Feasibility Studies on CDM Projects against Global Warming for the fiscal year 2001

Executive Summary of the Report

on

A Feasibility Study on Carbonization and Power Generation Projects Utilizing Biomass Wastes from Industrial Tree Plantations in South Sumatra Province

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Kansai Environmental Engineering Center Co. Ltd.

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1. Objectives of the Study

The present study looks into the feasibility of a project of producing charcoal and electricity utilizing a huge amount of residual wood wastes from large-scale industrial tree plantations. The project also aims at long-term CO2 sequestration by applying charcoal soil conditioners into long-term rotating plantations of indigenous lauan tree species of the family Dipterocarpaceae. The study site is located at pulp industry localities in the Province of South Sumatra, Indonesia.

2. Natural and Socio-economic Conditions at and around the Project Site

Sumatra has a total area of 113,339 km^2, 1.3 times as large as Japan, with an abundance of natural resources such as crude oil, natural gas and tropical forests. Sumatra has been being developed because of its rich natural resources, which resulted in a sharp increase in its population and a drastic decrease in the area of its natural forests. In the meantime the total area of industrial tree plantations increased in the past 10 years to reach some 900,000 ha in 1998. The Province of South Sumatra has the largest area of 110,000km^2 in Sumatra, with mountains to the west and lowland or swampland areas from the center towards the east. The population of the Province is 7.6 million, consisting of many ethnic groups.

The project site is located in the central lowland of the island, where monoculture plantations of *Acacia mangium* occupy a large area of 193,500ha and some natural forests and secondary forests are left. Most of these commercial tree plantations used to be waste grasslands. As many as some 130,000 people live in 265 villages inside and outside the plantations, working in rubber and coffee plantations. These tree plantations have created some 20,000 jobs for local communities.

Although Indonesian government, the private sector and research institutes have not paid much attention to the global warming issue yet, they are not against projects of CDM (clean development mechanism). The Deputy Minister of Environment Management and Policy, Environment Ministry, is in charge of this issue, but there is no significant action in the ministry or across the governmental organizations.

3. Grand Plan of the Project

The partners of the project are PT. Musi Hutan Persada (plantation) and PT. Tanjungenim(pulp production), both of which belong to the Barito-Pacific group. PT. Musi Hutan Persada started harvesting from 1999, targeting at an annual log production of 2.3 million m^3. PT.Tanjungenim produces and exports 450,000t of Kraft pulp using logs from PT. Musi Hutan Persada.

Based on these situations we proposed a CDM biomass zero-emission project of producing charcoal and electricity utilizing a huge amount of post-harvest residual wood wastes from industrial tree plantations and wood wastes from pulp mills. The project also aims at long-term CO2 sequestration by applying charcoal soil conditioners into indigenous lauan tree plantations. The project boundary is PT. Musi Hutan Persada's plantation concession area of 290,000ha and the associated pulp mills, while the project deals with a huge amount of wood wastes from the plantations and pulp mills. The baseline is considered as a scenario that wood wastes are decomposed on site and the carbon contained are eventually to be released into the atmosphere. Therefore, carbonization of the wood wastes reduces CO2 emissions, and biomass energy, as alternative source of energy, reduces fossil fuel consumption.

4. Estimation of Wood Wastes Available for the Biomass Project

Since standing trees and branches that are less than 7cm in diameter go to wood wastes, the survey of standing trees indicates that the annual amount of such residual wood wastes is 14.06t-dm (dry matter) /ha on average. Presently, the plantation area for harvest is 10,750ha annually, and the total amount of residual wood wastes sums up to 151,145t-dm annually. This amount of biomass is under the present feasibility study.

Wood wastes from pulp mills total up to 14,815bdt a month on average, or 177,780bdt a year. The wood wastes consist of bark (41%), wood losses (49%), chip dust (10%). As much as 63.5% of the total amount is used as fuel for power generation facilities, and the remaining 5,403bdt are buried unused in the field. This amount of unused biomass is under the present feasibility study.

5. Present State and Market of Charcoal Production Business in Indonesia

In Indonesia wood charcoal has a low economic value as fuel. Since 1980, in the meantime, in industries such as metal refining and metallurgy, food and drinking water production, and the production of medical supplies, the use of charcoal other than fuel, such as wood charcoal, coconut-shell charcoal and activated charcoal, has sharply been increased. In agriculture more rice-husk charcoal has been used as soil amendment. Main domestic production sites are Lampung, Riau, North Sumatra and East Java. About 150,000t of them are exported every year. There are several methods of carbonization such as the pit-earth process, dome kiln, flat kiln, and the briquette charcoal method, depending on what kind of charcoal products is used.

