CDM/JI Project Study

Supplementary Feasibility Study on Biomass Generation at a Sugar Factory in Thailand

Summary Report

（Caution: Additions to the previous report are shown in bold and underlined text.）

(1) Basic elements regarding the implementation of the Project

■Outline of the proposed project plan and its context

The Project is designed to collect and deliver trash (dead sugarcane leaves that are left on the field after harvest) for use in biomass power generation. Since trash is available only during the sugar production period (approximately from December through April in Thailand) the Project plans to purchase rice husks throughout the rest of the year in order to continue biomass power generation. Due to the rapid economic growth occurring in Thailand, the demand for power is expected to increase dramatically and private companies are therefore being encouraged to enter the power industry. The Project plans to secure biomass fuel throughout the year for use in power generation and will then sell the electricity produced to the Electricity Generating Authority of Thailand (EGAT) all year round.

However, since trash is also currently utilized as a soil mulch, the appropriate amount of trash to be used as fuel will be determined in order to establish a system which ensures the sustainable development of both agriculture and energy.

Molasses and syrups, produced during the sugar refining process, are residual liquids which retain some sugar content and can therefore be used in brewing. In order to make use of the surplus steam generated by the electricity generation process, alcohol-manufacturing factories will also be invited to make use of the cogeneration system.

■Basic information on Thailand

Thailand is a kingdom. Prime Minister Thaksin has established a strong political power base and displays aggressive leadership among the ASEAN countries. Although the country is relatively stable from political, economic and religious points of view, the harsh reality is that there has also been sharp increases in murder, robbery, narcotic use, terrorism and other crimes.

Located in the Tropical Zone, Thailand is rich in agricultural resources and produces a large amount of sugarcane (annual yield in 2003: 74,070,000 t) and rice (annual yield in 2003: 27,000,000 t).

Thailand is a developing country and a significant rate of growth is expected not only in the economy but also in the demand for electricity. After the currency crisis of 1997, the country entered a recovery phase in 1999. The estimated average growth rate from 1999 to 2003 (in terms of real GDP) was 4.6% and rapid economic growth is likely to continue in the future. This positive economic outlook is likely to be reflected in a rapid increase in electricity demand. According to the EGAT, the annual growth in electricity demand in Thailand is estimated to be around 6% from 2007 through to 2016. While the government has yet to privatize power stations, it plans to encourage the purchase of more electric power from independent power producers (IPPs) and small power producers (SPPs) in order to facilitate the entry of the private sector into the power industry.

At the same time, the country is also faced with growing concerns over the environmental issues of water and air pollution.

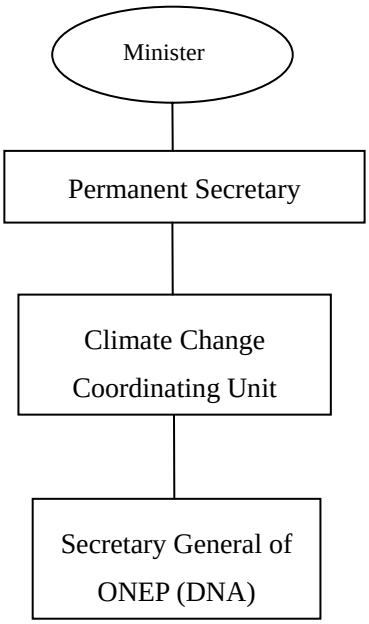
The government of Thailand ratified the UN Framework Convention on Climate Change (for the prevention of global warming) in March 1995 and the Kyoto Protocol in August 2002. The government has adopted a liberal approach toward CDM and has shown a willingness to approve any business that can demonstrate its capability to serve the interests of the nation and contribute to the country's sustainable social and economical development.

■Government policies and circumstances regarding CDM/JI projects in the host country (e.g. criteria for the approval of CDM/JI projects, establishment of DNA, etc.)

