Beijing Shengchang Bioenergy S&T Co: A Leading Bioenergy Benefits Both Business and Local Farmers

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Sector • Biofuels/Biomass
Type of lead organization • MSME
Executive Summary

Agricultural waste was previously just waste, burned outside in winter. It needs a lot of labour to handle and also produces severe environmental problems. This successful business converts agricultural waste into a valuable product. Beijing Shengchang Bioenergy S&T Co., Ltd. (SBST) is a bioenergy manufacturer located in Beijing, China, that turns agricultural waste into bioenergy, while simultaneously benefiting the local farmers. The company engages in bioenergy production, controlling the process from raw material access to final products and application. There are two production and value chains: one is collecting and purchasing bio wastes from farmers, then producing Biomass Pellet Fuel (BPF) and selling it to the users for cooking and heating; the other one is developing and manufacturing pellet boilers and stoves, then selling them to farmers and industrial users. Local farmers benefit by earning extra income through selling agricultural waste to the company and also by reducing their fuel expenses if they switch from their traditional burners to biofuel burners.

The business has made great impact on the economy, society and the environment. It promotes rural development, thus meeting the goals of the Government of China. Through purchasing agricultural waste (AW) from farmers and promoting biofuel burners, so far it has benefited at least 30,000 households. Families who sell AW to the company can gain an extra CNY 2,400 per year, while those families who are using biofuel burners can reduce their fuel expense by CNY 600 per year. Meanwhile, the burners reduce coal consumption and greenhouse gas (GHG) emissions. If the government could develop policies to treat the bioenergy industry in the same way as other renewable energy sources in China, the business could be scaled up quickly and have a greater impact.
Introduction

Mr. Yonghong Fu’s office is located in Beijing Bioengineering & Pharmaceutical Industrial Park in Daxing District, in southern Beijing. Mr. Fu is the Chairman of the Board of Beijing Shengchang Bioenergy S&T Co. He described his dream and the perspective of bioenergy industry as “a neglected golden mine.”

“China is developing quickly but still remains an agricultural nation with 721.35 million rural residents, which is 54.21% of the national population. The population living below the poverty line is 43.2 million,” Mr. Fu says. “The national poverty line is adjusted almost every year. The poverty line for 2008 and 2009 is CNY 1,067 (US$157).”

China produces 700 million tons of agricultural straw every year, with other agricultural waste (AW), such as excrement from cattle, pig and poultry feed-yards. This straw is usually burned outside in fall and winter, which causes severe air pollution and shutdowns of airport operations. For example, in September 2007, the fog and dust due to farmers burning straws in the surrounding area of Jinan, the capital of Shandong province, caused 141 air flight delays and five flights to be re-routed. In June 2009, burning straw forced the Liangyungang airport to shut down.

Straw is actually not waste. It can be used as bioenergy. Using particular technology, straw can be converted into biomass pellet fuel (BPF). Such BPF can be used to replace traditional coal for cooking and heating. If 300 million tons of agricultural straw of the 700 million tons could be used, an estimated CNY 180,000 million value would be created. The ash produced by burning BFP can also be used as a highly concentrated potash fertilizer for farming. “We also need to notice that there is a considerable amount of lower income rural people, even in Beijing.” Mr. Fu says.

Rural people in China still have lower income compared to urban residents. Beijing, the capital of China, is well developed, but the income of farmers living and working in Beijing rural (suburban) areas is much lower than those living and working in urban areas. According
to statistics by the Beijing Statistics Bureau, the average annual income of the Beijing rural farmer is as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Average income, Beijing farmer (per person per year)</th>
<th>Average income, urban resident (per person per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>CNY 10,474 (US$1,531)/pp</td>
<td>CNY 24,725 (US$3,615)/pp</td>
</tr>
<tr>
<td>2007</td>
<td>CNY 9,559 (US$1,398)/pp</td>
<td>CNY 21,989 (US$3,215)/pp</td>
</tr>
<tr>
<td>2006</td>
<td>CNY 8,620 (US$1,260)/pp</td>
<td>CNY 19,953 (US$2,917)/pp</td>
</tr>
</tbody>
</table>

Although the Beijing rural average income is not below the national poverty line, the average rural income was only 42% of the urban average income in 2008.