6. Feasibility of Charcoal Production Business in the Present Project

Residual wood wastes left in plantations:

As much as 151,145t-dm of residual wood wastes is available on an annual basis. Assuming that the amount of contained water is 15%, the carbonization efficiency is 20%, the number of months for operation is 11 months a year, 23,551t of wood charcoal can be produced. Since the carbon content of charcoal is 80% on average, 18,841t-C is estimated to be fixed in this amount of charcoal eventually. There are some carbonization methods available such as drum kiln, Colgate kiln and built-up brick kiln, but drum kiln is easy to use and appropriate for local people. Although the annual expenditure for this method is 110 million yen, the income from selling the charcoal products for fuel could cover the whole cost for production.

Bark / wood losses from pulp mills:

The annual amount of bark and wood losses is 47,196bdt, carbonization of which by flat kiln could produce 10,813t of charcoal (for carbonization efficiency 25% and 11 months for operation). With 170 small brick kilns for charcoal production the total cost would be about 42 million yen annually, which is not expensive. A more sophisticated kiln could produce high-quality charcoal, but could be less productive (carbonization efficiency 20%) and more costly (500 million yen).

Chip dust from pulp mills:

The annual amount of chip dust is 17,640bdt and activated charcoal could be produced from it. Raw charcoal, made from this chip dust (carbonization efficiency 27%) and then activated with super-heated steam, could produce 102t of activated charcoal a month (carbonization efficiency 25.6%), or 118t a year (assuming 11 months for operation). Flat kilns and 5 activation furnaces are necessary and the total cost would be about 89 million yen annually. Although business of activated charcoal could get considerably profitable, the production of activated charcoal would not make a good contribution to carbon sequestration due to its low efficiency of the carbonization process.

7. Electricity in Southern Sumatra

The average rate of growth of electricity demand in Southern Sumatra is forecasted 10.8% for the period of 2002-2010, which will go beyond its present capacity. The rate of rural electrification has reached about 74% until October 2001, and a higher rate of rural electrification is targeted to support regional developments. In Southern Sumatra the electricity system consists of small-scale separated systems, and the prospect of establishment of independent power producers (IPP). In spite that the potential resource of biomass energy in Southern Sumatra is promising, but no plan has been made for developing biomass power plants in this area because the energy produced is relatively small compared with its big investment.

8. Feasibility of Biomass Power Projects

Electricity used in the pulp mill is a captive power generated by the turbine generator (about 70MW). High-pressure steam for power generation comes from the recovery boiler and the power boiler. The former generates steam by combusting treated waste drainage from the process of pulp chip production. The latter generates steam by combusting waste biomass. Since as much as 22.6% of the total steam generation comes from the power boiler, biomass energy is estimated as 7,946MWh out of the total production 35,159MWh. This amount of biomass energy corresponds to a reduction of 6,527t-CO_2, presuming that the power boiler should replace a coal fire plant of the same power generation.

9. Feasibility of Charcoal Application to Plantation and Farmland and Rehabilitation of Indigenous Tree Species

Charcoal application to a plantation of *Acacia mangium*:

Wood charcoal is used for the experiment. Charcoal is to be applied at the time of tending seedlings in nursery, the time of planting and after planting. The amount of charcoal applied should also be studied.

Charcoal application to agricultural crops:

The effect of an application of wood charcoal and bark charcoal of *Acacia mangium* is tested on agricultural crops of Indonesia. The combination of charcoal and fertilizer and their amount applied is also tested.

Reforestation of natural forests:

PT. Musi Hutan Persada is interested in regenerating a natural forest for a part of its plantation concession, probably with cooperation from some experienced research institutes in Indonesia. Kansai Environmental Engineering Center Co. Ltd. could be among experienced research institutes, with a unique reforestation technique for rehabilitation (inoculation of mycorrizal fungi and enrichment plantation).

10. Project Proposal

This project, when registered as a CDM project, may be carried out by Barito-Pacific Group, under which PT. Musi Hutann Persada and PT. Tanjungenim operate. In this case the project might also cover plantations and pulp mills to be an integrated project. Both companies are running steady business and cooperative enough to be reliable partners. Cooperative relationships and project funding depend on how much of residual wood wastes in plantations and wood wastes from pulp mills will be utilized and also on in what direction international negotiations on CO2 reduction measures proceed.

11. Effects and Evaluation of the Project

The baseline for the project has two aspects. With a socio-economic aspect, it is less likely without the proposed project that the amount of captive power generation in the project site will increase dramatically or other projects of GHG emissions reduction by biomass utilization will be introduced in the project site within several years. With a scientific aspect, woody biomass wastes, when left outdoors and exposed to weather, eventually get decomposed by soil microorganisms and almost all of its carbon content is released to the atmosphere.

A part of the GHG emissions from the system boundary of the project originate from transportation vehicles and heavy industrial machinery that use diesel engines. This is estimated to 428 t-C annually to the atmosphere. Taking these and an assumption of 80% as the carbon content of charcoal into consideration, the carbon balance of the proposed carbonization project ends up to an emission reduction of 27,958t-C (or 102,513t-CO2) on an annual basis (see Fig. 12.1). This implies that emissions of as much as 559,152t-C (or 2,050,224t-CO2) could be reduced over the whole 20-year project. The cost-effectiveness of the project in terns of the GHG emission reduction turns out to be 2,086-2,288 yen/t-CO2 over the whole project period.

