

Sustainable business models for China rural renewable energy:

study of methane-generating pit and mini hydropower station

Overview of rural sustainable energy in China

Renewable energy development, a key component in constructing China rural area, played an important role in poverty alleviation there. By the end of 2000, rural households across the country had built and used 848 million methane-generating pits, 85511.08 million square meters of solar water heaters, 330,000 solar energy stoves, 120,000 small-scale wind generators, and 89,000 mini hydropower stations¹. Such renewable energy is estimated to account for 10% of rural energy by 2010 and 16% by 2020.² Among other renewable energy sources, the methane-generating pit and mini hydropower stations stand out as two most attractive energy sources for China rural area.

Methane-generating pit

Methane, a principal component of natural gas and a significant fuel, can effectively meet the rural residents' need for energy. Development of the rural methane-generating pits will play a significant role in protecting forest resources, improving rural production and living environment, promoting rural ecological balance, and increase the income of peasants.

Methane is produced from the degradation of organic material through microbial fermentation in an environment with certain temperature, humidity, and pH conditions. The organic materials usually include but are not limited to crop residues, green grass, leaves, reeds, and garbage. After the materials are added into the methane-generating pit, the pit will be sealed to avoid contact of Oxygen which prohibits the anaerobic bacteria to decompose the organic materials and to produce methane gas.³

Since 2000, China invested more than 1 billion Yuan (\$100 million) each year for the construction of rural methane⁴. The Ministry of Agriculture has developed a national rural 2003~2010 methane construction plan that by 2010 the total households nationwide

¹郝先荣, (2006) “中国农村可再生能源发展现状与政策趋势”(the study of China rural renewable energy) Sino-Italian Cooperation Program for Environmental Protection accessed by July 08 2006 from <http://www.sinoitaenvironment.org/ReadNewsex.asp?NewsID=193>

² Yong Wang 王勇 (2006 July 17) “到2010年可再生能源比例将达10%” (the renewable energy will account for 10% by 2010) ebuyww.cn accessed July 20 2006 from <http://www.ebuywww.cn/shownews.asp?id=1189>

³ “general information for methane gas” accessed July 20 from <http://www.biogas-cn.com/cqzs/cqzs2004-1.asp>

⁴ Yiming, (2006, June 10) “农村沼气建设国债项目简介” (introduce for rural methane construction) *MeizhouDaily* accessed July 03 2006 from http://www.e-shidai.cn/www/hb/Article_Print.asp?ArticleID=315

using methane-generating energy reached 50 million, 1/5 of the total residents in rural areas⁵.

A 8~10 cubic meters of methane-generating pit needs 1,500 Yuan(\$190) investment; by using the methane-generating pit, peasants can save 250~350 Yuan (\$30-45) from fuel and electricity fee reduction and 150~200 Yuan (\$20-28) from fertilizers and pesticides use reduction annually; one methane-generating pit can bring direct benefits of 800 Yuan (\$100) annually and the cost can be covered in two years⁶. The methane-generating pit can also significantly reduce the consumption of firewood in rural areas and facilitate greening the rural area. At present, owing to the soaring world oil prices, oil and liquefied petroleum gas prices rose subsequently. Under this circumstance, coupled with reducing production of China large coal mines which led to fluctuations in coal prices, methane, as an alternative to traditionally renewable energy, will become more important. At the same time, methane-generating pit can greatly reduce waste pollution from farm animals, improve rural production and living environment, and reduce the use of pesticide fertilizer to promote the development of ecological system in rural area.

Business models

In this case, one family with a methane-generating pit has a small business model: investing \$190 which is loaned from local government to build a pit which is expected to last at least 15 years. The methane-generating pit will bring this family \$100 annually part of which is from the enhanced crop output by using the high quality fertilizer from the methane-generating pit. In most cases, the local governments would loan the initial investments to peasants free of interests and receive repayment in the following years. In the area where government do not have fund to subsidize the methane pit program, China National Development Bank will provide the fund to peasants to build the pit and the bank will charge very low interest rates.⁷

However, besides this currently dominated model, there is a more prospering sustainable business model related with methane-generating pit to be discovered. Over 90% of urban residents own gas-consuming electronics (mainly gas stoves, water heaters, room heaters) and only 30% of rural residents do⁸. Most electronics companies abandoned rural market because of the scarcity of gas in rural area. However, with the development of methane-generating technology, electronics companies can invest to build large methane-generating pits in rural area and develop methane-power electronics to open the rural market. A well-known methane-power electronics product is methane water heater

⁵ 牡丹江农业信息中心 (2006 April 06) “沼气建设与农村小康的相关性分析” (the relationship between methane-generating pits construction and enhancing personal income level) www.mdjagri.gov.cn accessed July 06 2006 from <http://www.mdjagri.gov.cn/list.asp?id=101125>

