

# Brief Introduction of Making Ethanol Fuel with Sweet Sorghum

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# Contents

- Strategic significance of making ethanol with sweet sorghum
- Concept of ***Energy Agriculture***
- Ethanol fuel development in other countries
- Brief introduction of making ethanol fuel with sweet sorghum in China
- Conclusions

# Strategic Significance

- Energy demand has increased drastically. Since automobile become household goods, automobile industry has grown with unprecedented speed and the demand for liquefied fuel has increased. China has changed from petrol exporter to importer. In 2003, total import volume for petrol products was 87.18 million tons and the expected total demand in 2004 is 240 million tons.

# Strategic Significance

- Fossil energy resource has been quite scarce. With increased demand for energy, the extensive exploitation has been quite prevalent and the available fossil energy resource has become more scarce. It has been estimated by some experts that coal resource can only sustain 200~300 years and petrol resource only 50 years.

# Strategic Significance

- Fuel's market price has increased. With exhausted resource base and limited market supply, fuel price has grown and this has triggered dramatic cost increase for industries such as manufacturing. OPEC's decision on limiting oil output shall promote price increase.

# Strategic Significance

- Energy security problem has drawn much attention. The fights to control energy resources have led to various regional conflicts. It is not only an economic issue but also a diplomatic and political one. Years of conflicts in gulf region has fully illustrated this point. According to the internationally-acknowledged standards, a nation's energy security is vulnerable to threats when its exported oil volume accounts for half of its total consumption.

# Strategic Significance

- Environment problem has become increasingly serious. According to statistics, from 1960 to 1996, global CO<sub>2</sub> emission has increase from 10 billion tons to 23 billion tons. According to some estimates, the global surface temperature shall increase by 4~5°C in 2050 and the temperature in polar regions by 7~10°C. This change shall cause glaciers' thawing and increase sea level by 3~5m and it is possible that human shall be submerged. The Kyoto Protocol and the World Summit on Sustainable Development has aimed to promote environment protection and sustainable development.

# Strategic Significance

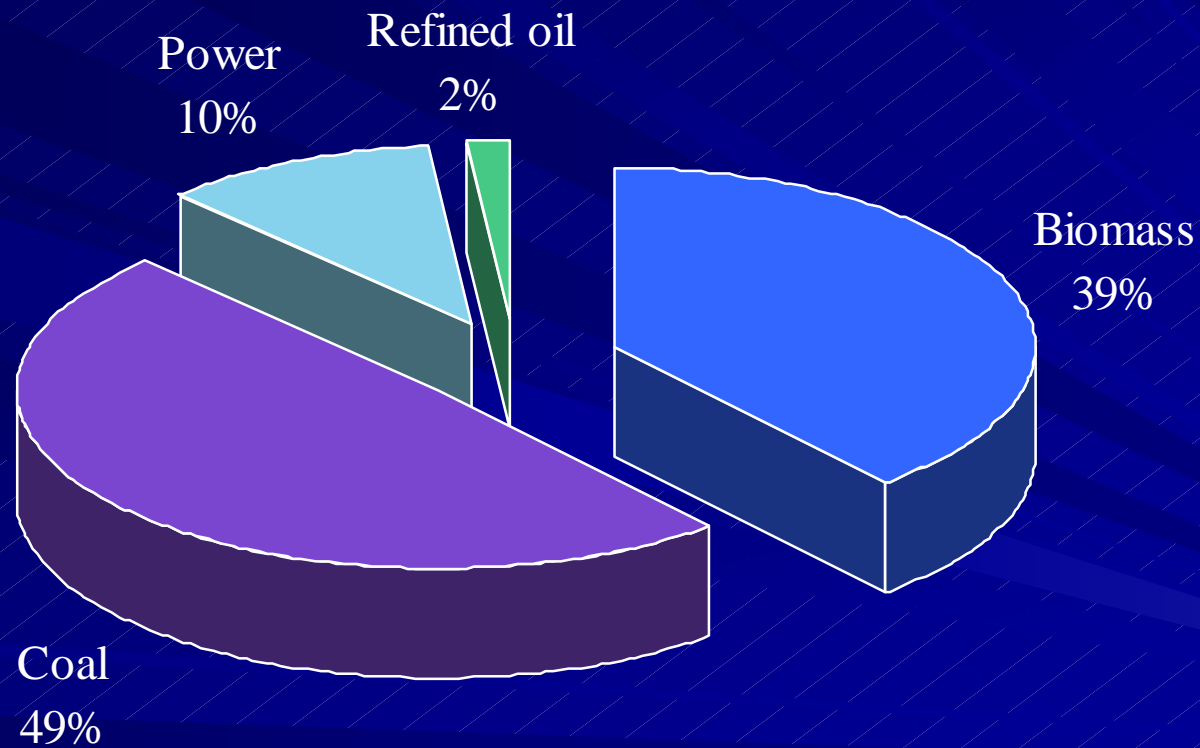
- Abundant biomass resource. As a huge agricultural country, China annually produces more than 700 million tons of biomass such as crop straws and stalks. The widely-distributed, renewable and low-cost biomass can be used to produce various clean fuels and effectively replace the use of coal and oil. This shall reduce the dependence on fossil fuel and guarantee ecological and energy security. Therefore, MOA has put forward the concept of “*Energy Agriculture*”



# Concept of *Energy Agriculture*

- Agriculture used to be a major energy consumer. In 2002, agricultural production and living consumed about 783 million tons of coal equivalent, accounting for more than 40% of the national energy consumption. Among this, 453 million tons were used for living and 330 million tons for living.