Beijing rural farmers’ average income is more than 50% less than Beijing urban residents’ income. Increasing farmers’ income is one of the key tasks of Beijing’s government, and also one of the social responsibilities of entrepreneurs. “From the sensitivity as an enterprise, I am aware that traditional power production and consumption based on fossil fuel and related environment protection is a critical issue for China, while China is developing its economy quickly. We need to develop our power generation to match the growing power demand but also protect our already very brittle environment,” Mr. Fu explains. He further wishes to explore a second area for business development: bioenergy.

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8 The exchange rate 6.84 between US$ and CNY is used. This is the current exchange rate. The rate should be slightly higher in previous years.
The green energy business, including bioenergy will have a bright perspective in the long-term; however bioenergy is just in its infancy compared with other renewable energy sources, such as wind farms and the photovoltaic (PV) industry. Bioenergy technology development and bioenergy application will play two roles: clean energy production and environmental protection. Bioenergy is an alternative energy for traditional fossil fuel, especially coal, which currently supplies more than 70% of energy in China. Furthermore, collecting agricultural waste can help farmers alleviate poverty.

“Thus, I, with my wife, decided to invest in this bioenergy business, Beijing Shengchang Bioenergy S&T Co. Ltd., from profit we gained in the bio-medical industry,” Mr. Fu concludes.

**History and development**

SBST was founded in February 2006, with a registered capital of CNY 15 million (about US$2.19 million). This company is a high-technology limited company that is a member of the Professional Thermoelectricity Institution of Chinese Society for Electronic Engineering and member of the Professional Feed Economy Chinese Institution of Forestry and Animal Husbandry. Its main business is in the field of research and development (R&D) of biomass pelletized fuel, the design and manufacture of pelleting equipment, the promotion of biomass power saving stoves and the development of biomass thermoelectricity industry.

The company is formed by three partners: Honghui Medicine Management Co., Ltd., a professional company specializing in drugs and medical devices; Beijing Oumai Investment Co., Ltd., a high-tech company in the bio-medical industry; and Beijing Industry Development Investment Company, Ltd. (BIDIMC), a government-owned investor designed to support industry development. Several cities in China have set up such funds to support new business development. If the business falls into the support category, then it can look for support through equity share. The profit generated may be reinvested in the company. Mr. Fu owns the first two companies and is the Chairman of the Board of both. The share of investment of Beijing Shengchang is as follows:

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9 Source: interview with Mr. Fu, his staff (Ms. Rongxiu Cao) and the company website, http://www.bj-sbst.com.
Table 1: Partners and investment

<table>
<thead>
<tr>
<th>Partners</th>
<th>CNY million</th>
<th>US$ million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honghui Medicine</td>
<td>7.7</td>
<td>1.1</td>
</tr>
<tr>
<td>Beijing Oumai</td>
<td>2.3</td>
<td>0.34</td>
</tr>
<tr>
<td>BIDIMC</td>
<td>5</td>
<td>0.73</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td><strong>2.20</strong></td>
</tr>
</tbody>
</table>

As Mr. Fu explains: “The Board meets several times a year and determines the major business strategies. I am also taking care of the daily operation. The third partner, BIDIMC, is not directly involved in the business operation, except by participating in the board meeting and reviewing the financial statements.”

Biofuel is a brand new renewable energy that has caught the attention of the government and public, which can also be attributed to the leadership of Mr. Fu and hard work of its employees. The company has developed rapidly and received the following recognitions:

- In 2003, the Bioenergy Project Dept. of Beijing Oumai Investment Co., Ltd. was set up;
- In February 2006, the company was founded in the China Beijing Bioengineering & Pharmaceutical Industrial Park in Daxing District, Beijing;
- In August 2006, approved by Beijing Municipal S&T Commission, the company was honored to obtain the certificate of high-tech enterprise;
- In August 2006, the company started batch production of BPF;
- In September 2006, the company’s two house-use-stoves won the Biomass Stove Competition with higher thermal efficiency and lower exhausts. This competition was organized by the Government of Beijing and only awarded three winner stoves in total.
- In March 2007, the company’s BPF factory in Lixian was chosen to participate in the ‘Leading Biomass Pelletized Fuel’ project of the Ministry of Agriculture of China.
The success of the company has received great attention from both society and government. The company has been visited by many important government officers, such as the Chairman of the National Political Consultative Conference, the Deputy Director General of Energy Sources Office of the National Development and Reform Committee, and the Deputy Mayor of Beijing municipality. Mr. Fu was proud when introducing these successes. “Our new bioenergy business has also attracted others, such as New Ventures, an NGO focusing on energy-saving, emission-reduction and low-carbon economy development. They also provide a financing platform for Chinese private business. They are interested in our business development and wish to help us get outside financial investors. But we have not been successful yet”, Mr. Fu says. He further states that “[his] objectives to develop the company are to: fully utilize the agricultural waste, develop BPF pelletizing technology, develop advanced bio-burners and boilers, explore the technical and development roadmap which is suitable for the reality in China, and become the leading business of China bioenergy technology and application.”

