BIOFUEL PROGRAMS IN CHINA, MALAYSIA AND JAPAN

Tatsuji Koizumi

Keiji Ohga
Biofuel Programs in China, Malaysia, and Japan. [Abstract]

Tatsuji Koizumi¹, Keiji Ohga²

1. Chinese Bio-ethanol Program

As a result of high economic growth in the 1990s, Chinese petroleum consumption is rapidly increasing and imports of crude oil are also rising. The increase in petroleum consumption is causing a serious air pollution problem. To deal with energy security and the air pollution problem, the Chinese government has strongly promoted the National Fuel Ethanol Program. In June 2002, the Chinese government began mandating the use of bio-ethanol blend gasoline. In October 2004, the government introduced the compulsory use of a 10 percent blend of bio-ethanol to gasoline (E10) in all areas of Heilongjiang, Jilin, Liaoning, Henan, and Anhui. The government plans to expand the E10 program to 27 cities within Shandong, Jiangsu, Hebei, and Hubei from 2006. Ethanol facilities in Heilongjiang, Jilin, and Anhui use corn, while the facility in Henan uses wheat. The Guagxi Xhuang autonomous region plans to build a fuel plant that will use cassava. The plant is scheduled to begin operations in October of 2007. The use of potato, sorghum, rice, and lignocelluloses for bio-ethanol production are in the experimental stages.

Corn has been allocated as the major raw material for producing bio-ethanol. Corn consumption has been increasing and the domestic corn price is at a high level. Corn consumption for bio-ethanol is now competing with corn consumption for animal feed, food, and other industries. The National Development and Reform Commission stated to regulate corn-based bio-ethanol expansion in December 2006. The Chinese central government wants to expand bio-ethanol production, especially that from cassava, instead of expanding corn-based bio-ethanol production. Technological innovation is a crucial issue for developing cassava-based bio-ethanol production in China.

(Appendix)


This study examines the impacts that the Chinese bio-ethanol program would have on domestic and international corn markets, by applying a newly developed Chinese corn market model. The model consists of eleven major corn-trade countries, and the

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corn markets in each country consist of production, consumption, exports, imports, ending stocks, and price activities, which are projected up to the year 2014/15. In the baseline projection, we assume that current agricultural policies and normal weather will continue throughout the projection period. We assume that the government will maintain and proceed with the E10 program in Heilongjiang, Jilin, Liaoning, Hernan, and Anhui. It is expected that the E10 program will be started in 27 cities in Shandong, Jiangsu, Hebei, and Hubei in 2006. World corn consumption and production are projected to increase by 2.0% per annum from 2004/2005 to 2014/2015. (World feed corn consumption is projected to increase by 1.8%.) World corn exports and imports are projected to increase by 2.7% per annum during this period.

As an alternative scenario to this study, we assume that the Chinese Government will start the E10 program in four provinces: Shandong, Jiangsu, Hebei, and Hubei. As a result of this new program, nine provinces are expected to promote the bio-ethanol program on a provincial level starting in 2007/08. As a result of the E10 program in nine provinces, Chinese corn imports are predicted to increase by 92.4% in 2014/15. World corn exports and imports are predicted to increase by 3.2% in 2014/15, and world corn production and consumption are predicted to increase by 0.4% in 2014/15. (World feed corn consumption is predicted to decrease by 0.3%.) As a result, the world corn price (Corn No.2 Yellow, Chicago) is predicted to increase by 1.6% in 2014/15. As a result of our analysis using the econometric model, we conclude that the expansion of the program is predicted to impact world corn markets.

