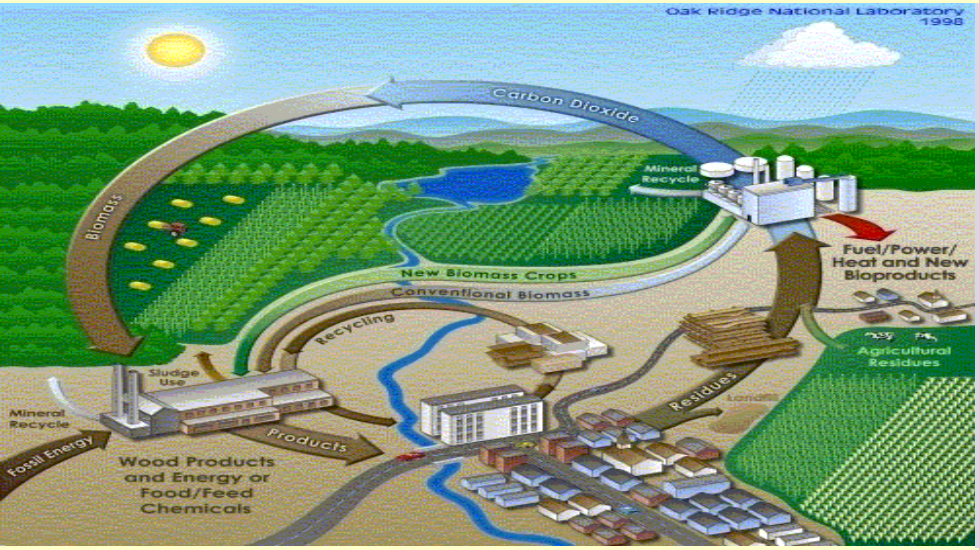
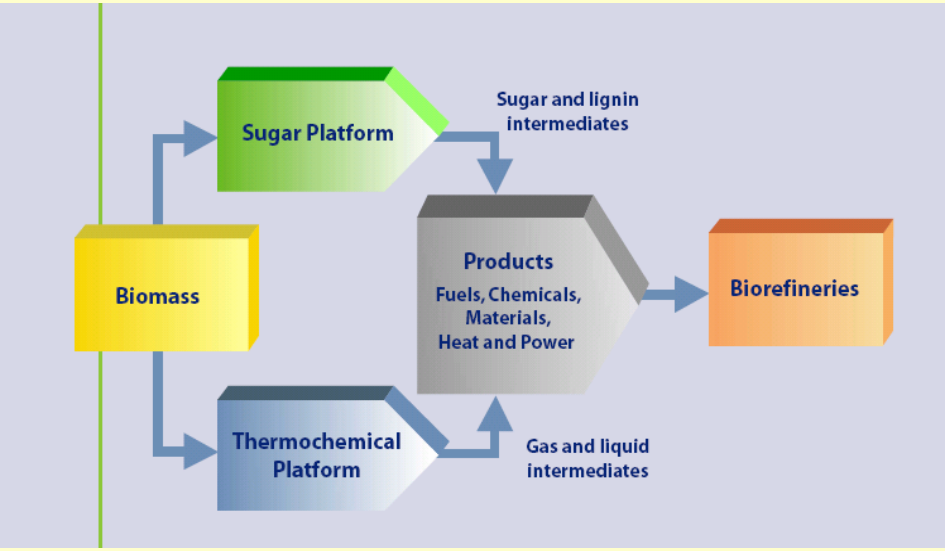
Current Status of Bio-energy From Non-timber Forest Biomass in China

