Feasibility Study on CDM/JI Project

- Summary Edition -

(1) Basic Factors in Project Implementation

■ Outline and Background of Proposed Project

This is a feasibility study on an electricity generation project, recovering and using landfill gas produced from solid wastes in a waste disposal center maintained and operated by Provincial Administration Organization of Nonthaburi (PAON), Thailand. A goal for this study is to develop Project Design Document (PDD) as a preparation to implement the project as CDM and also to revisit issues reviled in the study conducted FY2003.

■ Status of Host Country

After the general election scheduled in February 2005, it is expected that Thaksin administration will be reshuffled. And, under the new administration, the chair of DNA of Thailand may be reorganized and CDM policy is expected to be developed and authorized.

■ Status/Situation Concerning CDM/JI in the Host Country, including CDM/JI Criteria and Designated National Authority (DNA) Establishment

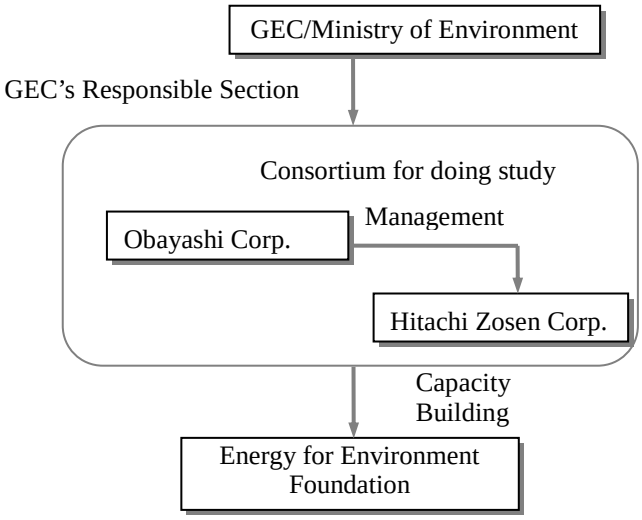
In February 2004, Office of National Resource and Environmental Policy Office (ONEP) was registered as DNA in Thailand, and the responsible department and the person in charge were changed in the period of September to October, 2004. The current responsible department and person in charge are as follows:

	Responsible Ministry	Responsible Department	Person in charge
Former	Ministry of Natural Resource and Environment	Office of International Cooperation on National Resource and Environment	Dr. Asdaporn K
Current	Ministry of Natural Resource and Environment	Office of National Resource and Environmental Policy Office: ONEP	Ms. Orapin W

The newly assigned officials told us that they need some time to prepare themselves for their new assignments, and CDM policy needs to be developed and authorized by the new cabinet. However, they also mentioned that any advancement of CDM policy will not be possible until the election and shuffle of cabinet is finished, scheduled for February 2005.

■ Study Implementation Setup (in Japan, host nation and others)

The working setup of study implementation is shown below. The study was undertaken jointly by Ohbayashi Corporation and Hitachi Zosen Corporation. For the capacity building seminar, E for E, a Thailand consulting firm was retained.



(2) Project Planning

■ Details of the Project

1) Outline of CDM Project

The proposed project is a project that recovers landfill gas for electricity generation from the sanitary landfills and open dumping site in the Solid Waste Disposal Center, Nonthaburi, Thailand. The Solid Waste Disposal Center is located in Sai-Noi district, in the north-west part of Nonthaburi province. The center is owned and operated by Provincial Administration Organization of Nonthaburi (PAON) and accepts wastes generated in this province, about 800 tons/day. Currently, all the wastes are disposed in the open dumping site in the center. It is scheduled that the open dumping site will be closed at the end of 2004, and the sanitary landfills, Landfill-B and Landfill C, will be operated from 2005. The proposed project is designed to collect and utilize landfill gas from those landfills and open dumping site. The project consists of a landfill gas collection system, an electricity generation system and a flare system, plus construction and running of these systems. The outline of the project is summarized as follows:

- Electricity Generation Capacity: Approx. 900 kW（300kW × 3 sets）
- Project Duration: 10 years (2007 –2016)
- All the landfill gas recovered to be combusted by electricity generation and flare system
- All the electricity generated to be fed to the grid