⁶ 牡丹江农业信息中心 (2006 April 06) “沼气建设与农村小康的相关性分析” (the relationship between methane-generating pits construction and enhancing personal income level) www.mdjagri.gov.cn accessed July 06 2006 from <http://www.mdjagri.gov.cn/list.asp?id=101125>

⁷ 邵阳市商务局 (2006 July 19) “为使农家更亮丽” (to make the rural residents better houses) 湖南省商务厅 accessed July 19 2006 from http://www.hunancom.gov.cn/szsw_newsread.asp?id=10716

⁸ 王明德 (2004 September 01) “市场前景明朗厨卫家电产业整合尚未完成”(Kitchen electronics have a bright although not confirmed future) <http://stock.163.com> accessed July 08 2006 from http://stock.163.com/economy2003/editor_2003/040901/040901_227410.html

produced by Kema Electronics Company located in Foshan, a city in south China.



<http://www.hxgift.cn/Web/sdkema/Hz/19632/ProductsView/index.aspx>

Such devices can enable the rural residents to enjoy the modern life style at a low cost especially in the current world with soaring energy prices. Because this kind of methane-power products possess many advantages and thus have broad market in rural area, the profit from increasing demand of electronics products for the electronics companies can easily exceed their cost of building pits. This sustainable business model can benefit both the poor by offering them access to more affordable electronics and sustainable energy and the electronics companies by helping them to sell more products, enhance the market shares, and achieve the economy of scales in mass production.

Mini hydropower station

From the perspective of the capacity, small hydropower stations generally refer to the hydropower with capacity of 5 million kilowatts or less⁹. After decades of development since 1949, the hydropower has already provided more than 500 million rural population with access to electricity which was not available before. In 2003, the national rural utilities increased additional 270 million kilowatts to reach a total of 3,120 million kilowatts. In 2003 the tax income from China's rural utilities reached 4.2 billion Yuan (\$50 million)¹⁰.

In some remote rural areas, cooking and heating mainly relies on coal and firewood which emitted carbon dioxide and sulphur dioxide to the atmosphere, causing serious air pollution. Long-term logging of firewood would also devastate the ecological system and exacerbate erosion of land. The use of mini hydropower instead of coal and firewood is more cost-effective in protecting the natural forests, reducing emission of poisonous gas as sulphur dioxide and maintaining a good ecological system. Furthermore, small

⁹ 中国投资咨询网 (2005 May) “2005-2006年中国小水电行业投资咨询报告” (consulting report for China mini hydropower stations for year 2005-2006) 中国投资咨询网 accessed July 07 2006 from <http://www.ewise.com.cn/2005report/2005066.htm>

¹⁰ 润丰、刘文国 (2004 October 20) “关注农村炊烟：小水电成发展最快的可再生能源” (The mini hydropower is best among renewable energies) 新华网 accessed by July 09 2006 from <http://www.ahnw.gov.cn/2006nwqx/html/200410/{87FFF516-FAD3-4AF6-A0B1-29A531B645B1}.shtml>

hydropower plants are low-cost and easy to build, making them suitable for rural and mountainous areas.

Business model

Most mini hydropower plants in China are built by local or central governments which are responsible for the continuous running of these plants. However, in recent years, small hydro-power plants become the target pursued by private capital which is especially active in China west area, a region with plenty of water resources.

In this area, an investor with necessary management skills can expect 15% annual return from a mini hydro-power plant. An investor provided the following data for his own mini hydro-power plant, Yong Le station with an installation of 1,100 kW. This plant needs 5 million Yuan (\$630,000) initial investment and can generate 400,000 kilowatt-hours electricity per month after construction. Calculated with the current price of 0.2 Yuan (2.5 cents) per kilowatt-hour, the revenue will reach 960 thousand Yuan (\$120,000) annually. The investor can get 900 thousand Yuan (\$113,000) of net profit after deducting the tax, maintenance fee and wages and will receive prime cost in seven years.¹¹

The steadily high profit brought by the plant makes this business model a sustainable one that can benefit both the investors and the local residents who have no access to electricity before.

Risk Analysis and Conclusion

There are many limitations for each business model. For the development of mini-hydro power plant, there are two major problems.

The first one is that in China, many mini-hydro power plants have vague property right at this time. In many cases, the initial investment used to build mini hydro-power plant combines capital from both the local governments and individual investors. When the government and individual investors invest into different part of assets for this plant, it is very hard to assess the value of each asset. Thus, it is hard to decide how to allocate the profit. This will hurt the enthusiasm of individual investors who contribute most private capital to the construction of mini hydro-power plants. What the government should do is to adopt some policies or laws to regulate this market. At the same time, there should have a government agency or some organization with clear goal to guide this market.