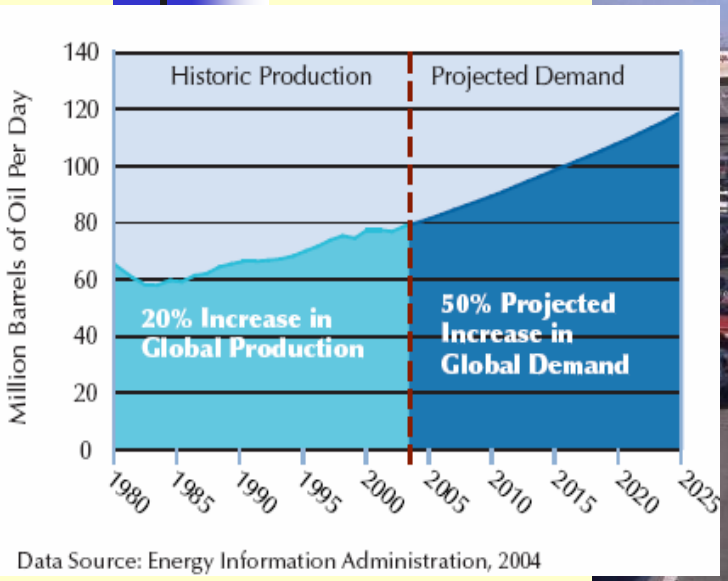
CHU Guxiang

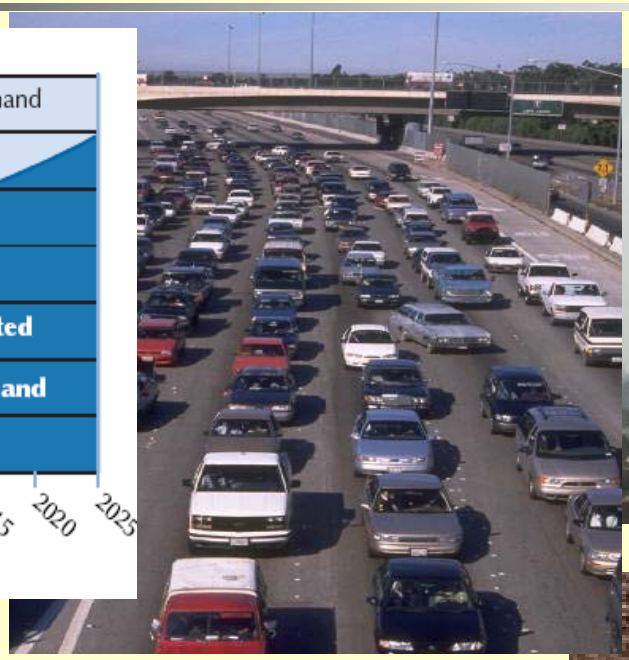
(Chinese Academy of Forestry)





Why bio-energy in China?

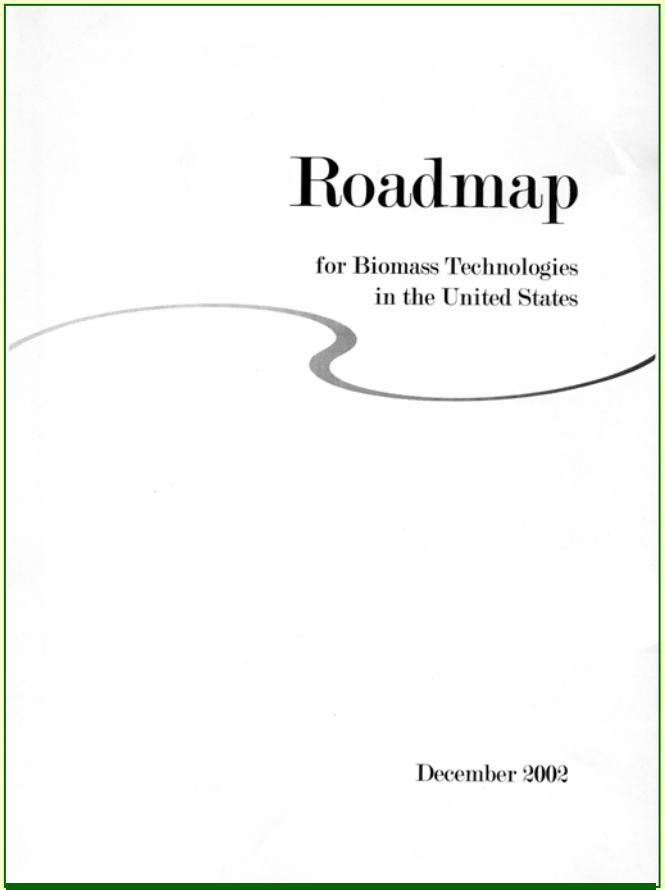




- Over dependence on imported oil
- Environmental issues
- Rural economy Promotion