Mr. Fu also introduced the team spirit, company mission, management mission and goal of the company. The company’s values include innovation, wealth creation, sincerity, rule obedience and responsibility.
- Company mission: ‘Devoted to the development of bioenergy industry’
- Management vision: ‘Satisfying and creating clients’ demand’
- Development aim: ‘Being the leader in the rural biomass fuel field’
MAJOR BUSINESS ACTIVITIES AND VALUE CHAIN

The company is focused on bioenergy production and controls the access from raw materials to final users. It goes through the following activities to gain profit and drive business forward.

These activities form two production and value chains:

1. Collect (buy) bio waste → Produce bio pelletized fuel (solid BPF) → Sell BPF to farmer family and industrial users
2. Develop and manufacture pellet boilers and burners → Sell the boilers and burners to farmers and industrial users → Users use the boilers and burners to produce electric power or heating by using bio-pellets

Collecting and purchasing bio wastes, such as straw from farmers

The cost of collecting agricultural waste (AW) is a key component in the company’s cost structure. For those farmers who live 30 km away from the company, it is not cost-effective to deliver these AWs directly. SBST has developed an AW collecting mode consisting of: Company + Base + Householders (Fig. 3). More than 20 specialized AW collecting and delivering agents (base) have been developed in surrounding areas. These specialized agents collect local AW from farmers and deliver them to the company. For farmers (households) who live close to the company, they may deliver their waste directly. Each agent usually delivers more than 200 trucks of AW per year. Each truck can be loaded with about 600-1,000 kg of AW; the amount per truck will depend on the kind of AW. The collecting activities are mostly concentrated in the fall and winter months based upon the harvest season of agriculture.

Figure 3: AW Collecting Mode
The company uses the AW to produce bio-pellets as BF. The technological process of production of BPF is shown in Fig. 4, and the fuel types produced to match the requirement of different burners are shown in Fig. 5. There are five different types of fuel: straw palletized fuel, straw block type palletized fuel, straw bundled fuel, wood ship, and wood fuel.

Carrying out R&D and manufacturing of biomass combustion equipment

The burners and boilers to be used for bio-pellets are different from traditional coal-based burners and boilers. The company designed specified burners and boilers for using BPF, which replace the consumption of traditional fossil fuel. The BPF has two basic applications: as fuel for stoves in farmers’ homes and for use in Community Heating Plants (CHP).
The company develops special stoves (burners) to match the nature of BPF. The stoves designed for biomass is shown in Fig. 7. The stoves are sold through rural agents and dealers not just in Beijing, but also in Tibet, Honglongjiang, and other areas. The households who are using the new stoves had the following to say about the new stoves: “The fire of this type stove is easy to be lit.”; “This type stove has no smoke and less dust, it is much cleaner than the old one we used before.”; “A bag of biofuel of 20+ Yuan can be used at home for cooking longer than a month. This is very economical.”

Another main application of BPF is for Community Heating Plants (CHP), an energy producing system, which produces both power and heat by burning biomass fuels. The advantages of BPF CHP are:

- Power savings, by making use of the heat energy coming from the power producing process to heat/refrigerate products.
- Not harmful to the environment, since burning biomass fuels generates no smoke and little emission.
- Balance the uses of energy, by making use of new biomass fuels and reducing the use of traditional energy sources.

The following pictures show the typical examples of BPF in heating applications. It is particularly used in rural public bathrooms since most families lack such facilities at home. Traditionally, these public bathrooms use coal as fuel to heat the water. BPF is also used for heating the office space of village committees in winter.
Greenhouse using BPF

Rural pubic showroom using BPF

Village committee office using BPF for heating
“The energy efficiency of patented CHP system developed by us is higher than traditional systems. The efficiency of the company’s CHP system is 65% while the traditional one is 40% only,” Mr. Fu is proud to report.

