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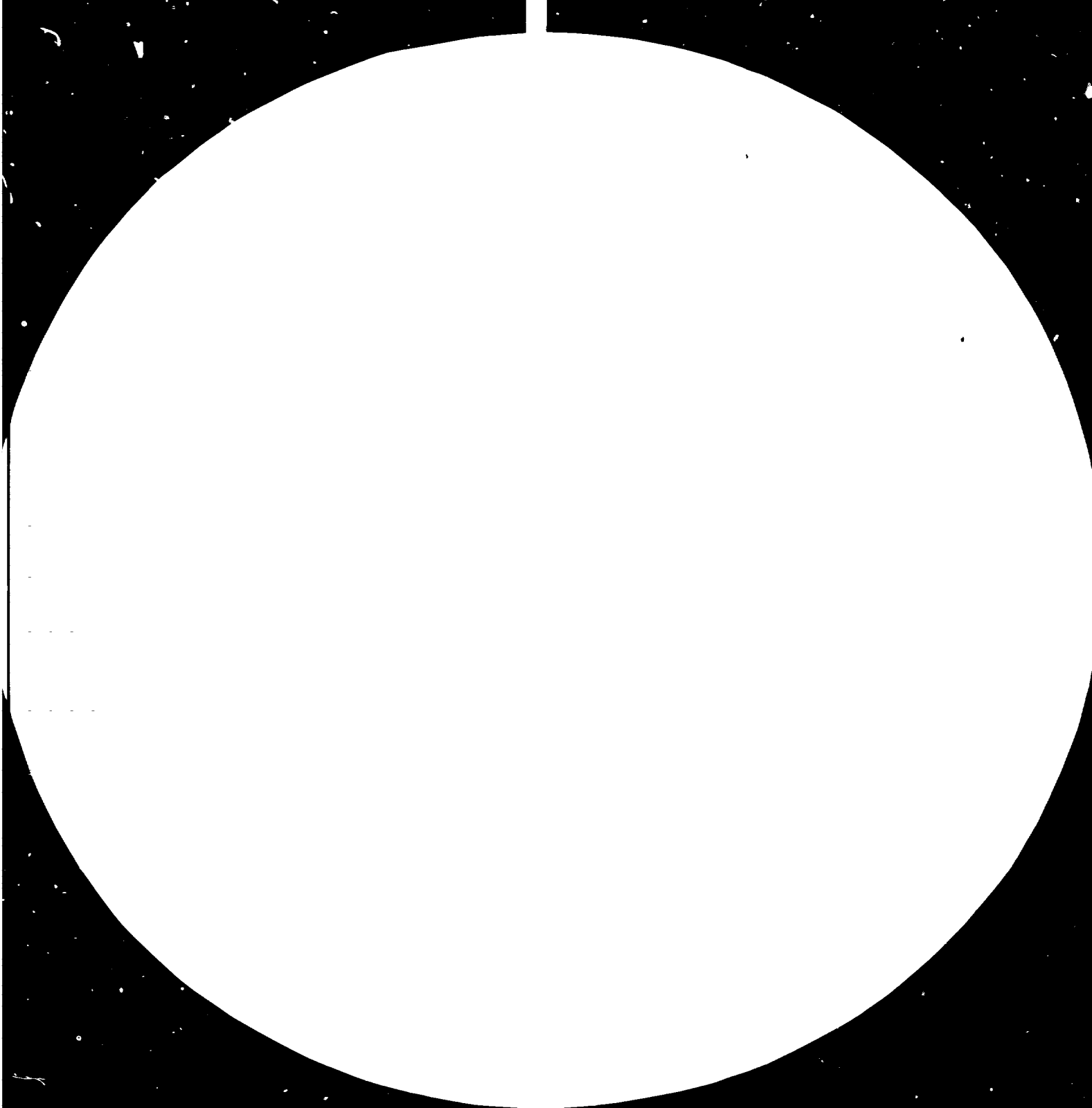
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BIOGAS DEVELOPMENT IN CHINA *