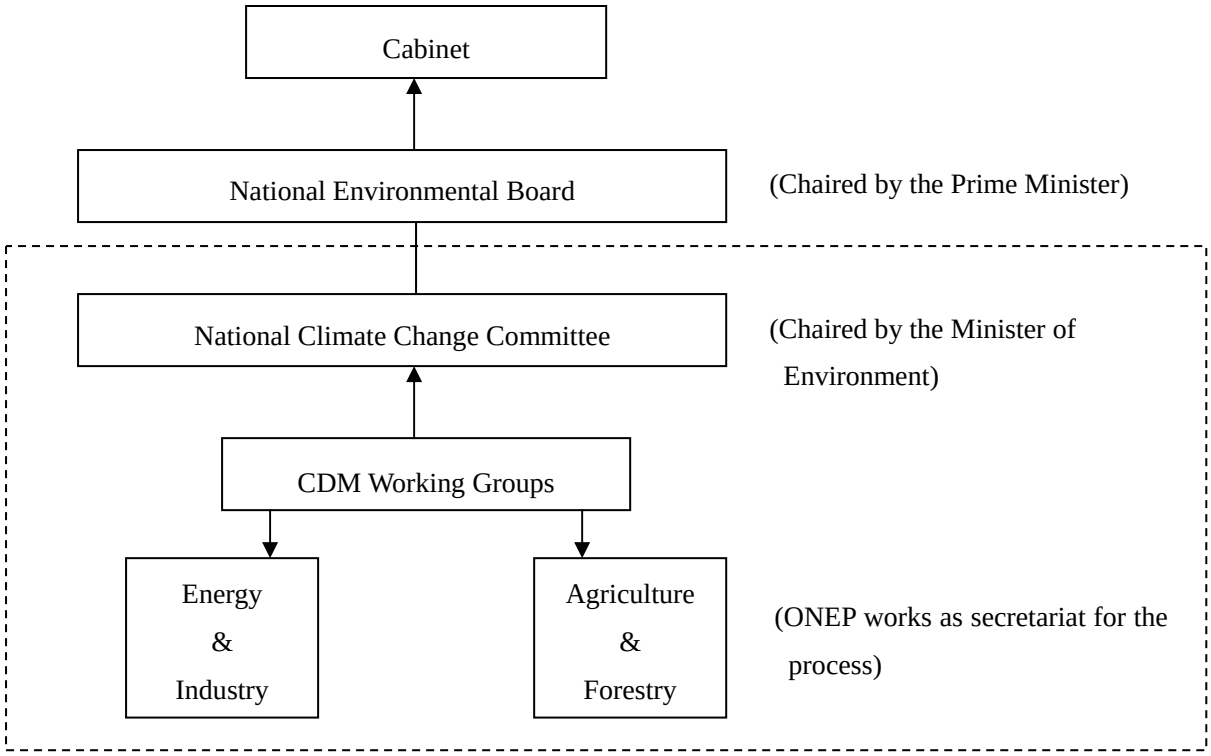
We visited and interviewed ONEP (DNA) on January 11, 2005, and obtained information regarding the current DNA structure/system and CDM approval process in Thailand, as shown below.

