



# **International Conference on Bioenergy Utilization and Environment Protection**

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## **CONFERENCE PROCEEDINGS**



The International Conference on Bioenergy Utilisation and Environment Protection was held in Dalian, P.R. China, from September 24 – 26, 2003. It was organized jointly by the Latin American Thematic Network on Bioenergy (LAMNET), the Center for Energy and Environment Protection (CEEP) of the Chinese Ministry of Agriculture and the China Association of Rural Energy Industry (CAREI).

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Updated information on this workshop is available at <http://www.bioenergy-lamnet.org>.

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## **SESSION 5: BIOMASS RESOURCES**

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### **Large-scale Industry Utilization is an Essential Approach for Resolving Stalks**

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#### **1. Preface**

In recent years, it has become a great social problem to burn stalks in grain production districts. It pollutes environment, threatens plane take-off and landing, and influences car traffic. Because this situation is getting worse, country leaders, ministries and commissions put emphasis on this topic and issued a ban on burning stalks. National administration departments on the one side increase technology investment for research on comprehensive stalk utilization and on demonstration engineering activities for the utilization of stalks. On the other side, they adopt manage means to burning stalks and severly execute the law. These measures show a large effect, but burning stalks is still a serious problem. With the developing of country economy and the improvement of farmers living standard, waste stalks are abundant in many districts of China.

It should be considered strategically to resolve the problem of stalk utilization and to eliminate pollution connected with the burning of stalks.

#### **2. Characteristics of burning stalks**

Through the production of food and stalks, grain provides the basis for living of many people in China. In the past, natural economy was the main economical factor in China. Every house was a life and production unit. Economy was not developed, and the living standard was low. Stalk was one of the valuable products of farmhouses. Stalk could be used as fuel for cooking and heating the houses and as raw materials to produce cushions, bars and to cover houses. It could feed flocks and herds. Since reform and opening, the country economy has experienced great changes. Farmers who changed their traditional life style became richer. Tile house were built instead of clay houses. Coal, LPG and electricity and used as energy source and machines replace cattle. Therefore, stalks become waste in some developed districts of China, especially in grain producing districts. So, the problem of stalk burning appeared. The characteristics of stalk burning are the following:

1) According to statistical data of the year 2000, annual production of crop stalk in China is 0.648 billion tons. Corn, wheat and rice are primary comprising 80 percent of the total. Stalk is still used as fertilizer, feed, industry material and planting material, but 45.7 percent of the total stalk is regarded as waste. The quantity of used stalks decreases every year, while waste stalk increases.

2) The largest quantity of stalk per year is 0.185 billion tons in East of China. Additionally, there are 0.147 billion tons in South of China, 0.1 billion tons in Northeast, 0.091 billion tons in North of China, 0.079 billion tons in the Southwest and 0.046 billion tons in Northwest. Provinces producing large quantities of stalks are ShanDong, HeNan, SiChuan, HeBei, HeiLongjiang, JiangSu, JiLin, AnHui, HuBei and HuNan. As in some provinces grain is produced in 2 or 3 harvests per year, stalks are being burned to ensure quick disposal in order not to influence the following harvest.

3) Stalks are burned between harvest time and the next seed time. Time is short and the quantity of stalks is large, so that some places have to dispose stalks within several days.

4) Economy is developed and farmers living standard has improved in some places, so that farmers rather buy LPG than collect stalks for cooking and heating purposes.

5) Disposing stalks is serious in united city-country districts and country layout zones. In these districts farmers strive for the same living conditions as people in the cities.

### **3. Actuality and problems of utilizing stalks**

Stalk is a good available material according to its property and It is widely utilized. It is fuel, feed, fertilizer, base material and raw material.

Stalk is a high-grade feed. With the increased production of meat and milk, waste has continuously increases. Today, stalk waste is 27 percent of the total.

A small amount of stalk is used as base material to breed esculent fungal or earthworm and non-soil plants.

About 3 percents of the stalk is used to make paper, shade bar, table box, packing board, sound insulation board, heat preservation material, artificial charcoal and furfural material.

The use of stalks as fertilizer is 15 percent of the total. In the past, fertilizer has been made from stalks by fermentation, but now stalks are spread in the field after crushing. But this method causes problems as China has more people than fields.