2. Malaysian Bio-diesel Program

Malaysia is the world's largest palm oil exporter and the second largest palm oil producer. To deal with an unstable palm oil price and the fast depletion of fossil fuels, the Malaysian government formulated the National Biofuel Policy in August 2005. The National Biofuel Policy spurs the Malaysian bio-diesel industry. Bio-diesel production in Malaysia is 158 thousands tones (200 million liters) in 2006 and 1.3 million tones (1.7 billion liters) in 2007. The government has granted licenses for 32 bio-diesel plants with a potential annual capacity of 2.6 million tones (3.3 billion liters). In 2007, Malaysia will become the world's main bio-diesel producer.

Over the past decade, Malaysia has mainly concentrated on consolidating its export market in CPO (Crude Palm Oil). This has, in turn, spurred the need to bring diversity into bio-diesel. Malaysia's future success in the global bio-diesel market will be driven primarily by cost and quality. The raw material cost dominates about 80 percent of the total cost in Malaysia, which means that the total cost is variable and can be increased
because of the increasing demand of palm oil utilized for bio-diesel. In the global scene, especially in the EU, the use of bio-diesel has achieved widespread acceptance. Malaysia’s government is interested in the boom in bio-diesel demand in Europe. Malaysian palm oil may become a major raw material of European bio-diesel projects and Malaysia wants to export palm oil based bio-diesel to European markets. These could lead to increased exports of CPO or palm oil-based bio-diesel to European markets. These expansions will increase the international palm oil price. Palm oil is widely used not only in developed countries, but also in developing countries. Palm oil is necessary for life in many Asian countries, especially in Malaysia and Indonesia. A higher palm oil price would increase the consumer price of food and may damage food security in developing countries, including Malaysia and Indonesia. In addition, the development of palm oil plantations may be responsible for deforestation in Malaysia. The expansion of palm oil production can damage sustainability and biodiversity. The main concerns for expanding bio-diesel production in Malaysia are sustainability and biodiversity.

3. Japanese Bio-ethanol Program

Biomass Nippon (Japan) Strategy was formulated in December 2002 for the prevention of global warming, the formulation of a recycling-oriented society, the development of strategic industries, and the vitalization of rural and farming communities. Kyoto Protocol put this into effect in February 2005, and the Revised Biomass Nippon Strategy was formulated in March 2006. In the new strategy, Japan promotes the utilization of biomass for transportation fuel. Japanese bio-ethanol production is in an experimental stage, and the current production level is 30 KL (April 2006). Molasses from sugarcane, wheat unsuited for food use, corn unsuited for food use, sorghum, and wasted woods are raw materials for bio-ethanol production. For further promotion of domestic bio-ethanol, farmland should be put to maximum use as farmland, all-out efforts should be made to plant crops in abandoned arable land and every possible arable land in the country, and farmland planted with crops should be used to provide raw materials for bio-ethanol.

Securing raw materials for bio-ethanol, reducing production costs, and reducing taxes on bio-ethanol are urgently needed to expand bio-ethanol production in Japan. The most crucial factor for expanding bio-ethanol markets is technological innovation: the technology to efficiently produce bio-ethanol from wooden biomass or rice straw, or the development of crops that can produce bio-ethanol in large quantities.

This study examines the impacts that the Japanese bio-ethanol import expansion would have on Brazilian and international sugar markets by applying a newly developed world sugar model. The model consists of twelve major sugar-trade countries. In the project, the sugar markets in each country consist of production, consumption, exports, imports, ending stocks, and price activities up to the year 2015. In the baseline projection, we assume that the current agricultural and bio-ethanol policies and normal weather will continue throughout the projection period. World sugar production and consumption are projected to increase by 1.7% per annum from 2004 to 2015. World sugar exports and imports are projected to increase by 1.4% per annum during this period.