【Organization of the DNA in Thailand】

ONEP（Office of Natural Resources and Environmental Policy and Planning）



【Government structure for the approval of CDM projects】

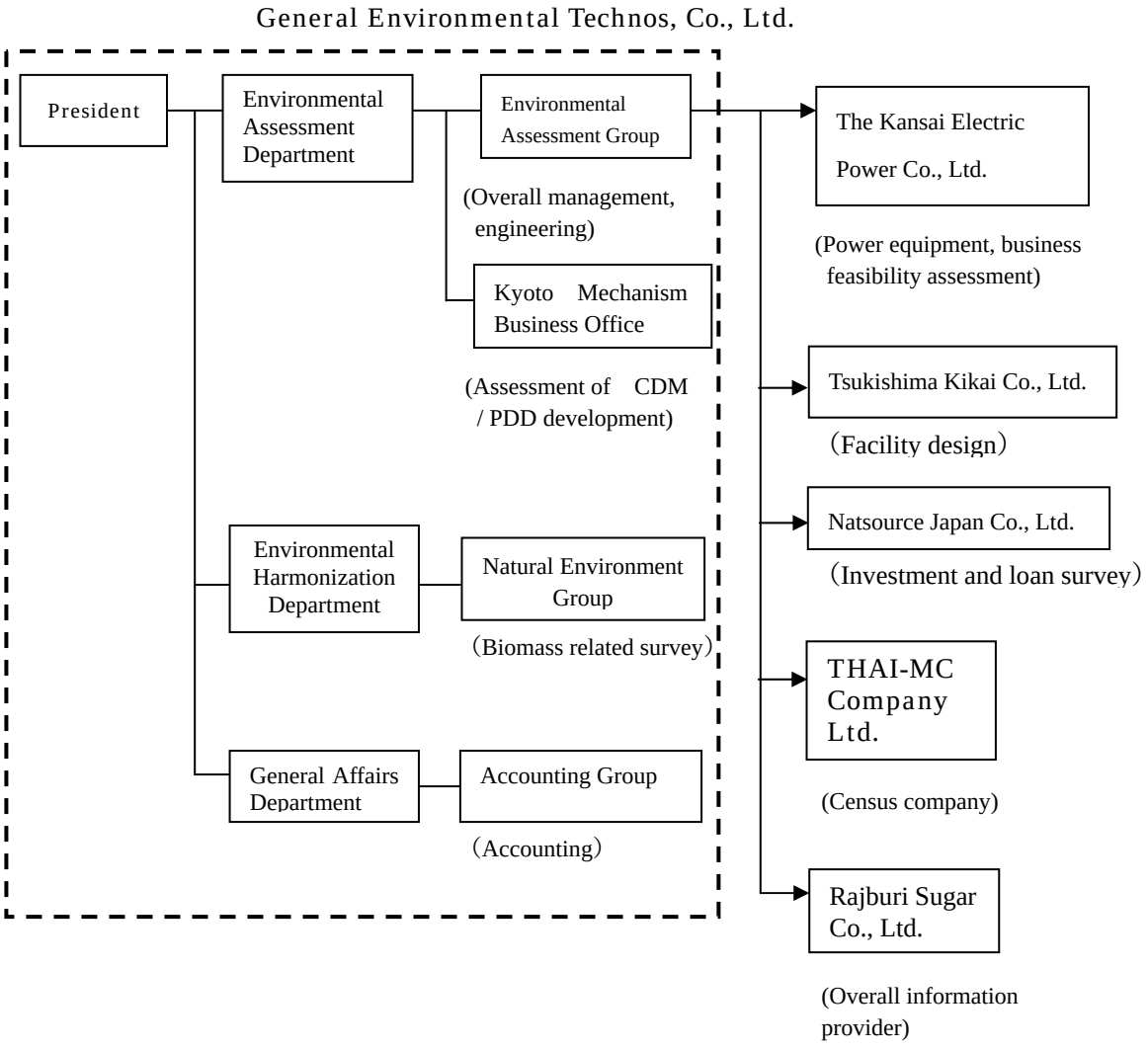


Comments received from the person in charge at ONEP

- Criteria for CDM approval will hopefully be announced by the end of 2005.
- With regard to the time frame of the approval process, screening at the personnel level will take 4 hours but the amount of time required for the rest of the process is unknown since it will depend on the decisions made by higher management.

■Implementation structure of the survey (Japan, host country, others)

This survey was conducted in accordance with the following organizational structure.



(2) Planning of the Project activity

■Description of the Project activity

The Project aims to contribute to the prevention of global warming through biomass-fired power generation. In addition to the dead leaves (trash) produced as post-harvest waste from sugarcane cultivation, rice husks will also be utilized as a biomass fuel.

