

The Promotion of Rural Domestic Biogas Plants in P. R. China

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1. Brief introduction

- **1.1 Current number of domestic biogas plants in use**
- After the 21st century, since feasible measures to disseminate biogas technology by the Chinese government, the numbers of domestic biogas plants in use was up to the high level, that was 15.4 millions by the end of 2004, Fig.1. The numbers of new plants in 2003 and 2004 were increased very quickly, separately with the numbers of 2.1 millions and 2.87 millions, Fig.2.
- By the end of 2005, the number of domestic biogas plants in use might be expected up to 18 millions.

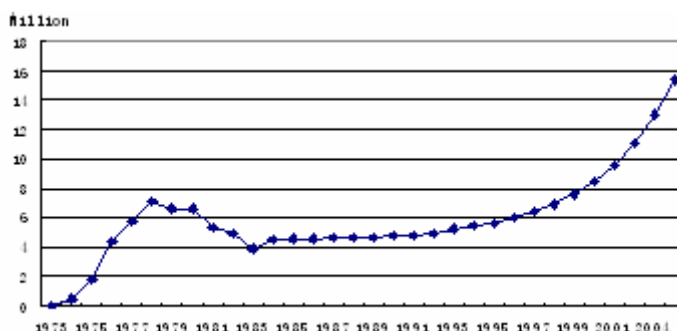


Fig. 1 The curve of the number of domestic biogas plants in use in China (1973 – 2004)

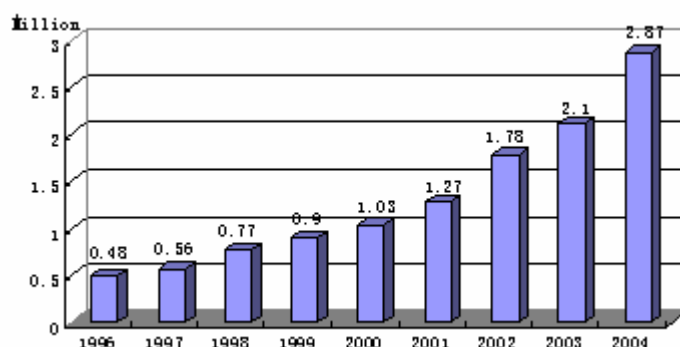


Fig. 2 Installation growth of new domestic biogas plants in China (1996 – 2004)

Faster dissemination speed of biogas in some south-western provinces in China

- Since the favorite financial support by the central government, these provinces, Guangxi, Sichuan, Yunnan and Guizhou, have installed more domestic biogas plants with annual

new digesters of more than 100 thousands.

- Fig.3 present the increase curve of biogas plants in use in Guizhou province, where is the area with the maximum speed of digester installations.

- Fig. 4 show the numbers of new biogas plants installed in Guangxi province from 2001 to 2004, with annual new digester building of more than 250 thousands.

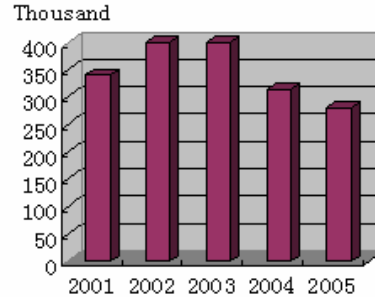
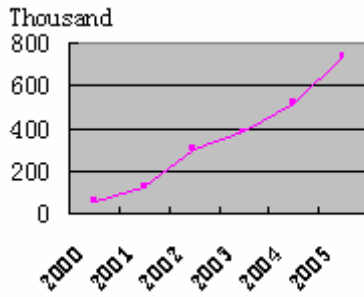


Fig.3 The biogas plants in use in Guizhou

Fig. 4 The new biogas plants installed in Guangxi

1.2 The main types of domestic biogas plants

- The hydraulic biogas plants (fixed dome) is still the main type of digester with National Standard Design Drawing GB/T4750-2002 as a representative type in China.
- But there are more number of biogas digesters with separated floating gas drum in Hunan province and more numbers of the digesters with strengthening slurry recycle.