As the implementation involves significant investment, the project is not financially attractive without revenues from the sales of carbon credit. Currently in Thailand, there is no regulation that

requires landfill gas capture and/or utilization, and no plan for such regulations in the foreseeable future during the project period. Without applying CDM scheme, it is considered that the current practice releasing landfill gases to the atmosphere will be continued. It is estimated that the amount of the methane released as landfill gas to be approximately 73,000tonnes (1,520,000 tCO2-e)/10years. In the project, it is estimated to be capable to capture approx. 50% of the landfill gases generated. The emission reduction due to capturing and combusting methane either by the electricity generation and the flare system is estimated to be about 671,000 tCO2-e/10years. In the mean time, the project will reduce GHG emission by replacing the electricity generated by other resources. The emission reduction due to the displacement of the grid electricity is estimated to be 41,000 tCO2-e/10years. The total emission reduction by this project is estimated to be 712,000 tCO2-e.

2) Contribution to Sustainable Development

- Improvement of Surrounding Environment

  Landfill gases create problems to the local community, such as odor, risk of explosion and fire etc. By capturing and utilizing landfill gases instead of releasing to the atmosphere, GHG emission will be reduced and local environment will be improved significantly.

- Improvement of Landfill Management

  Currently, landfill gas utilization projects are being planned in only those landfills that receive wastes from Bangkok Metropolitan area. Other landfill sites in Thailand (most of them are owned by local governments), however, have even no plan to recover and utilize landfill gas. This is because those landfill sites are not large enough in size to be economically feasible for power generation, in addition to the lack of fund at local governments. This project is recognized as the first landfill gas utilization project in the landfills in Thailand owned by local authorities. This project could be good demonstration for other local governments to show new windows to improve their both landfill management and local environment.

- Technology Transfer

  The technology to be applied for the proposed project is a proven and widely applied technology in the western countries. Those LFG utilization projects that are being planned in Thailand are only in a pilot phase, not in a commercial phase. In other words, there is no need for such technologies and facilities to recover and use landfill gases in Thailand. Accordingly, the technologies and facilities will be transferred from overseas to the nation through the process of project implementation. Also, management techniques and skills for LFG utilization projects will be transferred through the process of project planning, construction and operation.

- Others

  This project will create new jobs for project construction, operation and management in the region, even though they are small in number.

■ Project Boundary, Baseline, and Attesting Additionality

The methodology applied for this project is the consolidated baseline methodology for landfill gas project activities, known as ACM0001. "Tool for the demonstration and assessment of additionality" (EB 16 Report Annex 1) is used to demonstrate and assess additionality of the project, while a small-scale methodology, TYPE1-RENEWABLE ENERGY PROJECTS, 1.D. Renewable electricity generation for a grid, para. 29 is used to determine emission reduction associated with the displacement of the grid-based electricity generation.

1) Applicability of the Methodology

ACM0001 specifies applicability conditions of the methodology as follows;

The methodology is applicable to landfill gas capture project activities, where the baseline scenario is the partial or total atmospheric release of the gas and the project activities include situations such as:

a) The captured gas is flared; or

b) The captured gas is used to produce energy (e.g. electricity/thermal energy), but no emission reductions are claimed for displacing or avoiding energy from other sources1; or

c) The captured gas is used to produce energy (e.g. electricity/thermal energy), and emission reductions are claimed for displacing or avoiding energy generation from other sources.

The project recovers landfill gas, while the baseline scenario is total atmospheric release of landfill gas. And the project uses recovered gas for electricity generation or flare, and claims emission reductions by displacement of grid electricity. Therefore, it is considered to be appropriate to apply ACM0001 to this project.

2) Additionality assessment

Based on the "Tool for the demonstration and assessment of additionality (additionality attesting tool)", the additionality is attested. The result of the assessment shows that the project is not feasible and will not be implemented without CDM, because of barriers involved, such as financial, legislative and etc. Therefore, the project is considered to be additional.

