiangsu	Operating	?	4	Rice husks & cotton stalks
20	Gunaiqi	Inner Mongolia	Operating	?	2×12	Bush
21	Guoxin Huainan	Jiangsu	Operating	2007.11	2×15	Rice& wheat stalks

Chinese CDM biomass projects

Location	CERs estimated (tCO2e/y)	Installed capacity (MW)	Total investment (million CNY)	Main biomass type	Material price (CNY/t)	Electricity input into grid (MWh/y)	Electricity price (CNY/kwh)	IRR benchmark for additionality check (%)
Hebei Jinzhou	178,626	24	259.42	straw	190	132,000	0.51	8
Shandong Yucheng	189,552	15	121.56	Xylose, furfural residues (corn cob)	n/a	71,422	0.26	8
Henan Luyi	185,664	25	244.87	straw, cotton stalks	209	120,000	0.57	8
Jiangsu Suqian	123,055	24	241.34	straw, cotton stalks	300	132,600	0.64	7
Jiangsu Jurong	123,558	24	242.79	straw, cotton stalks	300	132,600	0.64	7
Shandong Shanxian	127,102	25	294.18	straw, cotton stalks	300	127,500	0.66	8
Shandong Wudi	113,433	24	247.74	cotton stalks	200	112,086	0.60	8
Heilongjiang Tangyuan	183,692	24	269.42	straw	150	124,000	0.50	8
Shandong Gaotang	140,695	30	290.96	cotton stalks	280	145,000	0.59	8
Jiangsu Sheyang	109,105	25	276.09	cotton stalks	240	126,500	0.64	8
Hebei Wei county	130,638	25	264.02	cotton stalks	208	126,500	0.59	8
Jiangsu Rudong	143,751	25	290.63	straw, cotton stalks	258	156,937	0.64	8
Total	**1,748,871**	**Average**	**253.59**	**Average**	**240**	**125,595**		

Monitored Chinese CDM Biomass (and Landfill) Power Plants (March 2009)

Project activity	CERs estimated per year	Monitoring period	CERs issued total	CERs issued/year (calculated)	Issuance success rate
Hebei Jinzhou 24MW Straw-Fired Power Project (ACM0006)	178,626	4 Mar 07 – 20 Mar 08	18,044	17,241	10 %
Zhongjieneng Suqian 2*12MW Biomass Direct Burning Power Plant Project (ACM0006)	123,055	18 Mar 07 – 31 Jul 08	108,860	79,309	64 %
Nanjing Tianjing Landfill Gas to Electricity Project (ACM0001)	214,741	1 May 05 – 29 Oct 07	91,890	36,817	17 %
Meizhou Landfills Gas Recovery and Utilization as Energy (ACM0001)	286,525	1 Dec 05 – 31 Dec 07	101,908	48,943	17 %
Anding Landfill Gas Recovery and Utilisation Project (ACM0001)	75,557	1 Jan 05 – 30 Apr 06	13,295	10,026	13 %
Shenzhen Xiaping Landfill Gas Collection and Utilization Project (ACM0001)	471,619	1 Jul 07 – 1 Jan 08	53,509	106,146	23 %
Jinan Landfill Gas to Energy Project (ACM0001)	112,908	13 May 07 – 30 Apr 08	28,333	29,296	26 %

Dry biomass handling processes in China

- **COLLECTION OF BIOMASS**
- Due to the different harvesting methods, the collection methods on the field can be different. This is why farmers choose burning corn stalks on the field. The use of machinery harvesting is not widely implemented for biomass collection though some of equipment is already available in the market. Due to the trend of young farmers to move to the cities, it is likely that dealers organize the collection on the field and the transport to the power plant.

Dry biomass handling processes in China

- **HANDLING PROCESS OF BIOMASS FEEDSTOCK**
- De-humification of the biomass is important before handling it. This will improve the quality and make handling easier.
- Cotton, corn and rice stalks shall be chopped into 10-15 cm piece for combustion in the boiler. Chopping equipment used today is both domestic and imported. T
- The biomass shall be packed. It shall be pointed out that the reliability and performance of the domestic machinery shall be further improved.