The primary purpose of stalk is the production of fuel. Involved departments attempt to adopt this conversion technique for bioenergy to improve the quality of fuel and to enhance enthusiasm to use stalks as fuel. We have build several hundreds of demonstration stations for stalk gasification. The technology routes are of three kinds:

- air-oxidation - gasification
- carbonisation - pyrogenation
- gasification for the generation of electricity.

The technique of stalk gasification is a promising conversion option for bioenergy. But it has some problems:

1) Stalk gasification is determined by the economical development of a city, the financial income and culture. These conditions are not adequate in rural areas.

2) Farmers are short of enthusiasm. They care for house, electricity, water, television, telephone, vehicle and fuel. It is not advisable to depend national allowance on constructing gas pipelines.

3) On account of limited finance and allowance, the investment of stalk gasification system is lower and hidden quality troubles are few. Some departments work out lower department standard and local standard, so stations of stalk gasification didn't run stably and continuously.

4) Stalk gasification improves the rate of energy utilization and decreases the quantity of stalks as fuel in rural area.

5) Concerning departments promote the route of oxidation-gasification of stalk, which produces low heat value and high impurity gas, which does not reach the standard of national fuel gas. The equipment is simple and crude while operating with no economical benefit.

We have more than 700 of these little gasification stations, which cost 0.3 billion yuan, and face termination of operation.

In summary, we have not resolved the social problem of surplus stalks, which pollutes the environment.

#### **4. Development of a great industry system for the utilisation of stalks**

Agricultural production schemes with families as basic units will not resolve the surplus stalk problem. It is considered as macroscopic strategic and great resource utilization problem, which can only be solved in a great-industry system. The technology level for the development of a great-industry system is sufficient today and economic benefits will be considerable after development of suitable markets. The following projects are envisaged:

##### 1) Construction of large production plants for organic fertilizer production

This is a mature technology to crush and ferment stalks to produce organic fertilizer. If we build organic fertilizer plants, which produce 0.1 to 0.15 million tons of fertilizer from stalks every year in surplus stalks district, we can dispose large amounts of stalks and get considerable economic benefit.

##### 2) Construction of large plants for stalk charcoal production

The technology of stalk pyrogenation is the same as for wood pyrogenation. If we build stalk charcoal plants, which produce 0.1 to 0.5 million tons of charcoal in surplus stalks district, we can dispose 0.35 to 1.65 million tons of stalks every year. The plants can produce 0.03 to 0.12 billion cubic meters of gas for the supply of small and medium-size cities and 0.03 to 0.15 million tons of gum. It is a project of great economic benefit.

##### 3) Popularisation of the technology mixing stalk powdery-charcoal into fertilizer

Japan uses a technology that mixes stalk powdery-charcoal into fertilizer for many years. The Chinese Agriculture department should promote this technique and develop supporting policies. This would decrease the quantity of fertilizer consumption and increase the production of crops.

##### 4) Construction of large electricity generation plants using stalks as feedstock

The technology of generating electricity by using smashed or lumpish stalks is mature. If we build stalks electricity generation plants, which produces 0.2 million kW of electricity in surplus stalks district, we can dispose 1.8 million tons of stalks every year, and can get considerable economic benefit. The quantity of generating electricity from surplus stalks is three times the quantity of generating electricity of the Yangtze Gorges, while the investment is lower.

##### 5) Development of utilization techniques for stalks similar to coal

After crushing granules of stalk can be mixed with coal. Mixing of 10 percent stalks powder with coal causes no obvious changes and will increase the production of gas.

#### 6) Wood replacement

Artificial coal made from stalk or straw is a good example for wood replacement. The performance of artificial wood made from sunflower straw is same as that of hard-wood. Fibreboards or thick boards made from stalk powder are is same as the ones made from wood chips.

Artificial wood sticks are easy to transport after crushing under high pressure. They can be used as fuel in the great-industry.

As soon as large-scale utilization of stalks is being developed, collection and transportation of stalks will become more professional. The transportation radius of coal, which is larger than the transportation radius of stalks, is more than 800 kilometres. Therefore, air pollution will also be reduced due to the smaller transportation radius of stalks.

#### **5.Conclusion**

In summary, it is not difficult to solve the problem of burning stalks with the help of mature technologies. The key to resolve burning stalks completely is the development and utilisation of stalk resources, to build designed and industrialized production projects in great-industry systems.

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