■ GHG Emissions Reduction and Leakage

1) Formulae to calculate emission reduction

$$\mathbf{ER}_{y} = \mathbf{MD}_{project,\,y} * \mathbf{GWP}_{CH4} + \mathbf{EG}_{y} * \mathbf{CEF}_{electricity,\,y}$$

$\mathbf{ER}_{y}$	The greenhouse gas emission reduction achieved by the project activity during a given year "y"	tCO_2e
$\mathbf{MD}_{project,\,y}$	The amount of methane actually destroyed/combusted during the year	tCH_4
$\mathbf{GWP}_{CH4}$	The approved Global Warming Potential value for methane	21 tCO_2e/ tCH_4
$\mathbf{EG}_{y}$	The net quantity of electricity displaced during the year	MWh
$\mathbf{CEF}_{electricity,\,y}$	The CO_2 emissions intensity of the grid electricity	tCO2e/MWh

$\mathbf{MD}_{project, y} = \mathbf{MD}_{flared, y} + \mathbf{MD}_{electricity, y}$

$\mathbf{MD}_{flared, y}$	The quantity of methane destroyed by flaring	tCH_4
$\mathbf{MD}_{electricity, y}$	The quantity of methane destroyed by generation of electricity	tCH_4

$\mathbf{MD}_{flared, y} = \mathbf{LFG}_{flare, y} * \mathbf{w}_{CH4, y} * \mathbf{D}_{CH4} * \mathbf{FE}$

$\mathbf{MD}_{electricity, y} = \mathbf{LFG}_{electricity, y} * \mathbf{w}_{CH4,y} * \mathbf{D}_{CH4}$

$\mathbf{LFG}_{flare, y}$	The quantity of landfill gas flared during the year	m^3
$\mathbf{w}_{CH4, y}$	The average methane fraction of the landfill gas	m^3 CH4 / m^3 LFG
$\mathbf{D}_{CH4}$	The methane density	tCH_4/m^3CH_4
FE	The flare efficiency	%
$\mathbf{LFG}_{electricity, y}$	The quantity of landfill gas fed into electricity generator	m^3

2) Leakage

Though the methodology states “No leakage effects need to be accounted under this methodology”, the project will take into account the emissions from use of the grid electricity for the project operation as leakage when electricity generation is not available or enough to run the project. The leakage that might be delivered by the project (L_y) is to be calculated by the formula as indicated below.

$\mathbf{L}_y = \mathbf{EG}_y * \mathbf{CEF}_{electricity, y}$

$\mathbf{L}_y$	The amount of leakage during the year	tCO2e
$\mathbf{EP}_y$	The net quantity of electricity purchased during the year	MWh
$\mathbf{CEF}_{electricity, y}$	The CO_2 emissions intensity of the grid electricity	tCO2e/MWh

3) Emissions Reduction

GHG emission reduction estimates are made by projecting the future greenhouse gas emissions from the landfills using First Order Decay (FOD) model (IPCC guideline, 1996). The emission reduction due to capturing and combusting methane either by the electricity generation and the flare system is estimated to be about 671,000 tCO2-e/10years. In the mean time, the project will reduce GHG emission by replacing electricity generated by other resources. The emission reduction due to the displacement of the grid electricity is estimated to be 41,000 tCO2-e/10years. The total emission reduction by this project is estimated to be 712,000 tCO2-e. Table 1 shows the conditions used for emission reduction calculation. Table 2 shows emission reduction estimated by the project.

Table 1: Conditions used for Emission Reduction Calculation

Parameters	Value	Unit
k （Methane generation rate constant）	0.15	1/yr
L_0 （Methane generation potential）	100	m^3/Mg
Methane fraction in LFG	50	%
Methane Density	0.0007168	tCH_4/m^3-CH_4(at STP)
Methane GWP	21	CO_2-e/CH_4
LFG recovery efficiency	50	%
Crediting Period	10 （2007-2016）	Years
Electricity generation capacity	933 （311 kW×3 sets）	kW
Grid CEF (Carbon emission factor)	0.67	tCO_2/MW