The Rajburi Sugar Factory (producing an average of 863,200 t/y of sugarcane over the past 5 years from 1998 to 2003) has been selected as a possible project site. Sugarcane harvest runs from December to April and the trash collected from the sugarcane farms that have contracts with the factory will be used as biomass fuel for the project. **After harvest, the trash will be collected using equipment designed to roll grass into round bales.** However, not all the trash can be used as fuel because it is currently spread over the field as a useful mulch that suppresses weeds and stops the soil drying out, etc. The Project will therefore only collect and utilize some of the trash, leaving enough behind to maintain the yield of sugarcane and thereby establish a system which enables the sustainable development of both agriculture and energy. **In order to maintain the soil carbon content at least at the current level for 30 years, the proportions of trash to be collected from irrigated and non-irrigated fields are estimated at 50% and 30%, respectively. These figures were derived by inserting data such as rainfall and soil characteristics into a simulation model which forecasts the long-term dynamics of soil organic matter.** After the trash is used as fuel for the Project, its ash will be returned to the sugarcane field for use as an effective fertilizer. This will contribute to the increase in sugarcane yield in the following year.

The Project will use trash as the primary fuel for power generation during the sugar production period, with rice husks being purchased for use during the non-production period in order to maintain continuous power generation. The electricity produced will then be sold to EGAT. The estimated average amounts of trash and rice husks to be collected are **46,600 t/y** and 64,300 t/y, respectively. Trash will be collected during the 87 days of harvest and will then be piled up in the field and stored for 36 days, as with bagasse. **It is projected that rice husks will be purchased at 910 Baht/t. This price has been increasing due to excessive demand in recent years and there is little prospect of this price falling in the future. However, after the rice husk is used as fuel, its ash can be sold at a high price because of its high silica content. Its estimated selling price is US$100/t, which will lead to an improvement in project profitability.**

In anticipation that alcohol-brewing plants making use of molasses will be constructed nearby, the

Project also discusses the implementation of a cogeneration (combined heat and power) system in which part of the steam produced by the power generation will be used by the alcohol plants. **As of 1st September, 2005, Rajburi Sugar Co., Ltd. has received approval from the Thai government for the construction of an ethanol plant, using molasses, and is now working on the design of the facility.** However, the construction of the alcohol plant is beyond the scope of the Project.

■Definition of the project boundary and its baseline/Demonstration of additionality

The idea of supplying steam to the alcohol-brewing plants, mentioned above, is still in its planning phase and thus not included in this CDM Project boundary. Therefore, in terms of the definition of the Project boundary/baseline and the demonstration of additionality, there is no special change to the Summary Report submitted last year. This means that these definitions and the demonstration of additionality are in accordance with the guidelines for small-scale CDM project activities.

■GHG emission reduction (the amount of CO_2 absorbed) and leakage by the Project activity

The estimated amount of GHG emission reduction by the Project is 32,119 t-CO_2/year. This figure is different from the one indicated in the report submitted last year (35,188 t-CO_2/year) due to the revision of the average emission factor of the EGAT grid. No leakage will occur due to Project activity.

■Monitoring plan

There is no change to the Summary Report submitted last year. As prescribed in the monitoring requirement for Type I.D. projects, the amounts of electricity sold to EGAT will be the only data monitored. Electricity sales will be monitored by recording data directly from the imported electricity meter installed at EGAT (verifiable by comparison with the accounting data for electricity sales). As a means of further quality assurance, data from the exported electricity meter at SPC (monthly operation records) will also be checked.

■Environmental Impact/Other indirect impacts

In terms of the environmental impact resulting from the installation of the equipment, there is no special change to the Summary Report submitted last year. In this study, the proportion of trash available for sustainable collection from the sugarcane field was investigated. It is indicated that the collection of trash has no direct influence on the sugarcane yield or the current soil carbon content for 30 years. This means that, from the perspective of sustainable farming, the trash collection undertaken by the Project will have almost no impact on the

harvest of sugarcane.