SALES OF BPF

“After the BPF is produced, we distribute it in two ways based upon its applications,” Mr. Fu explains (see Fig. 9). For household sales, the fuel is packed in a sack and then delivered to the villages for the purpose of stove fuel. For CHP, the fuel is transferred in bulk style and delivered to community heating plants directly, to replace coal for heating. Annex 1 shows the distribution network in Beijing. Villagers are hired as employees to sell BPF in villages. Usually one salesperson is hired in each village for a monthly salary of CNY 1,000.
“We also provide complete systematic solutions for the bio-pellet plant and the bio-thermal project. This ensures our company is at a complete active position in the bioenergy business. This is the strategy we are adopting to face the competition,” says Mr. Fu confidently.

**Financial model**

The company is a private business, raising money from the profits of the bio-medicine business operation, which is 67% of the total initial investment. “*We convert agricultural wastes into valuables and the value is created along several key business activities,*” Mr. Fu explains, “*The benefits are created and added onto the raw materials for the company and the farmers through four major activities, which are: paying for the collection of straw from farmers, converting the AW into pellets (BF), designing and manufacturing boiler and burners, and energy (expense) saving through households using BPF.*”
VALUE CREATED THROUGH THE COLLECTION OF STRAW FROM FARMERS

SBST pays CNY 160 (~US$24)/T of straw to agents and farmers in cash immediately, which allows the agent to earn a gross income of CNY 25,600\(^{10}\) (~US$3,800) per year through the collection and delivery of AWs. A single farm family will deliver about 10 tons of AW and make an extra CNY 2,400 (~US$350) per year on average. The total number of specialized agents for collecting and delivering AW was 20 in 2006, and increasing by 10% each year. The income of a specialized agent is a gross income since he/she has to pay for the delivery service (truck and gas). Yet, their income becomes even more than the urban average. The extra income for an independent family is 25-30% of the overall household income. This helps to improve standards of living.

A farmer testifies: “I sell corn stalks and peanut skins to the company, and earn an additional 500-600 Yuan per week during the season. The company helps us raise our income and helps reduce air pollution.” Another farmer attests that: “Before, we burned these stalks out, it was smoky and dirty. The company is doing a really good thing that converts the waste into valuables and allows us to make money.”

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\(^{10}\) Each agent collects and delivers ~200 trucks of AW per year; each truck can load about 800 kg on average. Each ton of AW is paid CNY 160 (US$23.5).

Figure 10: Number of AW collecting agent and independent families
Since farmers realize that collecting AW is a profitable activity, more farmers joined the business. The number of agents who collect and deliver AWs to the company is increasing year by year, while the number of individual families slightly decreasing (See Fig. 10). This shows that collecting AW is becoming more concentrated as a business.

On the one hand, the firm converts the AW into pellets (BF), which add extra value onto the raw materials. The BPF is sold at CNY 0.55/kg (~US$0.08/kg). For dry AW, the convert ratio is about 90%. The company pays CNY 160/T, so the raw material cost is about CNY 180, then the produced fuel is sold at CNY 550/T. Taking out all production cost, it is still profitable.

On the other hand, SBST designs and manufactures boilers and burners, thereby creating value through marketing. For example, the burner designed and marketed by the company is sold at CNY 100 apiece (vs. CNY 400 for the first generation). The sales of burners (stoves) for each year are increasing as shown in the following table. Mr. Fu says “You know there is a rural energy office in each county. We publicize the stoves through these offices and let the users understand its benefits. We also convinced the government to provide subsidies to encourage users to replace their stoves (400 Yuan per stove while we sold it for 100 Yuan.)”

So the company’s revenue is coming from three sources: 1) sales of BPF; 2) sales of BPF production equipment; and 3) sales of stoves (burners). At the beginning, the sales of BPF represented 30%, BPF equipment 50%, and stoves 20%. In 2010, the revenue is estimated to be distributed as follows: sales of BPF: 40% | BPF equipment: 50% | stoves: 10% (see Fig. 12).
RURAL HOUSEHOLD ENERGY EXPENSE SAVING

So far, more than 15,000 households in rural Beijing are enjoying the use of BPF stoves. Before using this type of stove, most rural families were using honeycomb briquette. Each family usually uses four pieces per day, costing CNY 3.80 (~US$0.56)/day. Now they are using BPF and each family consumes 3Kg/day: at CNY 0.55/kg, the daily cost is CNY 1.75, i.e. only about half of the previous cost.