As a first alternative scenario to this study (Scenario1), we hypothesize that Japan will start the E3 (3 percent blend of bio-ethanol to gasoline) program in all regions in 2012 and will depend on imported bio-ethanol from Brazil. As a second alternative scenario (Scenario2), we hypothesize that Japan will import 3 million KL of Brazilian bio-ethanol starting in 2010. As a result of the E3 program in all regions from 2012 (Scenario1), the Brazilian sugar price (Domestic crystal sugar price) is predicted to increase by 1.5% and the world raw sugar price (New York No.11) is predicted to increase by 1.4% in 2015. As a result of the 3 million KL of bio-ethanol import from Japan to Brazil (Scenario2), the Brazilian sugar price is predicted to increase by 4.4% and the world raw sugar price is predicted to increase by 3.1% in 2015. As a result of our analysis using the econometric model, we conclude that the expansion of Japanese bio-ethanol import from Brazil is predicted to impact not only the Brazilian sugar market, but also the world sugar markets.
Biofuels Policies in Asia: Trade effects on World Agricultural and Biofuels Trade

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USDA Agricultural Outlook Forum, March 2, 2007
Chinese bio-ethanol Program

The number of automobile in china is increasing

<10^3 Cars>

Source: China Statistical Yearbook 2005
Chinese petroleum consumption is increasing and its import of crude oil and oil products are rising too.

Source: China Statistical Yearbook 2005
The increase in petroleum consumption is causing serious air pollution problems

In order to deal with energy security and the air pollution problem, the Chinese government is strongly promoting the National Fuel-ethanol program

In June 2002, the government started to make the use of fuel-ethanol blended gasoline mandatory
Chinese Fuel-Ethanol Program

Motorization

- Increasing petroleum consumption
- Surging gasoline price

Concern for Energy Security

Fuel-Ethanol Program (2002)

- High Economic Growth
- Promoting Industrialization
- Concern for Environment

Demand

Inferior Corn
The Chinese Fuel-Ethanol Program

In 2004, the government introduced the compulsory use of a 10% ethanol blended in gasoline (E10) in provinces of Heilongjiang, Jilin, Liaoning, Henan, and Anhui.

The government expands the E10 program to 27 cities in the provinces of Shandong, Jiangsu, Hebei, and Hubei in 2006.
## Current and Future Fuel-Ethanol Production (1)

<table>
<thead>
<tr>
<th>Province</th>
<th>Company Name</th>
<th>Raw material</th>
<th>2005 production (MT/Year)</th>
<th>2007 production capacity (MT/Year)</th>
<th>Supply location</th>
<th>Supply volume (MT/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heilongjiang</td>
<td>China Resources Alcohol Co.</td>
<td>Corn</td>
<td>100,000</td>
<td>100,000</td>
<td>Heilongjiang</td>
<td>100,000</td>
</tr>
<tr>
<td>Jilin</td>
<td>Jilin Fuel Ethanol Co.</td>
<td>Corn</td>
<td>300,000</td>
<td>600,000</td>
<td>Jilin</td>
<td>100,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Liaoning</td>
<td>200,000</td>
</tr>
<tr>
<td>Henan</td>
<td>Henan Tian Guan Fuel-Ethanol Co.</td>
<td>Wheat</td>
<td>200,000</td>
<td>200,000</td>
<td>Henan</td>
<td>86,842</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hubei (9 cities)</td>
<td>113,158</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hebei (4 cities)</td>
<td></td>
</tr>
<tr>
<td>Anhui</td>
<td>Anhui BBCA Biochemical Co.</td>
<td>Corn</td>
<td>320,000</td>
<td>320,000</td>
<td>Anhui</td>
<td>100,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shandong (7 cities)</td>
<td>220,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Jiangsu (5 cities)</td>
<td></td>
</tr>
<tr>
<td>Guangxi</td>
<td>China Resources Alcohol Co.</td>
<td>Cassava</td>
<td>0</td>
<td>110,000</td>
<td>Guangxi</td>
<td>110,000</td>
</tr>
<tr>
<td>Hebei</td>
<td>China Resources Alcohol Co.</td>
<td>Sweet potato, corn etc</td>
<td>0</td>
<td>230,000</td>
<td>Hebei</td>
<td>230,000</td>
</tr>
<tr>
<td>Hubei</td>
<td>Tian Guan Fuel-Ethanol Co.</td>
<td>Grains</td>
<td>0</td>
<td>100,000</td>
<td>Hubei</td>
<td>100,000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>920,000</td>
<td>1,660,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fuel-Ethanol Production Sites