1.3 Working objective and potential

- The Ministry of Agriculture, P.R.China has set the working objectives of disseminating rural biogas steadily with the goal of increasing the number of domestic biogas plants to more than 27 million by 2010, accounting for over 10% of the total rural household in China.
- Based on current installation speed with annual increment of more than 20 millions of biogas plants, the objective will be achieved, no problem.

Potentiality of domestic biogas plants in China

- It was forecasted that the potentiality of domestic biogas plants is 150 millions on the basis of climate potential and social-economic potential by Some Chinese experts , that may cover of 55% of the household in rural area in China. It means that the number of biogas plants in use will meet the requirement of 20% of potentiality by 2010.
- If we consider the trend of rural economy developing in China, the potentiality should be modified based on two aspects: (1) Industrialization of animal husbandry with fast development speed; (2) the movement of traditional farmer from rural area to cities and towns.
- Approximately, the potentiality of domestic biogas plants in China is among the 80 millions mainly based on the national pig dung potential.

The calculation of biogas potentiality based on the number of pig in pen

- The number of pig in pen (2004) : 0.48 billion, in which 70% were raised by individual farmers.
- If individual ratio of pig in pen changes from 70% to 60% by 2010, the pigs in pen raised

by individual farmers will be about 0.3 billions.

- For feedstock requirement, a biogas plant with 8 m³ will need the manure of 4 pigs in pen at least .
- $0.3/4 = 0.075$ billion (biogas plant potentiality)

The promotion of biogas affected seriously by pig farming

- Since different reasons, some people in rural areas do not dealing with livestock farming now. Then, the installation and operation of domestic biogas plants will be obviously affected by decreasing availability of animal dung, especially pig manure as biogas feedstock.
- The small farms with the husbandry capacity of 30 -500 pigs in pen are the main form of commercial pig farming in China, covering 90% in recent years.

1.4 Lessons learned from post dissemination failure from 1973 -1978

- Between 1973 and 1978, a large scale dissemination program as a jump was launched in China, in which around 7 millions biogas plants were installed through out the country, with annual increase of 1.2 millions.
- But unfortunately, the most of the plants with bad designing and construction quality have been disused up to now.
- The failure of this biogas program was mainly attributed to: lack of the recognized design, construction; lack of the qualified mason and technicians, et al, especially due the weak foundation of economy and institution condition at the moment.
- The failure continually causes a huge negative affection to later promotion of biogas technology in China, even though it was a lesson that could be learnt a lot.

The key feasibility factors for the large-scale dissemination today in China

- Nowadays, the trend of social-economy development both in China and over the world is in a favorable situation to the dissemination of biogas technology.
- There has been the qualification with foundation of institutional facilities, financial support and credit facilities.
- The administrative networking for the promotion, installation, quality control & inspection, training and after sales service of biogas affairs have been established, which covers whole country from central government to the local government.
- The biogas development models suit to both southern or northern areas with different climate and situation have been achieved after demonstration, which have been followed as successful models to the most parts of China.
- There is a huge team with more than 150 thousands' recognized masons, technicians and engineers to satisfy the construction task.
- The commercial market to supply the biogas facilities such as biogas stove et al, has been established .
- Although the R&D of domestic biogas technology did not make a break through during past decade in China, but some progress of R&D had been achieved. As the increase of the budget for R&D of biogas technology during next Five Years Plan, our R & D will be competent the job of supporting the dissemination of domestic biogas for China, and make a contribution to the world.

2. Status of commercialization of biogas products

2.1 Market image of biogas plants

- The objective of disseminating rural biogas plants is consistent with the purpose of developing renewable energy, recycling agriculture and CDM, so that domestic biogas technology and facilities possess a fine market image in China, that is positive for farmers to accept biogas technology.
- The benefits of developing biogas technology have been quite familiar for the Chinese farmers, with respect to those of rural energy, bio-fertilizer, waste-recycling, public health and hygiene, pollution control and rural ecology.