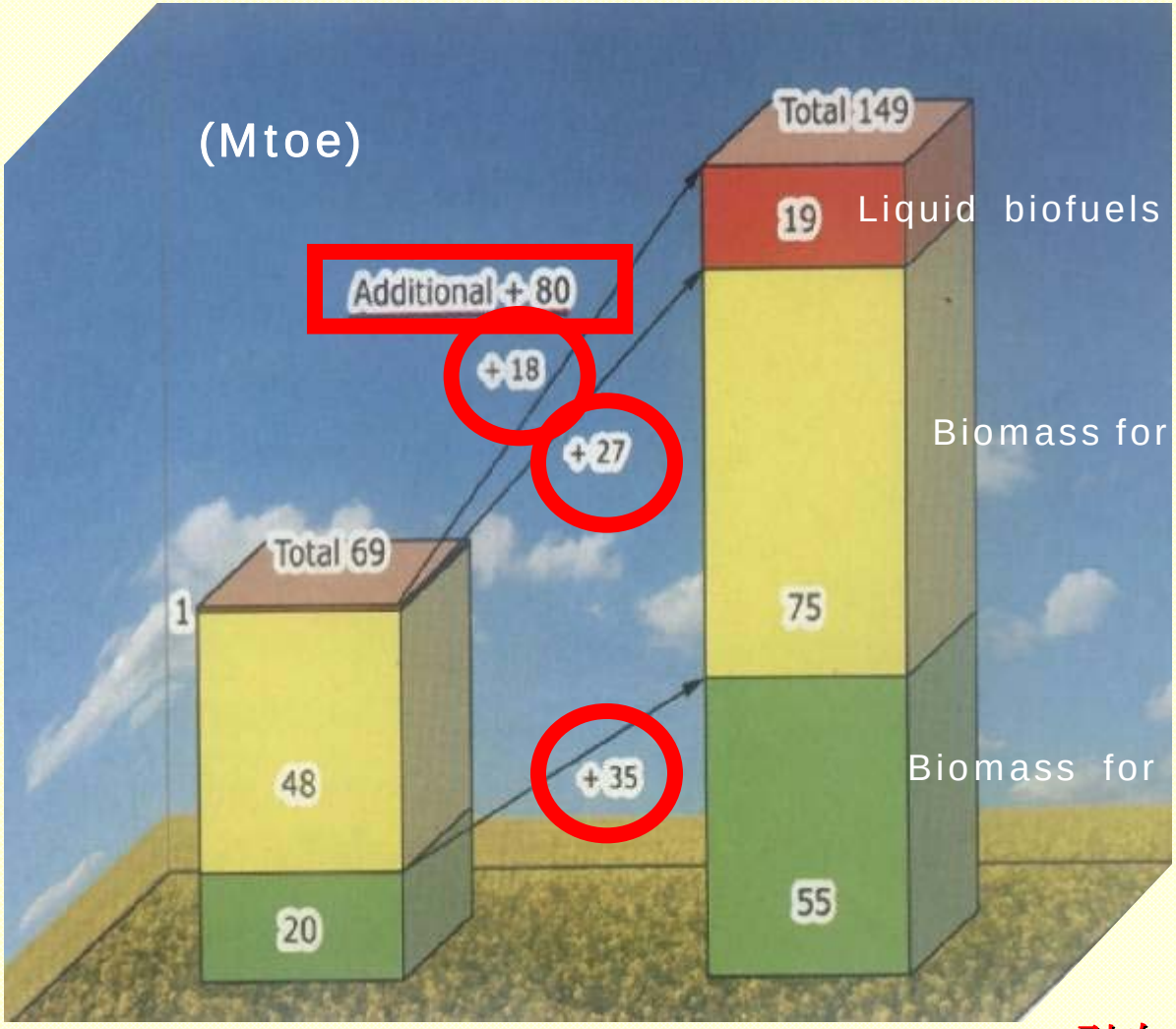
Roadmap for Biomass Technologies in the united States

- Bio-power: Meet 4% of total industrial and electric generator energy demand in 2010 and 5% in 2020
- Biofuels: Increase from 0.5% of transportation fuel consumption in 2001 to 4% in 2010, 10% in 2020
- Biobased products: Increase from 5% in 2001 to 12% in 2010 and 18% in 2020
- $20 billion a year in new income for farmers and rural communities, while reducing greenhouse gas emissions by as much as 100 million tons a year –the equivalent of taking more than 70 million cars off the road



《美国生物质技术路线图》
2002年12月

Targets for Europe -25
According to the Biomass Action Plan(2003-2010)



