Feasibility Studies on Climate Change Mitigation Projects for CDM/JI

Feasibility Study of Effective Usage of Palm Biomass for Value-added Products by CDM

Summary

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Ex Corporation

1. Objectives of the Survey

This survey aims at investigating the possibility of CDM projects with the effective utilization of palm oil mill effluent and the palm oil byproducts (biomass) .

2. Contents

Outline of this feasibility study is shown in the Fig.1. This survey was conducted in cooperation with the research collaboration of the KIT (Kyushu Institute of Technology) and the UPM (Universiti Putra Malaysia).

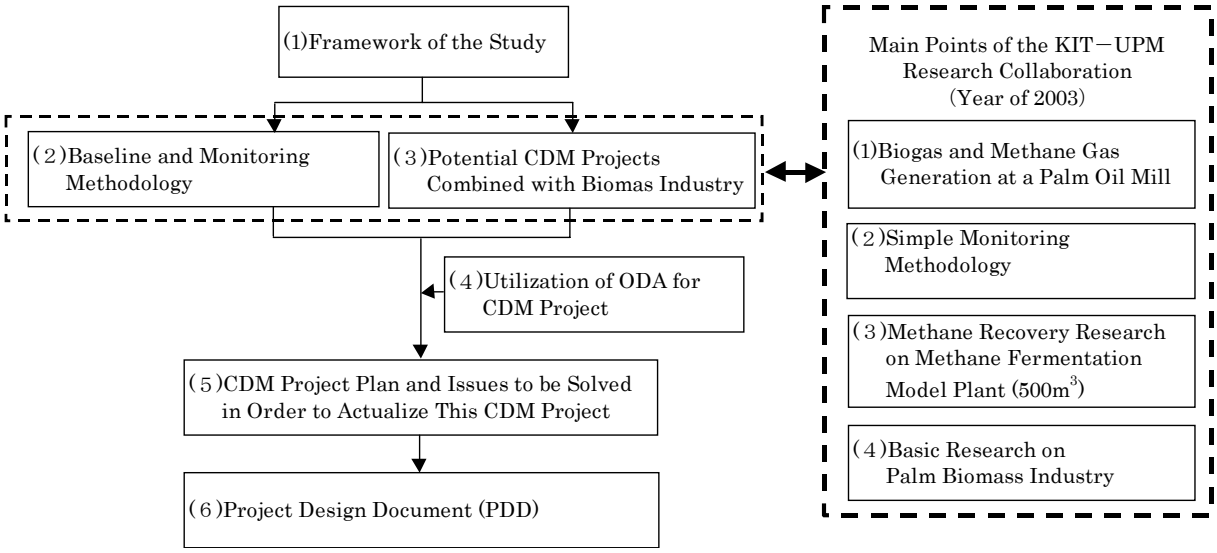

Fig. 1 Outline of this FS

3. Summary of this Feasibility Study

（1） Background and Outline

As the revenue of methane power generation project itself will not be sufficient to be financially feasible, CER sales will be required for implementation of this project. However, under the situation where the expected CER price is around 5 US$/t_$CO_2$, the operating revenue of this project, which is about 15 million yen for a big mill, is not very attractive for FELDA whose turn over in 2000 was the 101 billion yen only for palm oil related products.

On the other hand, when the byproducts of palm oil industry (Palm Biomass) are seen as biomass resources, they have the following features:

- No transport cost is needed;
- Composition is uniform;
- Vast collection is possible
  (From a Medium-scale mill with 200,000 t/y of FFB input, 50,000 t/y of EFB and 100,000 t/y of POME is generated)
- Fruit is harvested year-round(seasonal fluctuation is not huge)

- Methane generated from POME and solid by-products can be utilized as fuel (Methane: 5,000 Mcal/m^3, EFB: 1,400Mcal/t, Fiber: 2,700Mcal/t, Shell: 4,500Mcal/t)

Moreover, biomass can be utilized as materials for producing value-added products, which can create the new biomass industry. If some of the by-products are utilized for the new biomass industry, still there might be surplus biomass which can be used for energy supply for the industry. Therefore, in this feasibility study, the potentiality of the biomass energy generation projects to be the CDM project was investigated.

（２） Research CDM Project

"Organic acid project (POME utilization)", "Polylactide (EFB utilization)" and "Ethanol (EFB utilization)" are the potential biomass industries for this feasibility study on CDM. Energy demand and CO_2 emission from these industries are shown in the Fig.2

Energy supply project utilizing other palm biomass will replace the fossil fuel origin energy, which results in the CO_2 emission reduction as a CDM project.