2.2 User's buy capacity

- The user's buy capacity is mainly controlled by the local economic conditions, which are quite different from eastern area to southern area in China.
- The annual income of the farmers in some comparably developed provinces such as Zhejiang and Guangdong in China has been up to 8000 RMB Yuan (equal to 1000 US\$), so the capacity to invest a domestic biogas plant for local farmers is no problem. The dissemination of biogas in those areas is mainly affected by the progress of commercial livestock farming, the production transfer from agriculture to no-agriculture enterprises, and the human settlement transfer from countryside to cities & towns.
- Meanwhile the income of the farmers in Guizhou, one of the poverty province in the southern China, is about 2200 RMB Yuan (275 US\$), the local farmers can't pay for the installation of domestic biogas plants, unless the government supply enough subsidy.

2.3 Commercial level of biogas plants and relative facilities

- As like some agricultural and environmental technology, some benefits of biogas technology embody as for the society and public, not as direct profit to the users. So, it is reasonable and necessary that biogas facilities go through the way with government subsidy.
- In China, the dissemination of biogas plants is not completely in marketing way.

Some facilities and products with high commercial property

- Two sorts of these products:
 - ✓ Biogas facilities, including biogas stoves, lamps, multi-function meters, heaters, pipe et al;
 - ✓ Industrialized biogas plants, such as domestic biogas digesters made of reinforced glass-fiber.
- The main way for the company's sales to government dissemination channel is through participating open competitive bidding.

2.4 Cost of domestic biogas plants

- The costs of domestic biogas plants for either the east or the west are different, based on their different economic condition in China.
- The cost of a 8 m³ plant in Changshun County, Guizhou province is about 1538 Yuan (equal to 192 US\$). If including the cost for toilet remodeling, kitchen remodeling, and pen remodeling, the total investment will be 3533 Yuan (equal to about 442 US\$).
- Meanwhile the cost of a 8 m³ plant in some eastern China provinces such as in Guangdong and Zhejiang will be double.

Table1 The cost of the construction of “one plant with three remodeling” in Changshun, county, Guizhou in 2005

| Sub-project | Item | Cost (Yuan) | Money sources | |
|-------------------------------------|------------------------|-------------|----------------------------------|----------------------------|
| 1. Biogas plant (8 m ³) | Cement | 250 | Government subsidy (756 Yuan) | |
| | Transportation | 80 | | |
| | Biogas facilities* | 256 | | |
| | Mason cost | | 170 | Farmer users (782 Yuan) |
| | | | 130 | |
| | Slurry pump | 70 | | |
| | Seal chemical material | 14 | | |
| | Brick, Sand, Iron | 218 | | |
| | Labor cost | 350 | | |
| Total | 1538 | | | |
| 2. Kitchen remodeling | Mason cost | 15 | Government subsidy | |
| | Construction material | 147 | Farmer users | |
| | Total | 162 | | |
| 3. Toilet remodeling | Mason cost | 15 | Government subsidy | |
| | Construction material | 250 | Farmer users | |
| | Total | 265 | | |
| 4. Pen remodeling | Mason cost | 500 | Farmer users | |
| | Construction material | 855 | | |
| | Cement & Iron | 214 | Government subsidy | |
| | Total | 1569 | | |
| Total of all | | 3534 | | |

*Biogas facilities include: a biogas stove, a lamp, a multi-function meter and pipe

The data is from Quizhou rural Energy Office

3. The institutional facilities and the measures to promote the dissemination of biogas technology

3.1 The institutional measures and policies

It is a useful promotion method that the objective of developing biogas technology coincides with constructing the new countryside in China, which will upgrade the significance and benefits of the dissemination of biogas. Through continually launching biogas programs in national scale, the dissemination of biogas plants has been promoted. The main programs operated in recent years are as follows:

- The demonstration and dissemination of “Eco-biogas Models”, mainly including the southern model “Pig-biogas-fruit” and the northern model “Four in one” in 1990’s.
- Ecological Homeland Construction Program with the construction content of “one new plant and three remodeling”, beginning from 2000
- The construction of Socialist New Countryside, beginning from 2006

Renewable Energy Law of the People’s Republic of China

- The law has been implemented since Jan. 1, 2006.
- By promulgation and implementation of the law, a sound policy and legal environment for development of biogas, as a kind of renewable energy will definitely created.