Furthermore, this kind of business can be decentralized in the areas where AW is available. AW is a low energy density resource. Long-distance transportation and collection is too expensive, which will lead to poor economies of scale. Therefore, the best way to apply the technology for transforming AW is to develop local AW collection, pellets production and distribution mechanisms. The reasonable AW collection radius is less than 30 km. For this reason, it is not realistic for the company to have the fuel production line in a single spot to distribute its products nationwide. This is why the company is not only producing the BPF, designing and marketing the stoves and boilers, but also designing and improving the BPF production equipment.

This allows anyone who is interested in such business to buy the equipment and then produce the BPF locally, close to the AW source. “Actually we are encouraging people in other places to establish BPF production lines,” Mr. Fu says: “If people establish BPF production lines in their own place, they will make profit through manufacturing BPF, while we will make profit through selling BPF production equipment. For a small village, palletizing equipment with capacity of dozens of kg per hour will be enough. Each machine that costs 7,000-8,000 Yuan (US$1,030-1,175), can produce several hundred kg of fuel per day, which is enough for a small village. For larger villages, a machine with a capacity of 800-1,000kg/hour will be perfect.”
So far, the AW collecting agent is free to get the AW from farmers, since it reduces the farmers’ labour for handling these AWs and benefits both the collecting agent and the farmer. Later, the farmers who own these AWs may negotiate the price with the collecting agents.

The profit created through the AW collection and production is distributed in several ways, including employees’ salaries, R&D, business development, and the company’s shareholders.

- **Employment**: Currently SBST employs 30 people in R&D and engineering technology (80% of whom are at senior level, hold a postgraduate degree, or have returned from overseas). The average salary is about CNY 2,000-3,000 per month.

- **Research and Development**: Developing new product, improving burners, boilers and manufacturing equipment.

- **Expanding production capacity**: Due to the limitation of AW collection radius, several decentralized fuel manufacturing plants are better than a centralized plant. Several new palletizing plants will be established in Beijing rural areas starting in 2010.

- **Net profit distribution**: The net profit will be distributed among the investors based upon their respective shares.

The spending items of the company include the following: raw materials, processing, R&D and administration, and taxes (VAT and sales tax). In 2008, total sales were CNY 15 million, and profit was CNY 1.65 million. The distribution of revenue is shown in Fig. 13, and the distribution of major costs in Fig. 14. More than 10% of the revenue is used to buy agricultural wastes.

**Figure 13: Distribution of revenue**

![Figure 13: Distribution of revenue](image)
Constraints and solutions

“The constraints and difficulties are much more than I thought at the beginning,” reckons Mr. Fu, who identifies four main difficulties.

COMPETITION FROM TRADITIONAL ENERGY SOURCES (COAL)
The inertia of using traditional energy sources is a significant barrier for promoting BPF, especially because of the low price of coal, since it is not being charged for carbon emission and the cost of environmental protection. Also, final users are used to the stove and fuels they are currently using. “Without a significant reason and benefit, it is too hard to convince them to switch from one to another. We need demos. We need to get some funding to help final users to switch stoves and fuel with less ricks and foreseeable benefits”, explains Mr. Fu. To overcome this barrier, there is a long way to lobby the government to act in two aspects: 1) provide subsidy to renewable energy; and 2) effectively manage the traditional energy consumption and pricing. Either one will help the BF industry develop further.

LACK OF FUNDING
AW is a heavily seasonal resource. During the AW collecting season, lots of working capital is needed to buy AW. Also, funding is a key issue in order to design and develop new technology for converting AW into BPF and new equipment to use these BPF, to expand production capacity and establish more BPF power plant for heating, to educate users to become aware of energy and environment issue and shift to BPF, and to develop the market. Mr. Fu and his partners thought that CNY 10 million would be enough, but it resulted insufficient. Therefore, Mr. Fu worked with Beijing Industry Developing Investment Management Company, Ltd (BIDIMC) to successfully convince them to invest in the company.
LACK OF SENIOR PROFESSIONALS

Bioenergy is mature in developed countries, but it is still a novelty in China. Recruiting and training senior engineers and technicians is difficult, and retaining those already trained and experienced professionals is even more difficult. Building a better business environment in the company, including transparency regarding the company and its activities and prospects, is an effective way to retain senior professionals.