The second one is that most local government officials in poor rural area have very clear goal for poverty alleviation which is a key standard for the central government to evaluate the local government officials' political achievement. Thus, the local mini hydro-power plant companies usually afford many social responsibilities which can significantly increase the cost and minimize the investors' interests in continuous running of current plants and further investments into other plants. Actually, at this time, local

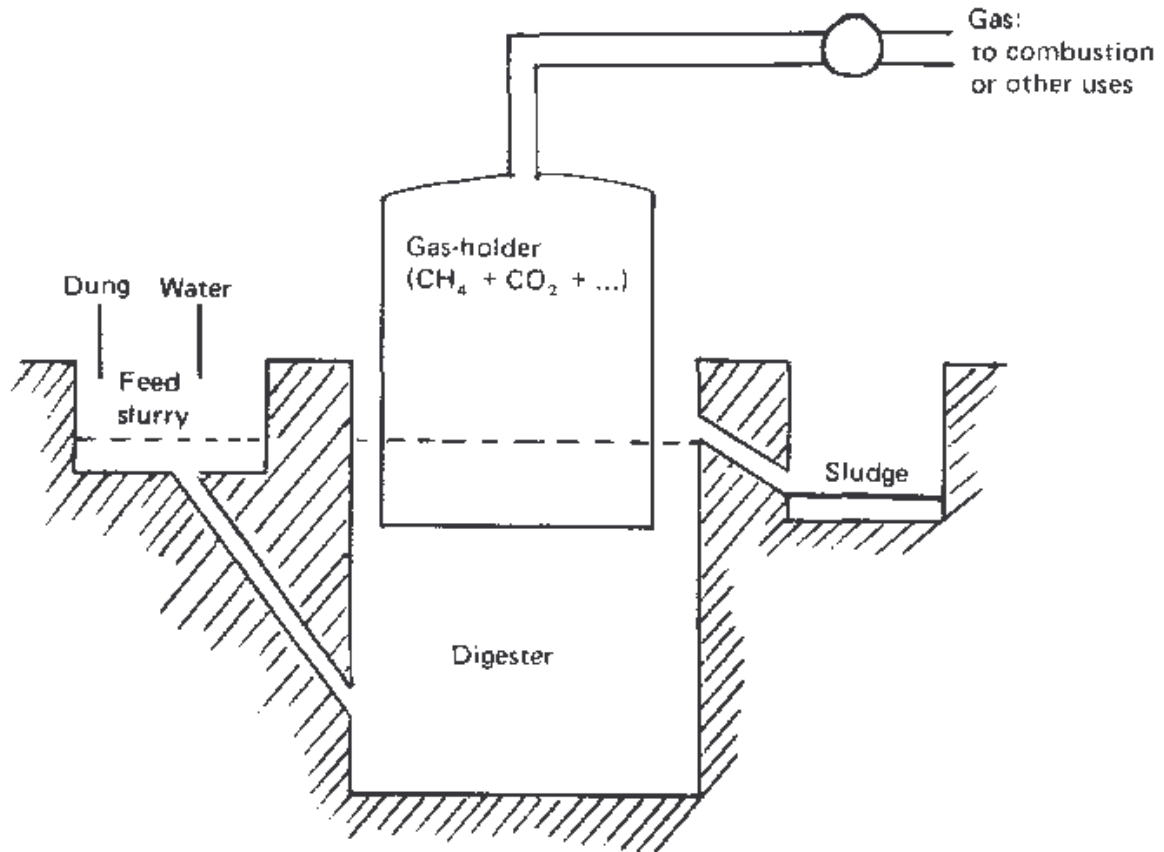
¹¹ SY (2005 Apr 27) “投资者西部淘金热钱为小水电而狂”(Investors are investing mini hydro-power plants in west China) 中国暖通制冷网 accessed by July 23 from <http://www.ntzl.com/zjshow.asp?id=6997>

government in poor area should realize that without enough energy supply, poverty alleviation can hardly be realized in most places. Thus, certain policies should be designed to protect the interests of mini hydro-power plant companies and encourage more investment into this area.

.For the business model related with methane-generating pit, the risks seem to be much smaller compared with the business model for mini hydro-power plant. The companies only need to think about how the demand of methane-power products will be; how to create new market in rural area; and how to build the sales and customer service system in these BOP market.

The two energy sources each have their advantages and disadvantages. The methane needs low initial investment but require special machines to use it. The electricity from mini hydropower has low unit price and can be used with any electronics, but building the plant requires higher initial investment, more technology and personnel. What is more, it must be built in places with sufficient streams. Accordingly, the sustainable business model appears different for them. Investors need a thorough analysis before making final decisions.

Map for methane-generating pit



<http://www.unu.edu/unupress/unupbooks/80434e/80434E1U.GIF>