3.2 Strengthening financial support

- The government financial fund has been increased by both of the central and local governments with a comparably speed since 2001. The central government fund (2001-2005) are as follows :
2001: 100 millions;

2002: 410 millions;

2003 – 2005: 1 billion /a, financed by the government bond.

- The investment of central government leads the input increment from the local government and the users, which form a sound investment mechanism to the dissemination of biogas technology.
- The share of investment by the central government, local government and the users was different from each other in the various areas.

The credit and loan

It is encouraged that the farmers buy biogas plants through credit facilities, which have been tried in the following ways:

- Micro-credit loan is supported with an interest subsidy financed by the local government.
- In order to attract the commercial banks actively participating biogas technology dissemination, the fund of loan guarantee has been provided by some governments and international funds.

3.3 The administrative networking

- The administrative networking for the biogas accessories and fittings has been established from the central government to the local government, with 3,640 departments and agencies in total.
- Number of the officers in charge of the management was about 12,200, meanwhile, the staffs and managers dealing with the biogas tech dissemination were of 26,400 in 2005 all over of China.

3.4 The facilities supply measurement through participating open competitive bidding

- The measures that the facilities are supplied through participating open competitive bidding can ensure the quality of the products, meanwhile the related companies could be forced to be more strong and qualified. This measure has absorbed some qualified enterprises with strong capacity of producing biogas products.
- Up to now, the production capacity of biogas facilities has been up to 3 millions sets/a, which mainly includes biogas stoves, lamps multi-functional meters and pipes.

Biogas facilities include mainly as the follows:

Basic facilities:

- Biogas stoves
- Biogas lamps (including electron lighters)
- Biogas multi-function meter (de-sulphuret, de-water, pressure and switch)
- Biogas pipes and valves

The above facilities are required by each of the biogas users and supplied through the channel of the open competitive bidding. The cost of above four items is about 250 RMB Yuan per household digester.

Additional facilities:

- Biogas cooker
- Biogas heater

3.5 Strengthening the standard making and the establishment of quality control system

- It was from the year of 2000 when the Ministry of Agriculture, P.R.China (MOA)

allocated the specific fund, so as to strengthen the standard making of biogas technology.

- Until now, more than two-third of the standard have been completed.
- It was from Jan.1, 2003 when “Household-used Biogas Digester Standard Collection GB/T4750-2002” were valid, which included the standard of design drawings, construction, quality evaluation, pipe and facility installation as well as operation / management.

Test Center for Biogas Product/Equipment Quality, Ministry of Agriculture (TCBPEQ), in BIOMA

3.6 The training and the entrance regulation

- The quality control of digesters installation is ensured by the entrance regulation for both of the individuals and the construction companies.
- A training system of masons and technicians for the installation of domestic biogas digesters has been established covering all over of China.
- Up to now, there are more than 110,000 of qualified masons with the licenses for digester construction.

3.7 After Sales Service

The service after the installation has been improved even though it was as good as wishes. There are three ways for the services as the follows, tried in China:

- The self-service mode was recommended that the users help each other in a village or a community.
- The service after sales of plants is going on though local markets by some special property management and socialized service companies, such as biogas service companies.
- For some public beneficial projects, the contract of the construction of biogas plants should include the content of after sales service between the responded companies and users.

4. Propaganda activities and advertisements

- As a promotion means of biogas dissemination, a lot of hand books, cartoon books, pictures, posters and VCD & DVD are published every year to guide the activities of biogas programs, mainly financed by the different levels of the governments.

Advertisements

- Nowadays, the companies and enterprises producing biogas facilities, such as stove have pay more attention to the advertisements on some media, including magazines, internet web, TV et al.
- The companies may also upgrade their well-know and marketing share through supporting some social activities and scholastic conferences

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