LOW DENSITY OF ENERGY IN AW RESULTS IN HIGH TRANSITION COSTS

The nature of AW of low energy density determines that the AW shall not be collected and delivered long-distance. A centralized factory is not feasible financially for BPF production. Decentralization, or manufacturing the fuel production equipment and letting the local people develop the bio-production and distribution business, is therefore an ideal solution.

The constraints and solution are summarized in Fig. 15 below.

![Figure 15: Constraints and strategies matrix](image)

**Actors and their relations**

The three main actors involved in the business model are Beijing Shengchang (the company), farmers, and local government.
BEIJING SHENGCHANG

The motivations/interests of the company are the following:
- Developing bioenergy industry, particularly bio-pellets from agricultural straw
- Making profit
- Creating job opportunities
- Producing clean energy

The role the company plays in the business model includes buying agricultural waste from local farmers, developing boiler and burners to use these biofuel for clean energy, and marketing the biofuel, boiler and burners.

FARMERS

The motivations/interests of the farmers are the following:
- Converting waste into valuable
- Making profit
- Reducing cooking and heating expenses

Their role in the business model consists in collecting straws, selling them to the company, and promoting the use of bio-pellet instead of coal.

LOCAL GOVERNMENT

The motivations/interests of the local government are the following:
- Supporting the company’s development
- Supporting the clean energy industry
- Solving the problem of agricultural waste
- Creating job opportunities

The role the local government plays in the business model includes providing financial support through a R&D fund, developing incentives to promote the market and helping to remove the barriers, as well as providing investment capital in the initial stage of the company development (especially through BIDIMC).

MANAGING THE RELATIONSHIP WITH THESE ACTORS

The relationships and respective functions of these actors are illustrated in the following graph.
• The company – farmers: Buyer-seller (agricultural waste) and seller-buyer (bio-pellet and company products)
• The company – government: Striving in getting support from government, either in R&D funding or incentives
• Government – farmers: Offering incentives.

Results

ECONOMIC IMPACT
Today, the company has developed an annual production capacity of 25,000 tons of palletized BF, and employs 180 people, including more than 30 professionals.

Its revenue was CNY 4 million (US$0.58 million) in 2007 (although it made a loss then) and about CNY 8.5 million (US$1.25 million), with a CNY 1.8 million (~US$260K) profit in 2008. Profit is expected to double in 2009. The capital investment, annual production of BPF, annual production of BPF stoves, sales value, profit and number of employees in history and prediction for the next few years are listed in Table 2 and Fig. 17 below.
Table 2: Statistics of SBST\textsuperscript{11}

<table>
<thead>
<tr>
<th>Year</th>
<th>Investment (CNY, million)</th>
<th>Annual yield Biofuel (1,000T)</th>
<th>Annual yield Stove (1,000 Unit)</th>
<th>Sales (CNY, million)</th>
<th>Profit (CNY, million)</th>
<th>Number of Employees (x10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>15</td>
<td>5</td>
<td>5</td>
<td>4.5</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>2007</td>
<td>15</td>
<td>10</td>
<td>8</td>
<td>8.5</td>
<td>0.85</td>
<td>7</td>
</tr>
<tr>
<td>2008</td>
<td>15</td>
<td>20</td>
<td>20</td>
<td>15</td>
<td>1.65</td>
<td>12</td>
</tr>
<tr>
<td>2009</td>
<td>25</td>
<td>30</td>
<td>38</td>
<td>20</td>
<td>2.4</td>
<td>18</td>
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<td>2010</td>
<td>38</td>
<td>50</td>
<td>50</td>
<td>40</td>
<td>4.4</td>
<td>20</td>
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<td>2011</td>
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<td>160</td>
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<td>120</td>
<td>13.2</td>
<td>30</td>
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<td>2012</td>
<td>98</td>
<td>240</td>
<td>100</td>
<td>180</td>
<td>25</td>
<td>45</td>
</tr>
</tbody>
</table>

Figure 17: Statistics and prediction of SBST

“While the company is developing and making profits, the company also lets the local farmers get some extra income,” Mr. Fu points out. Farmers benefit by selling straw. For these specialized AW collecting agents, each agent usually collects and delivers 200 trucks a year to the company. Each truck can load about 800-1,200 kg depending on the type of AW and the company pays CNY 140-200/ton (CNY 160 on average). So each agent can get CNY 25,600 (~US$ 3,759) per year.