prepared by

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With the current world energy crisis, the utilization of biological energy has aroused interest in many countries and among energy experts. In China the government and experts have also attached importance to the rational utilization of biological energy. As early as the 1930's, bio-gas was successfully produced and used in China. In 1936, Professor Zhou Paiyuan, a well-known Chinese scientist, designed and built a bio-gas digester in his native place in Jiangsu Province for lighting purposes. In Daming county, Hebei Province, an indoor bio-gas digester built in 1937 has been kept in good condition and still produces bio-gas today. In the 1950's, a movement in some provinces popularized the use of bio-gas but the movement failed to develop due to setbacks caused by impetuosity, lack of proper technique and poor management. However, interest was still retained. In 1968, commune members in Zhongjiang County, Sichuan Province, after repeated practice succeeded in producing bio-gas again. By the latter 1970's, with the encouragement and support of the government, there was a remarkable development of the use of bio-gas in the rural areas. Its production and utilization was extended from domestic use to the sphere of production, from the rural areas to urban areas and in technique from fermentation at ambient temperature to mesophilic fermentation and thermophilic fermentation. There are now more than 7 million family bio-gas digesters of 8 - 10 M³ each in the rural areas; benefiting about 30 million peasants. On top of this,

more than 36,000 larger-scale digesters were built in recent years by people's communes and production brigades, state farms, in pasturalands, by wineries, bakeries and confectioneries. They use bio-gas to drive internal combustion engines, pump water for irrigation, grain processing, fodder cutting as well as drying agricultural products and generating electricity. According to incomplete statistics at the end of 1979, 715 small bio-gas power stations totalling 1,234 n.p. and 617 small bio-gas electricity stations, with a total capacity of 5,069 kw, had been built. Besides, pilot projects treating urban effluent and nightsoil through anaerobic fermentation in digesters were built in cities in Guangdong, Shandong, Sha'anxi and Jiangsu Provinces.

The use of bio-gas frees China's peasants to engage in farm construction and provides them with leisure time for cultural activities and sports. When the day's work is over, it is now a common sight in peasant homes, lit by bio-gas lamps or electric lights using power generated by bio-gas, to see men and women, old and young, reading newspapers or magazines, watching t.v. programmes or listening to radio broadcasts, laughing and chatting, singing and dancing.

The rapid development of the use of bio-gas in the rural areas is a combined result of the energy shortage in the countryside, the urgent demand by the people for the development of bio-gas, government encouragement and effective support from quarters concerned.

Although China has rich resources of coal, oil and natural gas, the available supplies of mineral energy to the vast rural areas are restricted by limited capital investment, low technical level, inadequate equipment and transport facilities. In fact for China's 800 million peasants (who constitute one half of the 1,500 million world population that rely on the direct combustion of biological energy), eighty per cent of daily needs have to be met by direct combustion of biological energy.

It is estimated that from 400 to 500 million tons of firewood and straw are burnt up every year in China's countryside. This primitive and backward form of direct combustion is a prodigal waste of natural resources. Not only are large quantities of stalks destroyed by burning, which could otherwise be used as fodder and manure (more than one million tons of pure nitrogen and of organic matter are estimated to be burnt each year), but also large quantities of wood are consumed, causing serious soil erosion and an ecological imbalance. This situation has a direct impact on the development of agriculture, forestry and animal husbandry. Added to this destruction is the time and labour the commune members have to spend cutting firewood, mowing grass, gathering fallen leaves or making trips to town to buy coal. This not only imposes a heavy burden on the commune members but is a great waste of manpower. Therefore, in order to develop agricultural production, the energy problem for the 800 million peasants has to be solved. This is an urgent task confronting the Chinese people. However, it is unrealistic to expect the state to solve

the problem within a short period of time by supplying mineral energy. Through the production of bio-gas, China has now found a practical way to modernize the supply of fuel in the rural areas, that is the scientific and rational utilization of biological energy in the form of bio-gas, produced from manure and stalks which are provided by agriculture itself. In the past when nightsoil was used as manure, the heat it contained was not utilized. Stalks were usually burned directly, laying waste that part that could be used as organic manure. By promoting the production of bio-gas, nightsoil and stalks may be used both as manure and fuel, thus enhancing the value of the natural resources. At the same time the thermal energy utilization by the combustion of biogas produced from stalks is increased by 30% - 40% over that obtained by the direct combustion of stalks.