引自2006年世界生物质能源会议欧盟代表报告

Target of Biomass energy in China

	2010	2020
Bio-power	5GW	30GW
Compressed pellets	1 million tons	50 million tons
Bio-diesel	200,000 tons	2 million tons
Bio-ethanol	2 million tons	10 million tons

Forest biomass resources(1)

- Land area for forestry purpose: 263.3 million ha
- Forested area: 175 million ha
- Forest coverage: 18.21% of the total land
- Forest stock volume: 12.456 billion m^3



Forest biomass resources(2)

Forestry residues

- 110 million tons from forest harvesting and logs processing
- 42 million tons from timber processing
- 60 million tons from other waste timber materials

Forest biomass resources(3)

Oil bearing trees

- 1,554 species of oil plants and 154 species have an oil contents above 40% in the seeds
- more than 4 million ha of woody plants for fuel oil production with an annual fruit production of more than 5 million tons
- 1.5 million tons of annual production of natural rosin

Forest biomass resources(4)

Shrub resources

- 45.3 million ha of shrub forests with biomass production of 181 million tons, mainly distributed in northwest and southwest regions
- more than 3 million ha firewood forests which can produce 80-100 million tons of biomass

Woody biomass resources(5)

- 54 million ha of barren areas which are not suitable for farming but suitable for tree planting. These areas could be exploited to plant high-yielding energy plants

Conversion of non-timber forest biomass

Biomass resources	conversion processes	End products
Forestry residues	Thermochemical	Fuels
Oil-bearing plants	Biochemical	Pellets
Under forest plants	Chemical / physical process	Heats
Firewood forest		Electricity
Shrub forest		Bio-products

Bio-energy from forest biomass (1)

Pelletizing / briquetting

- Compressed biomass to Briquette and pellet with density 1.1-1.4 g/cm3 by using hot extruder
- Some 1.5t/h production lines have already been established
- Useful in house cooking、heating、 industrial boilers and power plants
- Problem: relatively high energy consumption and operation cost

Bio-energy from forest biomass (1)

Pelletizing / briquetting

- **Recently cool pelletising technology was developed with simplified process and low energy demand**
- **Single extruder of 300 - 500 kg/h**
- **Some special appliances for burning pellets have also been developed**

Bio-energy from forest biomass (1)

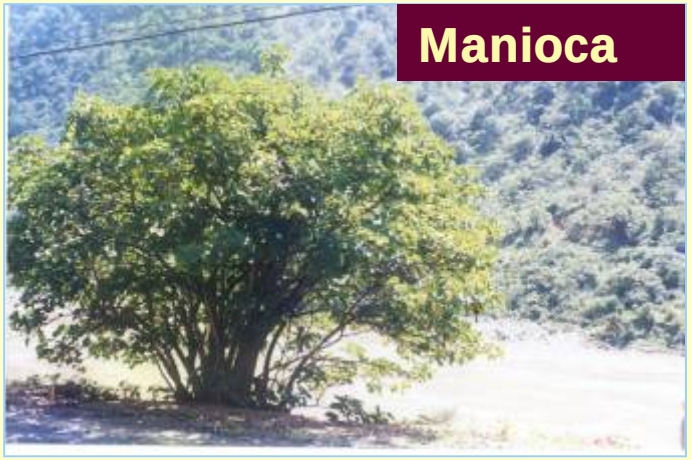
Pelletizing / briquetting

- There are more than half million industrial boilers at average operation efficiency within range of 65 % -70 %, consuming 400 – 500 million ton raw coals every year
- If one third coal used by the industrial boilers are substituted with pellets, 250 million tons of pellets will be needed

Bio-energy from forest biomass (2)