China Resources Alcohol Co, Heilongjiang (Corn)

Jilin Fuel Ethanol Co, Jilin (Corn)

Anhui BBCA Biochemical Co. (Corn)

Henan Tian Guan Fuel-Ethanol Co, Henan (Wheat)

China Resources Alcohol Co, Guangxi (From 2007, Cassava)

Tian Guan Fuel-Ethanol Co.Hubei (From 2007, Grains)

China Resources Alcohol Co, Hebei (From 2007: Sweat potato, corn etc)

Corn is the major source of fuel-ethanol in China

1) Corn
   80% of fuel-ethanol is made from corn in China
   Ethanol facilities in Heilongjiang, Jilin, and Anhui use corn

2) Wheat
   Wheat is used in Henan

3) Cassava
   The Guagxi Zhuang autonomous region plans to build a fuel-ethanol plant
   The plant is scheduled to begin operations in October of 2007 at a
   production capacity of 110,000 MT

4) Others
   Potato, sorghum, rice, sugar, and lignocellulose are on experimental stage
   for fuel-ethanol production
Chinese fuel-ethanol production cost and agricultural production

Production (10^3 tons) vs. Production cost (Yuan/ton)

- Corn
- Wheat
- Sorghum
- Cassava

Note: Production data is derived from FAS, USDA, PS&D (2006)
Production cost is derived from the Chinese National Development and Reform Commission
Chinese ethanol production cost is higher than other producers

Corn use for Fuel-Ethanol production

Although Chinese central government ordered to use inferior corn for fuel-ethanol production, facilities in Heilongjiang and Jilin use normal corn

If China continues to expand corn-based fuel-ethanol production, corn utilization ratio for ethanol will increase

Chinese central government stated to regulate corn-based fuel-ethanol production (Statement from National Development and Reform Commission in 21/12/2006)
Chinese corn production, consumption and ending stocks

(10^3 tons)

If China expands ethanol production from cassava, China will have to rely on imported cassava.

Summary (Chinese Bio-Ethanol Program)

80% of fuel-ethanol was made from corn in China in 2005

Chinese central government wants to regulate corn-based ethanol production

Chinese government wants to diversify the sources of fuel-ethanol production, especially to cassava

Technological innovation is required for developing cassava-based fuel-ethanol production
Malaysian Biodiesel Program

Malaysian petroleum consumption has increased rapidly since 1990

Malaysia is the second largest producer of palm oil

Malaysia is the world largest exporter of palm oil

Source: FAS, USDA, PS&D(2007)
International palm oil prices are unstable

Note: Palm Okein RBD, Mal. cif. Rotterdam

Malaysia is promoting National Biofuel Policy

- Energy Security
  - Depletion of fossil fuel
- Agricultural Development
  - Unstable palm oil price
  - Escalating petroleum prices
- Biodiesel boom in EU
- Environmental Concern

National Biofuel Policy (August 2005)
National Biofuel Policy (Objectives)

Supplementing the depleting supply of fossil fuels with renewable resources

Mobilizing local resources

Exploiting local technology to generate energy for the transportation and industrial sectors

Enhancing exports of biofuels

Benefiting from the spin-off effect of more stable prices of palm oil
National Biofuel Policy (Implementation Plan)

○ Short term

Malaysian standard specifications of B5 (5 percent processed palm oil and 95 percent diesel) will be established

Selected government departments with their fleets of diesel vehicles will participate in trials for using B5 diesel

B5 diesel pumps for the public will be established at selected stations
National Biofuel Policy (Implementation Plan)