The key to the rapid development of bio-gas in China has been the vigorous support given by the government. The late Chairman Mao Zedong, Chairman Hua Guofeng and other leaders have all along attached great importance to the development of bio-gas. A national office for the promotion of the use of bio-gas has been set up to ensure its development. This office is in charge of planning, policy, exchange of experience, coordination of research work, training of technical personnel and solving of problems that arise in the development and extension of the use of bio-gas. Similar administrative units have been set up at the provincial and municipal levels, in various autonomous regions and also in many districts and counties. Special

scientific research institutes have also been set up in this field. Scores of institutes and scientific research units throughout the country are now taking part in bio-gas research. Government policy in promoting bio-gas development is to "strengthen leadership in this field, to popularize its use in area after area and to seek steady advances" and "to rely on the initiative of the commune members with help from the governments or collective". Under this policy, the commune members only need to pay for the materials used in building the digesters, while labour expenses are borne by the brigade. The cost of training technical personnel at county, commune or brigade levels and carrying out experiments, is borne by the state. Every year scores of millions of yuan are appropriated by the central and local governments for bio-gas development. The people's communes also provide considerable labour and capital to help the commune members develop bio-gas. The banks too grant low interest loans to commune members with insufficient funds to build digesters. Various agencies make arrangements for the production and supply of materials, equipment and needed apparatus. In short, all trades are organized to promote the development of bio-gas.

China's experience has revealed that bio-gas produced by anaerobic fermentation of organic matter is an ideal source of energy with the following characteristics:

1. Biological energy is the energy in living organisms

produced by the transformation of solar radiation energy to green plants through photosynthesis into chemical energy. When it is used up, it can be reproduced. Bio-gas is the most scientific and rational utilization of biological energy. It provides a new inexhaustible source of energy.

2. There are abundant resources everywhere for bio-gas such as animal manure, stalks, fallen leaves, weeds and organic effluent etc. They may be collected and fed into digesters which produce the bio-gas for use. According to preliminary estimates, if only half of the nightsoil and stalks in the countryside were collected and used to produce bio-gas, 68,300 million M^3 of bio-gas could be produced each year which could provide 800 million peasants with gas for daily use, with a surplus of 6,000 million M^3 . This surplus would be enough to keep 890,000 12-h.p. bio-gas power stations working six hours a day and if used to generate electricity, 9,000 million kwh of electricity could be produced each year, an enormous wealth of energy.

3. The production of bio-gas involves only a small investment, yielding the desired result within a short period and can readily be popularized. One of the characteristics of the bio-gas digester in China is that it is built underground, with a very simple technique which can easily be mastered by the peasants. Since no steel is used, building materials are saved and the cost of construction is low. The underground construction preserves heat in winter. The building of a 10 M^3 digester from breaking the ground to producing gas takes only twenty

days. The materials cost only ¥ 50 to ¥ 80 , which the peasants can well afford. Users who keep the digester in good condition are able to recover building costs from what they save on fuel in a year's time.

4. The sludge in the digester is a high-quality multi-element organic fertilizer valued in farming, by fisheries and mushroom cultivators. Generally speaking, it increases the crop yield by 10% more than other fertilizers. It further improves the quality of some crops. In the long run, the use of bio-gas fertilizer will have the effect of improving the soil. This is an important discovery in the development of the fertilizer industry in China. The evolution of a system involving the use of organic fertilizer with bio-gas fertilizer as the key link is now being studied.

5. Bio-gas in itself is pollution-free, a hygienic energy resource. Its combustion is complete, smokeless and dustless, with no environmental pollution involved. Furthermore, animal manure and organic effluent that might otherwise spread disease, are collected, fed into the digester, sealed and fermented, thus improving environmental hygiene and greatly reducing the breeding of mosquitoes and flies. The eggs of parasites and bacteria are for the most part deposited and killed in the digester. When the sludge is discharged from the digester and lime or ammonia is added, all the remaining eggs and larvae are destroyed. Thus the spread of disease is effectively prevented and sanitation in the rural areas improved. This is an important environmental protection measure for rural development.

The Chinese government has included the development of bio-gas in the Agricultural Development Programme as a component part of the modernization of agriculture. With the readjustment of the national economy during the last two years, the pace of bio-gas development has been intentionally slowed down in order to focus attention on consolidating and improving the management of existing digesters, summing up past experience and intensifying scientific research work, so as to prepare for development in the future.

Positive progress has been made in bio-gas development in China through practical experience up to now. Yet, much work remains to be done. Efforts are now being made to effect improvements. During the current decade, the use of bio-gas in China is expected to develop on a bigger-than-ever scale.

In today's world which is seriously threatened by the energy crisis and environment pollution, the production and utilization of bio-gas can turn waste materials into things of value. It has great potentials. The Chinese Government and its experts would like to cooperate with their counterparts in the United Nations and friends in various countries in a common effort to make bio-gas serve the interests of all mankind.