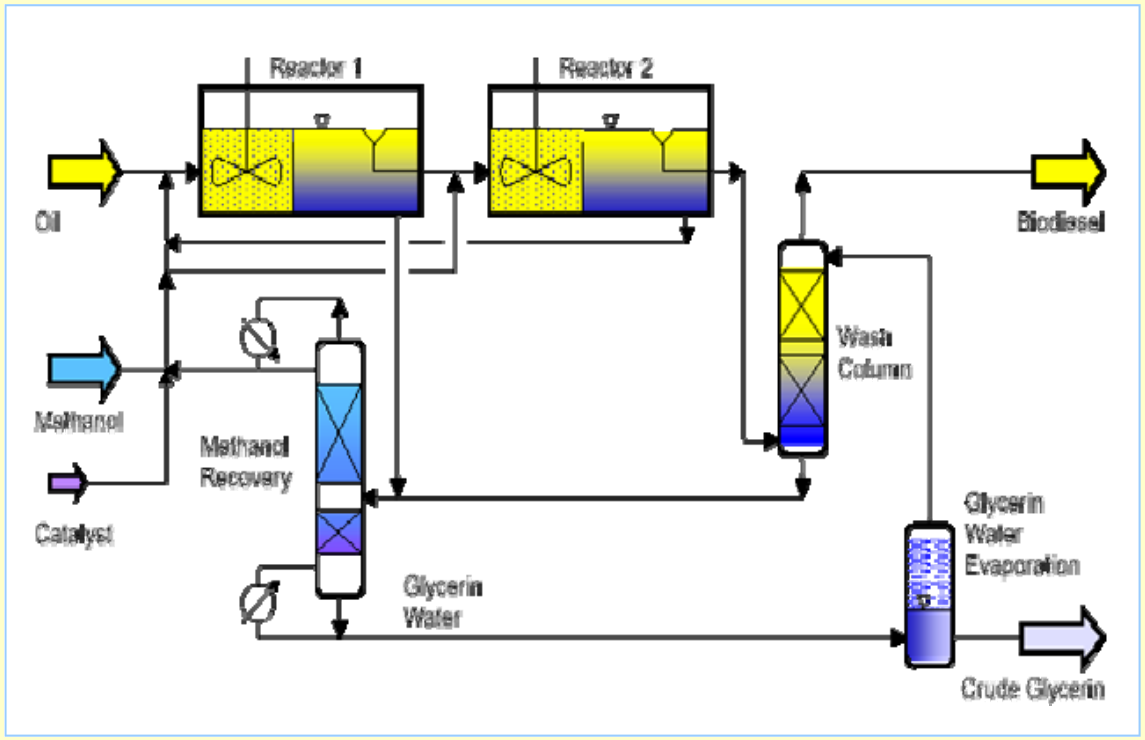
Bio-diesel from oil-bearing plants

- Rich species on oil-bearing plants
- Extension to a certain areas of high oil –content and more adaptive plants for fuel oil
- Progress on converting technologies
- 20,000t/y pilot plants



Bio-energy from forest biomass (2)

Bio-diesel from oil-bearing plants



- Enzyme catalyst
- Non-polluting technology
- Large-scale manufacturing facilities with continuous process

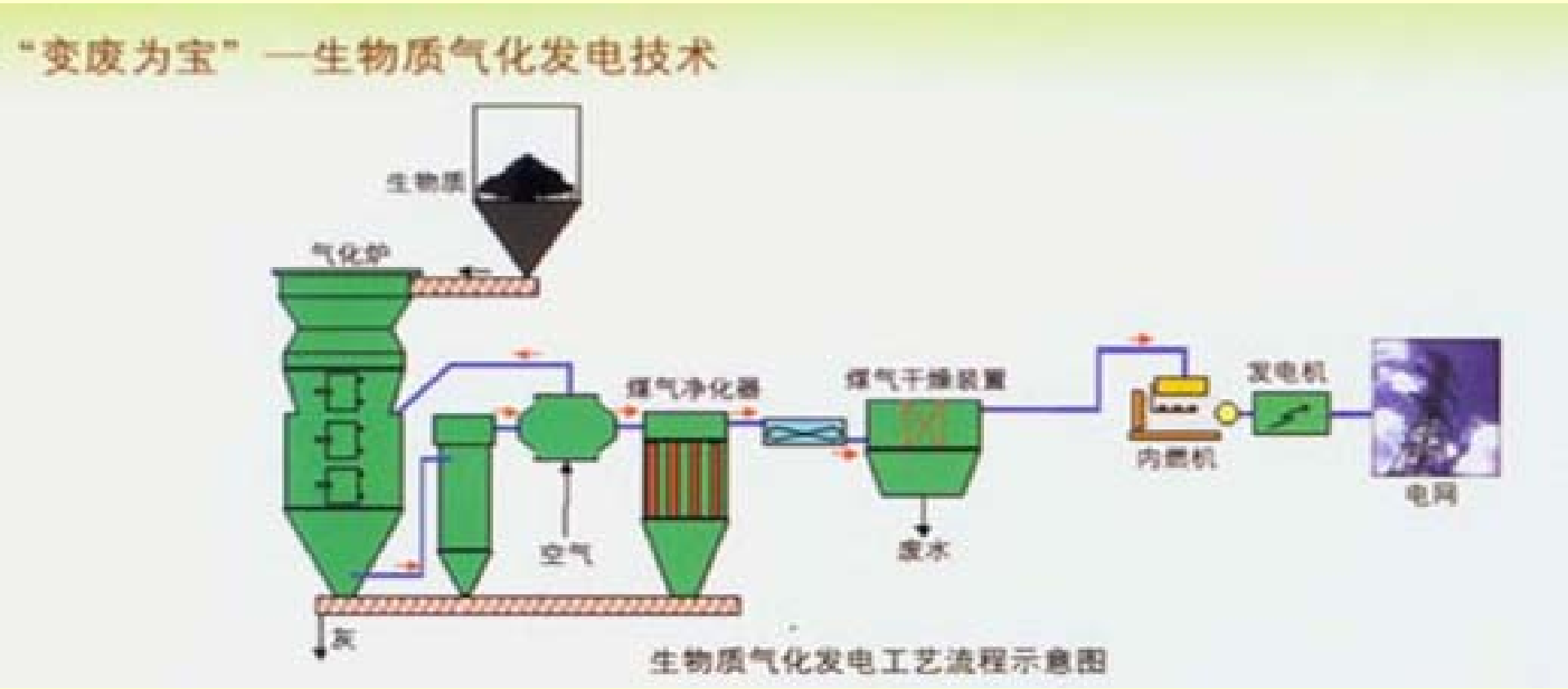
Bio-energy from forest biomass (3)