Dry biomass handling processes in China

- **TRANSPORT OF BIOMASS**
- The transport is the process that biomass is delivered from the field to the gate to the biomass power plant. The vehicles are often modified from other vehicles or specially designed for the purpose of biomass transport. Subsidies for machinery for collection, transport and storage of biomass have not included in the provincial policy documents. This will make the dealer's benefits lower for the biomass trading which will then transfer to the high price of biomass feedstock.

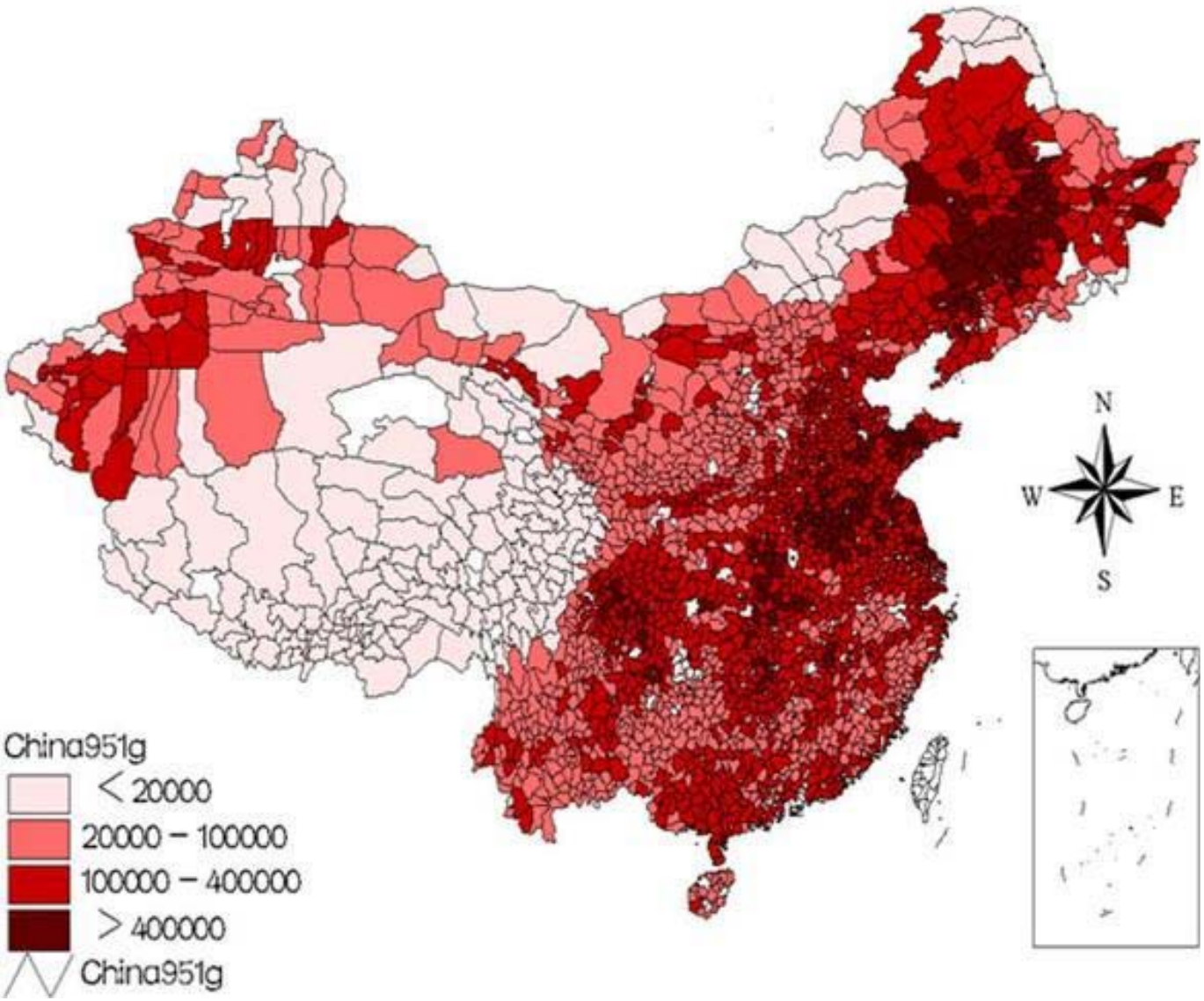
Dry biomass handling processes in China

- **STORAGE OF BIOMASS**
- The scale of storage is determined by the feedstock collection, processing and transport as well as the biomass power plant capacity. A dealer often manages un-treated biomass. Nowadays most of the storage is in open-air or semi-open. Because the agriculture activities have seasonal characteristics, it is not possible to collect biomass over all the seasons of a year. This requires the biomass plant to have a storage with an capacity for at least 6 months.

Outlook on Chinese biomass energy generation capacity