○ Medium Term
  
  Malaysian standard specifications of palm-oil-based biodiesel for domestic use and export will be established
  
  Legislation to mandate the use of B5 diesel will be passed and enforced

○ Long Term
  
  The proportion of processed palm oil in the diesel blend will be gradually increased
  
  Greater uptake of biofuels technology by Malaysian companies and foreign companies abroad
Biodiesel production in Malaysia

Biodiesel production in Malaysia is estimated 158 thousand tons in 2006 and 1.3 million tons in 2007

(PECC, “Pacific Food System Outlook 2006-2007”)

Government has granted licenses to 32 biodiesel plants, with potential annual capacity of 2.6 million tons

(PECC, “Pacific Food System Outlook 2006-2007”)

If Malaysia promotes B5 program in all regions, 500 thousand tons of biodiesel will be newly required

Malaysia may export biodiesel to European markets at the range of 300-350 thousand tons by 2010

(Asian Palm Oil for Euro Biodiesel, 2005).
Main Biodiesel Projects in Malaysia (2006)

- **MPOB, Golden Hope Plantation Bhd** (60,000t)
- **MPOB, JC Cjang Joho** (60,000t)

Biodiesel Production costs in Malaysia

Raw material cost contributes about 80 percent of total production cost

<table>
<thead>
<tr>
<th>Raw material</th>
<th>(US $ / liter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude Palm Oil (CPO)</td>
<td>0.39</td>
</tr>
<tr>
<td>Methanol</td>
<td>0.02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conversion from CPO to Biodiesel</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Cost</td>
<td>0.07</td>
</tr>
<tr>
<td>Variable Cost</td>
<td>0.05</td>
</tr>
</tbody>
</table>

| Total                                 | 0.54           |

Note: Based on date from Japan Petroleum Energy Center (2004).
Production Costs (International comparison)

Note: Malaysians cost is based on data from Japan Petroleum Energy Center (2006).
Brazilian cost is derived from Biodiesel in Brazil (2005).
Japanese cost is derived from Japan’s Ministry of Agriculture, Forestry and Fisheries.
Palm Oil production in Malaysia

Malaysian palm oil production will expand to the future
Particularly in Sarawak, East Malaysia

Source: MPOB (2005)
Malaysia’s potential for palm area expansion is estimated to be about 2.0 million ha, which can produce 10 million ton of CPO.

**CPO Production in Malaysia**

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current palm area</td>
<td>3.6 million ha</td>
</tr>
<tr>
<td>Potential area expansion</td>
<td>About 2.0 million ha</td>
</tr>
<tr>
<td>Total national land area</td>
<td>33.0 million ha</td>
</tr>
<tr>
<td>Current production</td>
<td>12.1 million t/year</td>
</tr>
<tr>
<td>Production prospect</td>
<td>14 million ton in 2005</td>
</tr>
<tr>
<td></td>
<td>19 million ton in 2020</td>
</tr>
</tbody>
</table>

Malaysian biodiesel export

Malaysia wants to export biodiesel to European market

Malaysian palm oil may become a raw material of European biodiesel production

Whether European market chooses CPO or biodiesel from Malaysia is uncertain. It depends on the quality and cost of biodiesel
Benefits for Malaysia

New demand for palm oil
Mutual beneficial effects on petroleum and palm oil sectors
Efficient utilization of raw materials
Mitigating the effects of petroleum price escalation
Savings in foreign exchange
Environment-friendly source of energy
Achieving socio-economic safety net
Concerns for biodiesel expansion

Expansion of palm oil production is possible in Malaysia

1.0% of palm oil production is used for biodiesel in 2006, and 7.9% of palm oil production will be used for biodiesel in 2007

The expansion may cause a high international palm oil price
In Malaysia, 11% of the total land area is already devoted to palm oil (F.O.Licht 2006)

“Between 1985 and 2000, the development of palm oil plantations was responsible for an estimated 87% of deforestation in Malaysia” (Friends of the Earth 2005)