\textsuperscript{11} All data quoted here and later are from the company.
Each individual farmer in Beijing rural areas owns about 2-4mu of arable land, and they may also collect some AW in surrounding areas at their convenience. For example they may collect and deliver 10-20 tons of AW to the company, so they would make around CNY 2,400 (~US$352) per year. Furthermore, these families can switch from traditional coal to BPF for cooking and heating at home, and can reduce fuel expenses by 25-30% by using bio-burners and bio-boilers. The average cost for cooking and heating using traditional honeycomb briquette at home for each family is about CNY 3.8 (US$0.56) a day, or CNY 1,387 (~US$200) a year. If they switch the fuel from honeycomb briquette to BPF, they can save up to 50%.

However, since BPF cannot be directly applied to a traditional stove, the stove needs to be replaced, which represents an upfront cost. The first generation stove developed by the company was about CNY 400. Then, through continuous innovation, the cost for second generation stoves was reduced to as low as CNY 100.

Mr. Fu says: “especially if the replacement of stoves can receive government subsidies, which the Beijing government has actually begun doing, it can be very attractive for farmers.” Currently the number of individual farmer households enjoying both the benefits from selling AW and changing the stove is about 100, while enjoying the BPF stoves are about 30,000. Mr. Fu also notes that “the Beijing government provided a subsidy of 400 Yuan per stove at the beginning, but the total amount of subsidy was limited. So when we developed the second generation of the stove, the subsidy was stopped. The stove has greater commercial potential than before, since it is much cheaper than it was, but the consumer still needs to spend 100 Yuan to replace the old one. If the government could provide some subsidy, I am sure it will speed up the applications.”

The company is expected to expand in the near future. Three more BPF factories will be developed in 2009, and more will be established in the near future in places close to AW resources. The three BPF factories under construction in Beijing and their production capacities are as follows:

- Yanqin: Production capacity of 120,000T/y
- Fangshan: Production capacity of 12,000T/y
- Yongqin: Production capacity of 35,000T/y.

Mr. Fu is very optimistic about his business. He thinks the business will progress quickly in the coming year, and the production capacity and profit will double throughout the next few years. In 2008, the sales revenue from BPF and stoves (burners) was almost 50% each. This year, the revenue from stove sales will be a little more than BPF. He also thinks BIDIMC may increase their contribution in capital, which is currently being negotiated.
SOCIAL IMPACT

The social impact of this business includes increased incomes and improved living conditions in rural areas.

The income from selling AW is CNY 2,400 for individual families and the fuel saving is CNY 600 per year. If a family is engaged in both, the total benefit is about CNY 3,000. For a family of two parents with one child in rural Beijing, each person’s annual income is CNY 10,474 (average Beijing rural income) and the total household annual income may be about CNY 31,000. The extra income thus means a family income increase of 9.7%.

Usually it takes a lot of labour to burn out AWs after harvest. It also creates great risks due to its potential to catch fire. Since farmers do not need to spend time on burning straws and other AWs anymore, and have more time to enjoy their life or engage in other activities. Furthermore, households benefit from improved indoor air quality and reduction of health hazards previously due to cooking smoke.

ENVIRONMENT IMPACT

“The application of AWs will bring significant environment benefits.” Mr. Fu emphasizes, “This is mostly reflected in reductions in coal consumption and greenhouse gas (GHG) emissions.”

The heating value of BPF is 3,600-4,000 kcal, honeycomb briquette is 4,000 kcal, and normal coal is 5,000-5,500 kcal. BPF is to be used in two areas: one is at home to replace honeycomb briquette, another one is in CHP to replace normal coal. Assuming the quantity of both applications are equal, and considering that the average heating need is 4,750 kcal, then each ton of BPF can replace 0.8 ton of coal. Therefore, if the company produces 30,000 tons of BPF in 2009, it means that 24,000 tons of coal will be saved.