# Concept of *Energy Agriculture*



## Concept of *Energy Agriculture*

- From the point of energy consumption structure in rural China, about 40% energy comes from agriculture, including crop straws, stalks and fuelwood. If the annual 700 million tons of crop straw output can be used as energy, it amounts to 300 million tons of coal equivalent. Currently, only 40% is used as energy. Agricultural sector enjoys huge energy supply potential if biomass, fuelwood, human and animal waste and old grains can be used as energy.

# Concept of *Energy Agriculture*

- The currently adopted technologies to convert biomass to energy have gradually become mature:
  - Directly burning technology;
  - Anaerobic fermentation technology;
  - Gasification technology;
  - Solidification technology;
  - Liquefaction (Making ethanol).

# Concept of *Energy Agriculture*

- We hope to gradually transform agriculture from an energy consumption sector to energy production sector with incessant efforts and mature energy conversion technologies.

# Concept of *Energy Agriculture*

- Benefits brought by the transformation:
  - provide clean and renewable energy, replace traditional fossil energy and reduce GHG emission;
  - improve China's energy security and reduce risks caused by international energy market fluctuations;
  - adjust agricultural production structure and improve productivity and comparative benefits;
  - absorb rural surplus labor and increase farmers' income.

# Ethanol fuel development in other countries

- The development and utilization of biomass has drawn governments and scientists' attention. Many nations have formulated plan to develop and utilize biomass as follows:
  - Energy farms in the United States;
  - Brazil's ethanol energy plan;
  - Japan's sunlight plan;
  - India's green energy project;
  - EU members, etc.

# Ethanol fuel development in other countries

- The technology of using ethanol as auto fuel is quite mature in some foreign countries and the United States and Brazil are the major users. EU has begun to produce and use ethanol as auto fuel since 1990s and has formed a complete R&D network on biomass energy.



# Ethanol fuel development in other countries

- **USA:** since the oil crisis in 1970s, the United States has formulated Ethanol Development Plan in order to reduce the dependence on imported crude oil. It has promoted the extension of ethanol that was made out of corn. Laws and supporting policies have been worked out to grant financial subsidy and tax exemption and reduction to producers and users. In August 1999, Clinton Administration announced to implement the long-term plan to replace fossil fuel with crop ethanol and in 2010, biomass shall increase from the current 3% to 10%.

# Ethanol fuel development in other countries

- **Brazil:** since 1975, government has begun to implement Ethanol Gasoline for Motor Vehicles Fuel Plan. In order to promote the development of fuel ethanol industry, the government has developed systematic supporting policies such as preferential tax and loan policy and subsidy. The major raw materials for ethanol fuel include sugarcane, molasses and granulated sugar. In 2000, the total ethanol fuel output reached 7.93 million tons, accounting for  $\frac{1}{3}$  of the total petrol consumption. Brazil is now the largest fuel ethanol producer and consumer. It is also the only country that does not use pure gasoline as motor vehicles gasoline.

## Ethanol fuel development in other countries

- **Japan:** in order to reduce GHG emission, the government has formulated ethanol fuel plan. Japan's Environment Ministry has proposed to mix 10% ethanol that is made out of biomass into common motor vehicle gasoline. Environment Ministry planned to launch pilot auto in 2003 and spread this practice to the whole nation in 2008. By that time, all the motor vehicles shall use this mixed fuel. Environment Ministry shall offer subsidy to change waste emission control equipment and to establish stations engaged in mixed fuel sales.

# Ethanol fuel development in other countries

- **EU:** The key reason to develop ethanol gasoline for motor vehicles is to solve the problem of crop surplus. Currently, with the support of preferential tax policy, ethanol gasoline for motor vehicles has been more and more widely used in EU.

## Brief introduction of making ethanol fuel with sweet sorghum in China

- Chinese government has attached great importance to biomass utilization and has conducted R&D activities such as biogas projects, energy-efficiency technologies, fuelwood, biomass briquette, gasification and gasification electricity generation, liquefied biomass fuels. All these efforts have laid a solid foundation for industrialized development of biomass. The plan to produce fuel ethanol with crop has been launched.

## Brief introduction of making ethanol fuel with sweet sorghum in China

- The production of fuel ethanol has been based on diversified raw materials including corn, sugar cane and sweet sorghum. The project of Producing Ethanol with Sweet Sorghum Stalks has draw attention from relevant ministries. During the Ninth Five-Year Plan and the Tenth Five-Year Plan, MOST has list technical demonstration in Key Technologies R&D Programme and High-Tech Research and Development Programme (863). MOA has also paid attention to the technical development and supported its industrialization.