Biomass	**2010**	**2020**
biomass power generation	5.5 GW	30 GW
solid biomass pellets	1 Mt	50 Mt
biogas	19 GM3	44 GM3
non-crop based bioethanol	2 Mt	10 Mt
bio-diesel	0.2 Mt	2 Mt

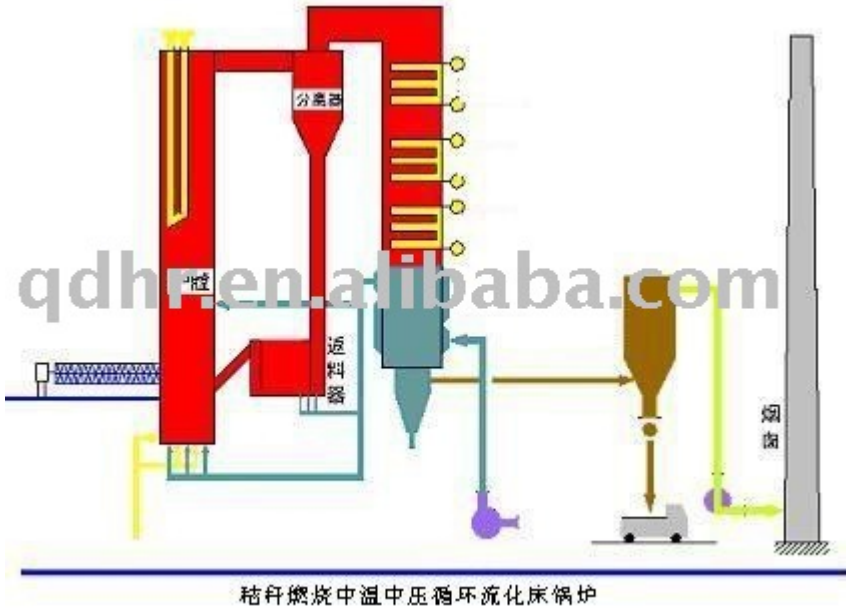
Most suitable provinces for construction of biomass power facilities with regard to different technologies



The provinces with the highest density of straw per capita are Jilin, Heilongjiang, Xinjiang, Liaoning, Shangxi, Henan, Hebei.

Straw and stalk resource distribution in Chinese regions (Mio t)

	Total straw and stalk output	Fertilizer / collection loss	Use as fodder	Use as paper raw material	Use as fuel (cooking & heating)	Others
East China	**184.759**	27.715	42.125	4.291	110.628	
South China	**147.503**	22.126	56.296	7.170	61.911	
Northeast China	**100.646**	15.097	1.934	2.579	63.636	17.400
North China	**86.786**	13.018	13.646	3.105	57.017	
Southwest China	**82.666**	12.400	41.555	2.112	26.599	
Northwest China	**45.566**	6.836	4.910	1.744	26.518	5.558
total	**647.926**	97.192	160.466	21.001	346.309	22.958



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THANKS FOR YOUR ATTENTION