Gasification and power generation

- More than 300 of small scale gasification systems in rural areas
- Electricity generation using residues have been practiced in some timber processing plants, paper mills
- A number of larger scale demonstration projects of direct burning of forestry residues are been established
- By the end of 2004, biomass power generation capacity installed is 2 GW

Bio-energy from forest biomass (3)

Procedure of gasification and power generation



Bio-energy from forest biomass (4)

Bio-ethanol exploration

- 1 million tons of fuel ethanol was produced in 2005, mainly from Corn and wheat
- Fuel ethanol have been used in 9 Provinces
- For the concerns about food safety and land requirements, woody biomass will be the future feedstock of bio-ethanol



Bio-energy from forest biomass (4)

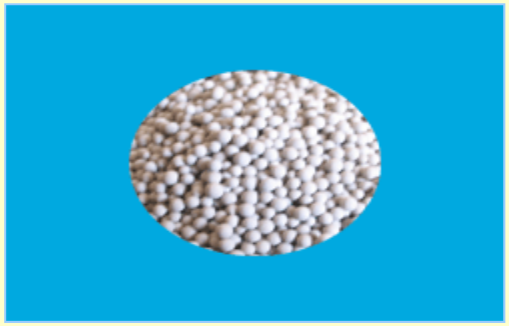
Bio-ethanol from woody biomass

- Bio-ethanol from woody biomass has not been industrialized
- The main bottleneck is the high cost of pretreatment of raw fiber material and production of fiber enzymes that discomposes fiber into glucose
- improvement of the transformation effectiveness and reduction of the production cost will be the key technologies that need breakthrough

Bio-energy from forest biomass (5)

New materials based on non-timber forest biomass

- Composite of wood fiber with polyolefins
- Degradable biomass plastics
- Lignin grafted polymer materials used in sandy soil stabilization
- Acrylic grafted cellulose as super absorbent resin in desert prevention
- Hybrid polymer based on cellulose and acrylate



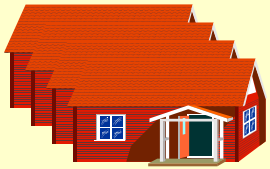
The greatest *challenge* of the 21st century....

....***reduce*** **global warming!**

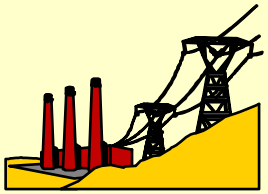
....***improve*** **enviroment!**

....***provide*** **energy for**

transportation



Cooking and heating



electricity

....***provide*** **household necessities**

Conclusion

The renewable ability, biodiversity, environmental friendliness, intimacy with mankind possessed by forest resource all show that the bio-energy from non-timber forest biomass will play an important role in optimizing the structure of energy consumption, expanding production of non-timber forest products, improving ecology and environment, promoting development of rural economy.


Thank you
for your attention!