Fig.2 Energy demand and CO_2 emission of each biomass industry

Energy type	Organic Acid	Polylactide	Ethanol
Electricity (MWh/y)	2,000 (0% is replaced by the CDM project)	171,400 (0% is replaced by the CDM project)	39,200 (0% is replaced by the CDM project)
Heat (MWh/y)	62,450 (100% is replaced by the CDM project)	407,000 (4% is replaced by the CDM project)	91,400 (16% is replaced by the CDM project)
CO_2 emission (t_CO_2/y)	20,461	17,693	17,693

The estimated balance of each biomass industry is shown in the Fig.3. Approximately 4.8 million US$ profit is generated from the Organic Acid project. Although the expected price of the Organic Acid product is uncertain, even if the price of butyl butyrate goes down to one third of the current estimated price, the IRR will still be 20% (profit will be 0.22 million US$/y), which indicates this project will be profitable as long as the preconditions are not changed.

The Polylactide project gains 3.4 million US$/y and its estimated IRR is 40%. Although the investment will be bigger than the organic acid project, marketability of Polylactide is better.

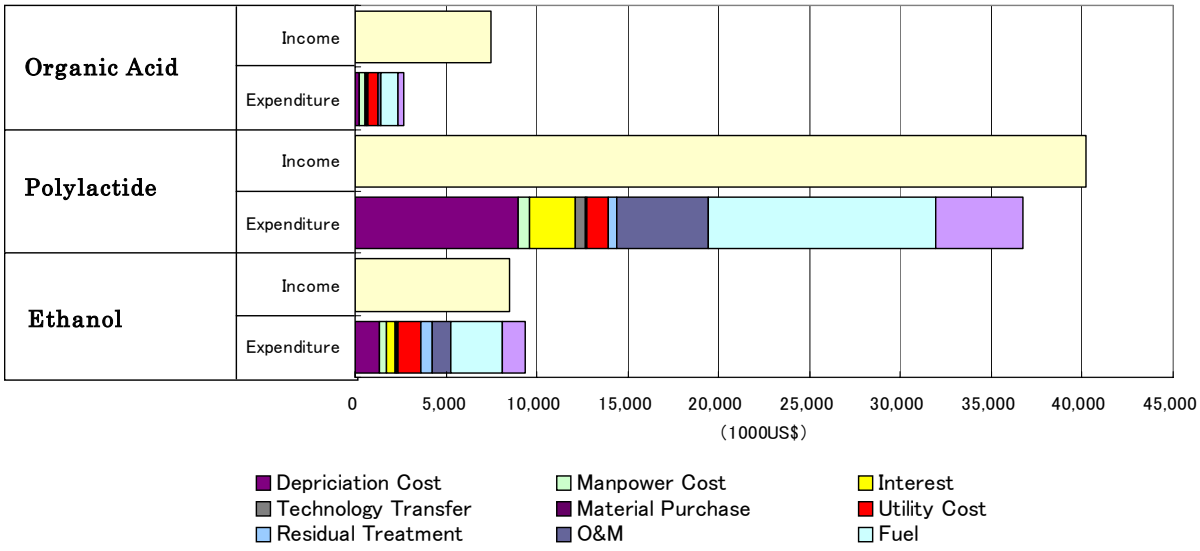

Fig.3　Balance of the each biomass industry

The following two projects were studied as CDM projects combined with the biomass industries.　Here, ethanol project was excluded as the potential CDM project although its profitability can be enhanced depending on the circumstances.

- Energy supply project to the Organic Acid industry
  Supply the steam generated by EFB combustion to the Organic Acid industry, which results in the reduction of the fossil fuel usage.
- Energy supply project to the Polylactide industry
  Recover the methane generated from POME by the sealed digester tank, and supply the steam generated by methane combustion to the Polylactide industry which results in the reduction of the fossil fuel usage.

（３）　CDM Project Scheme

Estimated minimum CER price is shown in the Fig.4.　If the CER price is more than this minimum value, biomass steam price can become lower compared to the ordinary (crude oil origin) system and incentives for the biomass industry to utilize the biomass steam will increase.

In the case of Organic Acid project, CER price must be more than 15.5US$ in order for the biomass steam to be purchased by the biomass industry.　However, considering that the current estimated CER price is at most 10US$, there is little possibility that the energy supply project to the organic acid industry is realized.　Therefore, the targeted CDM project of this feasibility study became the energy supply project to the Polylactide industry.

Fig.4　The minimum CER price in order to adopt biomass fuel for each biomass industry

Items	Organic Acid Industry	Polylactide Industry
(1)Annual energy expenditure (fossil fuel utilization) (US$)	914,000	12,600,000
(2)Replaced energy expenditure within (1)(US$)	830,000	188,000
(3)Annual energy expenditure (biomass utilization)(US$)	1,033,000	264,000
(4)Cost increase because of the biomass utilization ((3)－(2)) (US$)	203,000	76,000
(5)Estimated annual CER acquisition (t)	20,461	17,704
(6)CERPrice (4)／(5) (US$/$CO_2$-t)	15.5	4.3

（4） Profitability Analysis of the CDM Project

As described in (3), the energy supply project to the Polylactide was selected as the targeted CDM project. For the profitability analysis, the following two items were set as the preconditions.