■Stakeholders' comments

Additional stakeholders' comments obtained during the site visits are as follows:

- On visiting the Department of Agriculture, Ministry of Agriculture and Cooperatives, on January 10, 2005, the following information and comments were obtained:
  a) Of the trash, which constitutes 5% of the total weight of sugarcane, 40% is used as a soil fertilizer and 60% is burned in the open air by farmers just before harvest in order to make the process of harvesting by hand easier.
  b) In principle, it is preferable not to collect trash from the field, however, it is possible to collect trash if the field is in good condition (especially with regard to soil retention). If additional income is expected from the sale of trash, then its selling price and the amount of trash to be collected need to be negotiated with the farmers.

- On visiting and interviewing ONEP (DNA) on January 11, 2005, regarding the future CDM schedule, they commented that it is important not to rely on financial support from the investing country but to build a partnership between the central players in both the investing and host countries.

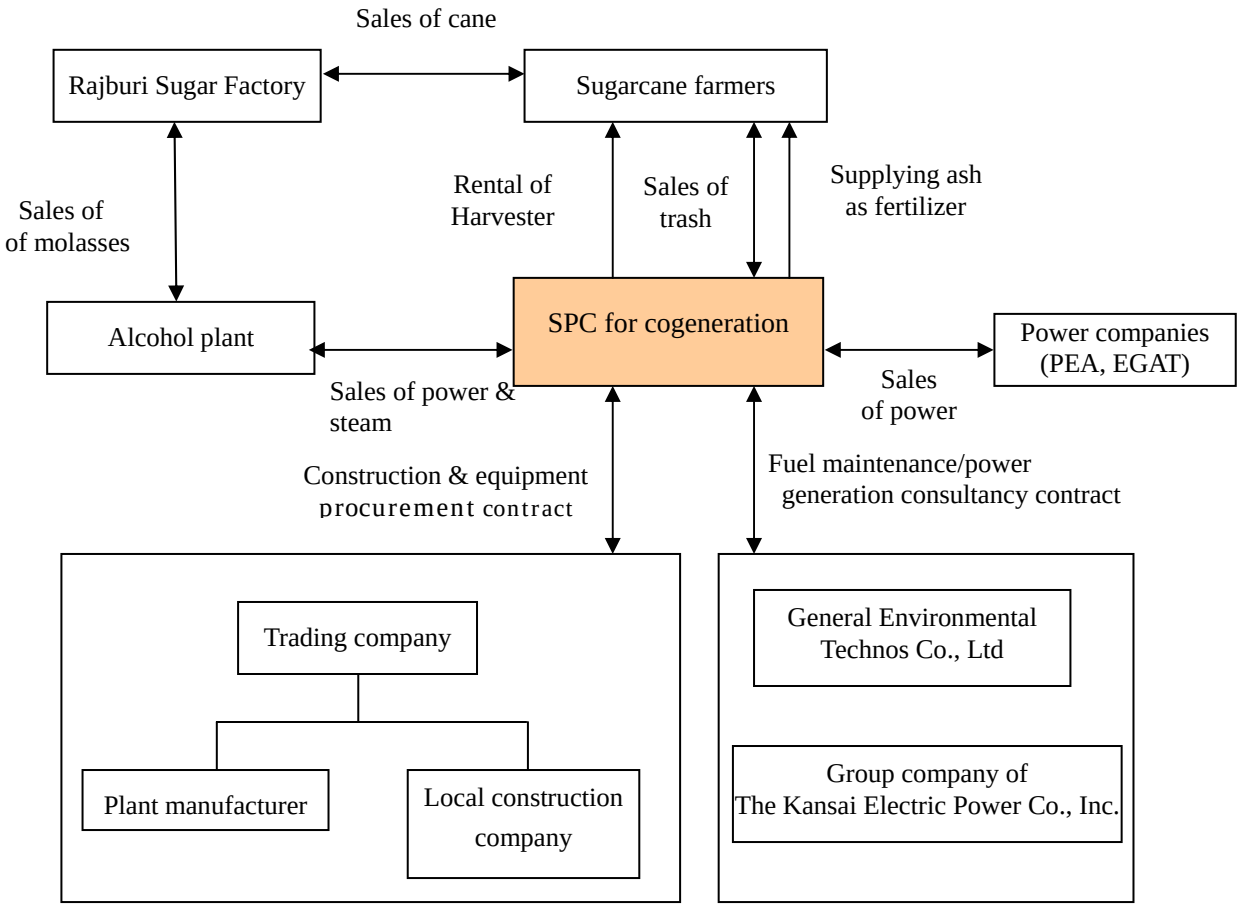
- The following opinions were received on visiting the Prefectural governor of Rachaburi Province on January 12, 2005:
  a) Trash is an effective material for use as a soil conditioner.
  b) When implementing the development project in the Province, a referendum will be held by the local residents in case conflicts of interest are created. This means that the project will not be continued without the cooperation of both the government and the residents.
  c) The Project will contribute to the sustainable development of Ratchaburi Province.