Sustainability of palm oil production and biodiversity are main concern for expanding bio-diesel production
Summary (Malaysian Biodiesel Program)

Malaysia will expand biodiesel production from palm oil

Malaysia may meet both domestic and international demand

Malaysian biodiesel programs can contribute to mitigate energy in security and be beneficial for palm oil producers

However, this program may cause to increase international palm oil price

This program can damage for sustainability of palm oil production and biodiversities in Malaysia
Japanese Bio-Ethanol program

Preventing global warming

Development of strategic industries

Vitalization of rural and farming communities

Biomass Nippon Strategy was formulated in December 2002
Revised Biomass Nippon Strategy

Kyoto Protocol was put into effect in February 2005

Revised Biomass Nippon Strategy was formulated in March 2006

Promotion of utilization of biomass for transportation fuel, particularly of domestic biomass
Current Bio-Ethanol Production

Japanese bio-ethanol production is at an experimental stage

Current production level is 30 kl (April 2006)

Tokachi area, Hokkaido (From wheat and corn unsuited to food)
Shinjo city, Yamagata (From sorghum)
Maniwa city, Okayama (From wasted woods)
Sakai city, Osaka (From wasted woods)
Ie village, Okinawa (From Molasses)
Iiyako Island, Okinawa (From Molasses)
For Further Promotion of Domestic Bio-Ethanol

The abandoned arable land can be used to grow crops for bio-ethanol production.

Farmland planted with crops may be used to provide raw materials for bio-ethanol.

Technological innovation is the key.
Expected Result

Food and Agriculture
- Reinforcement of international competitiveness to agriculture
- Improvement and maintenance of food supplying capability

Environment
- Contribution to fulfillment of the target dedicated by the Kyoto Protocol
- Actions in consideration of Post-Protocol situation

Energy
- Action to cope with rising crude oil price
- Diversification of energy sources (energy security)
Production cost and fuel-tax need to be reduced to expand bio-ethanol production in Japan

<table>
<thead>
<tr>
<th>Item</th>
<th>Yen/Liter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline from oil manufacture</td>
<td>121.0</td>
</tr>
<tr>
<td>Fuel Tax</td>
<td>53.8</td>
</tr>
<tr>
<td>Gate price from oil manufacture</td>
<td>66.2</td>
</tr>
<tr>
<td>Imported Ethanol from Brazil</td>
<td>148.4</td>
</tr>
<tr>
<td>Import Tariff</td>
<td>53.8</td>
</tr>
<tr>
<td>Import Price</td>
<td>18.2</td>
</tr>
<tr>
<td>Domestic Molasses</td>
<td>144.2</td>
</tr>
<tr>
<td>Processing Cost</td>
<td>53.8</td>
</tr>
<tr>
<td>Raw Material Cost</td>
<td>76.4</td>
</tr>
<tr>
<td>Wheat (Non-food grade)</td>
<td>151.8</td>
</tr>
<tr>
<td>Manufacture</td>
<td>53.8</td>
</tr>
<tr>
<td>Raw Material Cost</td>
<td>46.0</td>
</tr>
<tr>
<td>Processing Cost</td>
<td>52.0</td>
</tr>
</tbody>
</table>
Summary (Japanese Bio-Ethanol Program)

Japanese government promotes bio-ethanol production and utilization for automobile

Securing raw materials for bio-ethanol, reduction of production cost, tax reduction for bio-ethanol are needed to expand bio-ethanol production in Japan

Further technical innovation is the key factor to promote domestic bio-ethanol production
Concluding Remarks

The governments in Asian countries are promoting bio-fuel programs.

Their raw materials for bio-fuels have various sources.

Increasing bio-fuel consumption would compete with food and feed.

The governments in Asian countries are working for bio-fuel programs, which will not conflict with food security.
Thank you for your attention!!