# Brief introduction of making ethanol fuel with sweet sorghum in China

- China has made great efforts to support ethanol production with sweet sorghum and a lot of experiences have been accumulated:
  - ⇒ On April 2, 2001, State General Administration for Quality Supervision and Inspection and Quarantine (AQSIQ) issued two national standards: *Denatured fuel ethanol* and *Ethanol gasoline for motor vehicles*. These two standards have been followed in production of biomass ethanol fuel;
  - ⇒ There are some excellent sweet sorghum varieties available. The sweet sorghum produced with 863 Program variety has high stalk, high yield and full seeds. More than ten provinces from northern China to southern China have adopted this variety and achieved satisfactory output.

# Brief introduction of making ethanol fuel with sweet sorghum in China

- ⇒ There are a great number of arable and waste lands that can be used to plant energy crop such as sweet sorghum that is resistant to drought, waterlogging and saline-alkali soil. According to some rough estimates, in Neimeng Autonomous Region alone, 10 million Mu land can be used to plant sweet sorghum and 2 million tons of ethanol can be produced;
- ⇒ The improved technology of producing ethanol with sweet sorghum can be adopted for industrialized production. For example, there are fermentation processes for solid sweet sorghum stalks, processes and equipments for liquefied materials and distillation equipments. There are about 200 enterprises specialized in ethanol production and 700 wine enterprises that have ethanol production workshops;



# Brief introduction of making ethanol fuel with sweet sorghum in China

- ⇒ From 1996 to 2003, provinces and regions including Neimeng, Shandong, Jilin, Hei Longjiang, Liaoning, Xinjiang, Chongqing, Sichuan and Hubei had planted sweet sorghum and conducted ethanol production on a small-scale basis. There are about 10 qualified counties and cities that have formulated cultivation plans and project plans;
- ⇒ In 1990, FAO supported China to conduct sweet sorghum research project. In 1999 and 2000, Biomass Committee of CAREI cooperated with European Biomass Industry Association, and conducted feasibility study on making fuel ethanol with sweet sorghum stalk in Huhehaote region. It is expected that the project shall be implemented in 2004 ;

## Brief introduction of making ethanol fuel with sweet sorghum in China

- ⇒ During the past ten years, a great number of scientists, technicians and entrepreneurs have actively participated in biomass liquid fuel R&D and industrialization. Many nongovernmental enterprises have invested in this industry and run market risks to implement national projects and demonstrations. Valuable experiences have been accumulated from these efforts and this will benefit the future large-scale ethanol production with sweet sorghum.

# Brief introduction of making ethanol fuel with sweet sorghum in China

- Chinese government has provided a series of supporting policies for fuel ethanol production:
  - ⇒ SDPC together with MOF has done research on preferential policies such as consumption tax, value-added tax and subsidy on old grains, and formed provisional agreement, which has been principally approved by the State Council;
  - ⇒ Program on the Extension of Ethanol Gasoline for Motor Vehicles during the Tenth Five-Year Period has been worked out. By the end of 2005, the extension of ethanol gasoline for motor vehicles shall be conducted on a national scale basis. Laws and regulations shall be formulated to guarantee the extension of ethanol gasoline;

## Brief introduction of making ethanol fuel with sweet sorghum in China

⇒ According to the current subsidy standards, MOF shall annually grant 1.8 billion Yuan subsidy for the production of ethanol gasoline for motor vehicles to Henan Tianguan Wine Group (300 thousand tons), Jilin Fuel Ethanol Company (600 thousand tons), Heilongjiang Huarun Company (240 thousand tons) and an ethanol enterprise in Anhui province (60 thousand tons);

# Brief introduction of making ethanol fuel with sweet sorghum in China

⇒ Plan on Pilot Use of Ethanol Gasoline for Motor Vehicles has stipulated that enterprises engaged in the production of ethanol gasoline for motor vehicles shall enjoy preferential financial policy: during the pilot period, the 5% consumption tax that shall be levied on enterprises engaged in ethanol gasoline for motor vehicles shall be exempted; value-added tax shall be levied first and reimbursed later; the sales price of ethanol gasoline for motor vehicles shall be consistent with the same grade of gasoline. It is also stipulated that after implementing these preferential policies, the loss caused by denatured fuel ethanol production, distribution and sales shall be subsidized by the government according to the principle of breaking even or marginally profitable.

# Conclusions

- It is a certain trend to use clean renewable energy to supplement or replace traditional fossil energy and producing ethanol with biomass is one of the feasible ways;
- Conducting *Energy Agriculture* demonstration has become one of MOA's key working points in the near future. Major activities shall include: internal and external technical exchanges; research on development strategy and countermeasures; establish high-level demonstration enterprises; research on varieties selection, cultivation extension and technical pilot-scale experiment.

# Thanks

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