- The steam by the methane combustion is sold at the same price of the steam by the crude oil (baseline fuel) combustion
- IRR of the project is more than 15%

In order to satisfy these preconditions, it was estimated that the CER price should be more than 5.3US$/t_$CO_2$.

Fig.5　Project Expense of the Methane Recovery and Steam Supply Project

Items	Cost (1,000US$)	Remark
①Construction cost(a)	1,074	
Boiler	108	230t/d (20,000US$ per ton of steam)
Methane fermentation tank	916	1.5MW×2 units (Based on the FFB processing capacity)
Incidental facility (Pipe/Gas holder)	50	3,420m^3×2units、$458,000 per unit
②Expenditure	264	Constant cost + Variable cost + Administration cost
Constant Cost	176	
Depreciation cost	97	Depreciation period: 10 years, Residual value: 10%
Manpower	18	6,000US$/person/year×3 persons
Interests	50	Average of 10 years
Technology transfer	11	(a)×1%
Variable cost	54	Maintenance : (a)×5%
Administration cost	34	(Constant cost +Variable cost) ×15%
③Revenue	188(281)	
Steam sales	188	15.4US$ per unit weight
CER sales	(93)	5.3US$/t_$CO_2$
④Balance	▲75(17)	④=③－②
⑤Vapor price	15.4US$	Per unit weight(ton) of steam
⑥IRR	2.7% (15%)	

（５）Operational Life Time of The Project Activity / Crediting Period

First crediting period will be 7 years from 2006 till 2012. With two renewals, the total crediting period will be for 21 years.

（６）Estimation of the CER Acquisition

In this feasibility study the following items were counted as GHG emission reduction:

- Methane emission in the process of the baseline POME treatment;
- Fossil fuel origin GHG emission substituted by methane steam generation;
- Emission from transportation of increase of FFB received;
- Emission from start-up of methane steam generation facility.

The following items were considered as leakage emission:

- Methane emission reduction at other mills caused by the increase of the FFB received of the project mill;
- GHG emission increase/reduction caused by the CPO transportation rout change attributed to increase of FFB received of the project mill.

Based on the two items listed above, the CER acquisition was estimated as shown in the Fig.6.

Fig.6. Estimated CER Acquisition(1)

	Annual CER t_CO_2	Project Period CER (7years) t_CO_2
Methane recovery/Fuel use (Supplied to Polylactide industry)	17,704	123,928

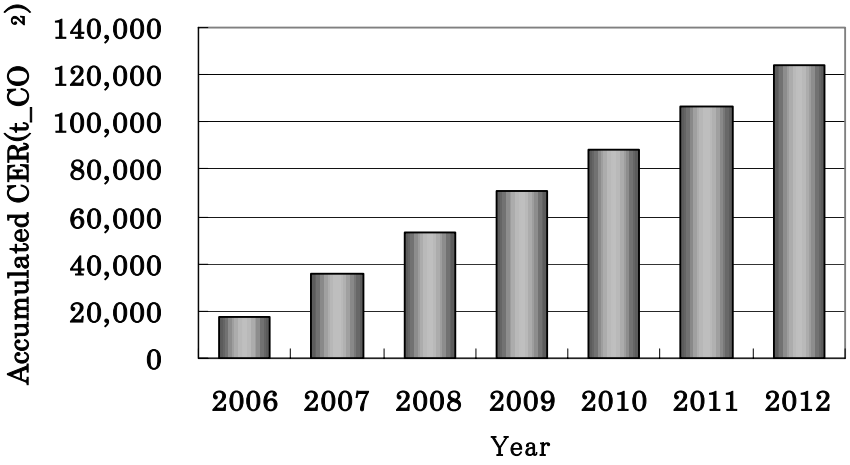

Figure6. Estimated CER Acquisition(2)

（７） Utilization of ODA for this CDM Project

This project accords with the basic principle of the general framework of ODA (Japan's ODA charter) in terms of "support of the self-help efforts of developing countries" and "utilization of Japan's experience and knowledge". This project also addresses the priority area (ASEAN) and the global priority issues such as environment, population, food and energy.

The Biomass industry scheme targeting palm oil industry will bring benefit to both Japan and Malaysia. Mr.Chow Kokee who is the director general of the Malaysian Meteorological Service, and also a member of the CDM Meth Panel mentioned that the following indirect support through Japan's ODA would be strongly desired in order for the start-up of the biomass industry.

①ODA for educational facility utilizing the land after lagoon which supports introducing and promoting Biomass-related products (made from POME, EFB, fibre and shell) or its production process.
② ODA for R&D of utilization of palm oil by-products in order to foster engineers who will lead biomass industry.
③ODA for capacity-building (technical training) for such as operating methane fermentation facility or factory of biomass-related products.

（８） Issues to be Solved in Order to Actualize This CDM Project

Issues to be solved are as follows:

①Plan the CDM project scheme between Japanese party and the host country's party
②Get approval from the CDM Meth panel;
③Secure sufficient FFB in order for the project risk reduction;
④Assist to start up biomass industries
⑤Collect the basic data.