- On visiting Rajburi Sugar Factory on January 11, 2005, the following information was obtained:
  - They do not burn trash in the open air. However, 10% of trash is burned accidentally.
  - 20% of the sugarcane is mechanically harvested, while 80% is harvested by hand.
  - Contract farmers of Ratchaburi Sugar Factory prefer to leave trash on the field.

(3) For the implementation of the Project

■Implementation structure for the Project (Japan, host country, others.)

The proposed implementation structure for the Project is shown below.



■Financial plan for the implementation of the Project

Business funds necessary for the Project and its income are as follows:

1. Business fund (unit: million yen)

Item	Amount	Remarks
1. Equipment cost	1,694	30% discount on manufacturer's quotations (except for roll baler)
2. Annual operating cost	256.4	Including maintenance and operation cost of the equipment, labor cost etc.
3. Cost for establishment of SPC	20	Deferred assets account

2. Income (unit: million yen)

Item	Amount	Remarks
1. Power sales to EGAT	349	
2. Power sales to alcohol plant	14	
3. Steam sales to alcohol plant	59	500 Baht/t × 7 t/h × 24 h× 250 days × 2.81 yen/Baht
4. Sales of rice husk ash	133	
Total	555	

Based on the above income and expenses data, the IRR of the Project is estimated to be 7.91%.

Adding in the asset value of CERs obtained, the IRR will increase to 9.06% at 545 yen/CER, or to 10.19% at 1,090 yen/CER.

■Cost effectiveness

Based on the initial investment cost for the Project, including the cost for establishment of SPC (1,714 million yen) and the annual operating cost (256.4 million yen), the total operating cost for 10 years is estimated at 4,278 million yen. On the other hand, the Project will reduce GHG emissions by 32,119 tCO_2 annually, totaling 321,190 tCO_2 over the entire 10-year crediting period. The cost effectiveness of the GHG emission reduction effort by the Project is therefore calculated at 13,319 yen/tCO_2.

■Feasibility and implementation of the Project

In order to implement the Project, further agricultural and technical investigation is required to calculate the proportion of trash that can be collected from the sugarcane field. Trash is not very effective as a fertilizer, however, and it will be necessary to conduct on-site demonstrations to prove its effectiveness in suppressing weeds and/or preventing the soil from drying out and to obtain understanding from the farmers. After demonstrating these effects, the sustainable proportion of trash that can be collected from the field (to be used as fuel) without having an adverse impact on the sugarcane yield will be decided upon.

(4) Validation / Determination（when necessary）

Not applicable.

■Summary of the Validation (Determination) or Desk Review

■History of communication with OE