Each ton of standard coal will emit the following GHG and other pollution while it is burning for power generation:

- CO₂  440kg
- SO₂  20kg
- Dust  15 kg
- Slag  260 kg

So 30,000 tons of BPF will reduce the emission as follows:

- CO₂  10,560T
- SO₂  480T
- Dust  360T
- Slag  6,240T
In addition, this pollution reduction will also reduce acid rain. Furthermore, energy consumption from fuel transportation is reduced since coal mines are usually situated very far away from the market while BPF factories are usually set up very close to the AW source.

Assuming the average delivery distance of AW is 20 km, each agricultural truck will load one ton of AW, and consume four litre of gas for a round trip which equals about 4kg std coal (0.004T). For the average simple BPF equipment, it consumes 50kWh to produce one ton of BPF (an automated equipment will consume 80-100kWh). Standard coal will produce 2,500-3,000kWh, therefore, to produce 1 ton of BPF, around 0.03 ton of std. coal is needed. Including the transportation fuel cost, 0.04 ton of std. coal will be needed, but the one ton of BPF produced can replace 0.8 ton of std. coal. Considering all other energy consumption, including administrative costs and others, the average energy consumption per ton of BPF is 0.1 ton of standard coal. The subsequent rough but conservative estimate of the energy feedback ratio is 0.8/0.1 = 8, which is quite high. Regarding the Clean Development Mechanism (CDM), Mr. Fu says that “I know CDM, but unfortunately, since the application is too spread out, the transaction cost of CDM is too high and no one is working on that”.

The positive impacts of the business and its mechanism are straightforward. The benefits to farmers are also obvious. The only concern is whether the government will act to support such kind of renewable energy technology development projects through policies, regulations and incentives.

Conclusion

Mr. Fu is optimistic about the development of the business. Annual production capacity will be expanded. This business, especially in promoting the application, is receiving and will continue to receive support from Beijing’s government and the China Poverty Alleviation Foundation, as well as international donors and corporations, such as Shell. “Currently we are discussing the promotion of the BPF application in Tibet with Shell,” Mr. Fu says.

To improve the business’ social and environmental impact, the government plays an important role. If the government could develop policies to treat bioenergy industry in the same way as other renewable energy (such as solar power), then the business could be scaled up quickly. This, in turn, could help collect and process more AW: not only straw, but also excrement from cattle and poultry feed yard, which will benefit economic development, stay environmentally friendly and help increase rural income.

AW exists not only in Beijing’s rural areas, but anywhere else in China and worldwide, particularly in developing countries. The technology, the business model and marketing mechanism described in this case can be applied in most nations to alleviate poverty, save fossil fuel, protect the environment, and serve businesses and the local poor.
Reference

INTERVIEWS

− Mr. Yonghong Fu, Chairman of the Board, Beijing Shengchang Bioenergy S&T Co
− Ms. Rongxiu Cao, staff member, Beijing Shengchang Bioenergy S&T Co

PUBLICATIONS

− Municipal Commission of Science and Technology/Beijing Shengchang, Survey on Beijing Agricultural and forestry biomass resource, 2008 (i.e. outcome of a project sponsored by the Beijing Science and Technology Commission)
− Company brochure, 2008
Annex 1: Distribution network of the company in Beijing
Annex 2: Organizational chart of SBST

Board of Directors → General Manager → Vice General Manager → Senior Consultant

Senior Consultant → Finance Dept.

CBO Assistant → Project Development Dept. → Design & Production Dept. → Lixian Plant

Vice General Manager → Information Dept. → CHP Dept. → Market Dept. → Sales Dept.

Director of S&M → Law Dept.

HR & Administration Dept. → Administration office → HR Dept.
Annex 3: Patent of stove using BPF

实用新型专利证书

实用新型名称：下饲式自动进料炊事采暖两用炉

设计人：傅友红

专利号：ZL 2006 2 0118420.0

专利申请日：2006年6月7日

专利权人：北京盛昌绿能科技有限公司

授权公告日：2007年6月20日

实用新型经过本局依照中华人民共和国专利法进行初步审查，决定授予专利权。颁发本证书并将在专利登记簿上予以登记。专利权自授权公告之日起生效。

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The case was completed in July 2010 and released in 2011.

The information presented in this case study has been reviewed and signed-off by the company to ensure its accuracy. The views expressed in the case study are the ones of the author and do not necessarily reflect those of the UN, UNDP or their Member States.

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