It depends on further quantitative analyses to see whether or not the ongoing project as a whole is really an effective CDM project of CO_2 emission reduction. If charcoal production and biomass power generation may be accepted as means of CO_2 emission reduction, however, the proposed project can be a challenging enterprise of good feasibility and sustainability.

Some positive effects of leakage of the project to nature and societies may be regeneration of natural forests, promotion of productivity in agriculture and creation of new opportunities of employment, though there seem to be some negative effects of the project. With respect to monitoring activities for this carbonization project, it is crucial to develop the reliable procedure of correctly monitoring the amount of residual wood wastes and charcoal products and the whole flow of each charcoal product.

The whole project can be functional when some different subsystems within relate to one another. Among the subsystems are ‘plantation industry for pulp chip material,’ ‘pulp chip industry,’ ‘charcoal production industry with residual wood wastes,’ ‘power generation industry with woody biomass wastes,’ ‘CO_2 emission trading business,’ and ‘trading business with various final products from the project.’ As for the question of uncertainty the whole system of the project might not work properly without any of the above subsystems, and this in turn indicates that keeping all the subsystems mutually in good balance should be important.

With respect to subjects for future examination, we already have started a talk with the two partner companies on pilot carbonization experiments and charcoal application tests for the next fiscal year, on the basis of the present feasibility study. In the meantime CDM projects should be sustainable and could have a large impact on local communities, and also require international negotiations between countries getting involved in the project. This suggests that many of the official procedures associated with the implementation of a CDM project goes beyond the scope of voluntary actions by private companies. Therefore, with the project site of the present study as a model site, it is necessary to examine and solve all problems that might arise along the whole course of procedures from negotiation to validation and verification in an effort to have a consulting manual. At the same time, it will be desirable to make rigid evaluation of the project on the basis of LCA (lifecycle assessment) with its carbon balance, energy balance and economics based on detailed data of the project in question.

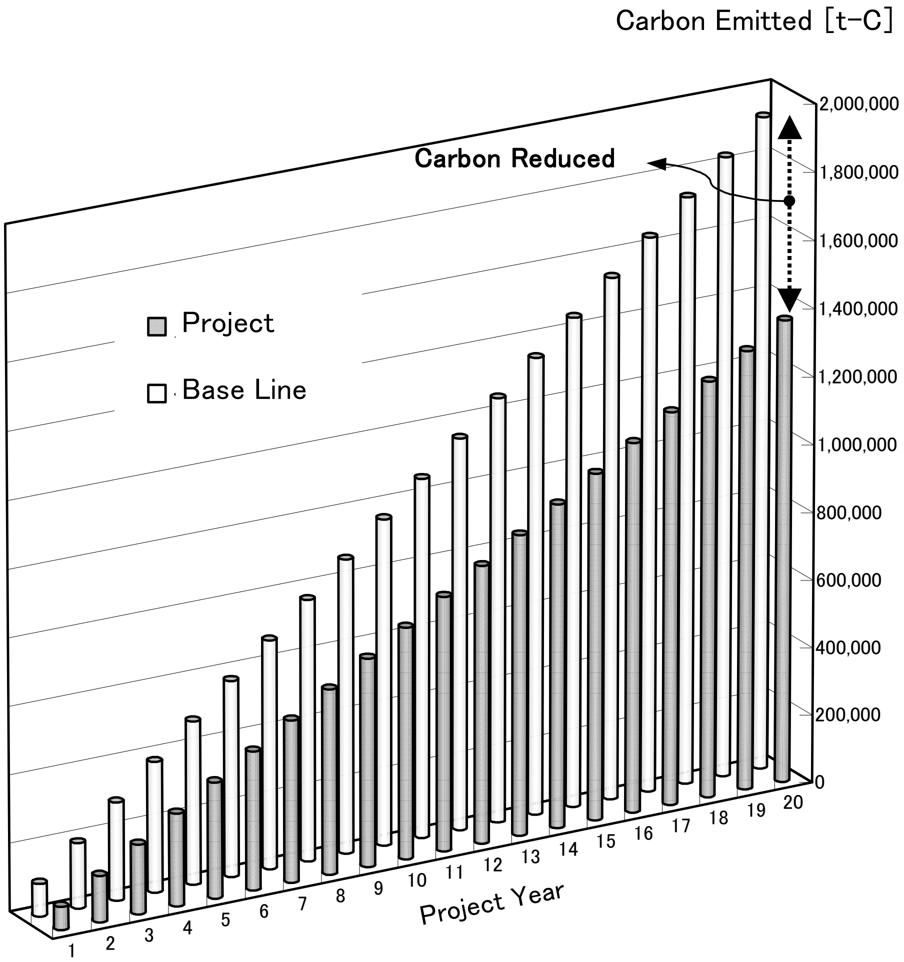

Fig. 12.1 Emissions by the project and the base line.
The difference of the two indicates the
emissions reduced (vertical arrow).