Table 2: **Emission reduction by the project**

Year	Emissions reduction due to methane destroyed	Emission Reduction due to displacement of grid electricity	ER_y (tCO_2/year)
2007	41,724	1,533	43,257
2008	105,826	4,332	110,158
2009	104,381	4,332	108,713
2010	89,838	4,332	94,170
2011	77,333	4,332	81,665
2012	66,560	4,332	70,892
2013	57,288	4,332	61,620
2014	49,308	4,332	53,640
2015	42,441	4,332	46,773
2016	36,530	4,332	40,862
Total	**671,228**	**40,521**	**711,749**

■ Monitoring Plan

Monitoring will be performed based on ACM0001. Detailed monitoring plan will be developed

together with the project operation plan.

■ Environmental Direct/Indirect Impacts (In case of afforestation, including the survey of risks)

Those negative impacts, such as changes in land use by construction of the project, noise and air pollution caused by the operation of the project, that might be delivered through the project are considered to be limited.

On the other hand, the project will deliver a great deal of positive impacts on the local environment, including reducing terrible odor by recovery and destruction of landfill gas, as well as reduction of risks of fire and explosion.

■ Stakeholders' Comments

We have conducted a capacity building seminar organized for the people related to the project (local government officials, representative from villages around the landfills and etc.) on Global Warming, Kyoto Protocol, CDM and the concepts of this project. Comments collected during the seminar from the participants shows that they are basically positive to the concepts of the project. In particular, they appreciate the fact that the project implementation will help to improve the local environment. Meanwhile, local government officials suggest that their final decision on whether they want the project to be implement to be made when the detailed plan of the project is proposed.

(3) Next steps for the project Implementation

■ Project Implementation Setup (in Japan, host country, and others)

To implement the project, establishment of a special purpose company (SPC) in Thailand is planned. Share of the ownership of the SPC is planned to be 51% of local capital and 49% of the Japanese capital in order to smoothly operate the project. Detail formation of SPC to be determined when the project plan is finalized.

■ Financial Plan for Project Implementation

In the beginning of the study for this fiscal year, it was planned that the Japanese government subsidy to be considered to improve the economic feasibility of the project. However, the subsidy was not taken into consideration, since there was information that Japanese government would revise their supportive program for CDM/JI drastically next fiscal year. When the details of subsidy plans are announced, the subsidy will be evaluated from the standpoints of financial assessment of the project.

■ Cost Effectiveness

Economic viability of the project was assessed by IRR based on CO2 Credit prices of $5, $7, $10, and $15. The results are as follows:

1) In case of $5/CER IRR= 8.5%
2) In case of $7/CER IRR= 15.6%
3) In case of $10/CER IRR= 25.3%
4) In case of $15/CER IRR= 39.9%

Conditions used for economic viability assessment are shown in Table 3.

Table 3: Conditions used for Economic Viability Assessment

Condition Items		Values Set	
1)	Exchange Rate (Yen/Dollar)	110	Yen
2)	Exchange Rate (Yen/Baht)	2.7	Yen
3)	Project Period	10	Years
4)	Corporate Tax	0	%
5)	Depreciation Period	Ten years, straight-line	
6)	EPC Cost (design, procurement, and construction)	285,000,000	Yen
7)	O&M Cost	127,000,000	Yen
8)	CDM Transaction	67,000,000	Yen
9)	Loan	220,000,000	Yen
	Rate of Interest	7%	
10)	Electricity Purchased (MWh)	60,000	MWh
11)	Average Electricity Cost Purchased	2.1	baht/kWh

■ Plans and issues to implement the project

Further improvement is necessary to make the project attractive enough to invest and finalize the project plan. Further improvement will include such actions as applying for government subsidy program and squeezing initial investment and operational costs etc.

It is targeted that a MOU with the local governments be signed in the first half of next fiscal year, when the project plan is finalized. However, the execution of the MOU will depend on the Thai government's approval procedure of CDM, the time required for approval and etc. since the timing of landfill gas recovery decides the financial feasibility of the project.

On the other hand, uncertainties on the framework of Kyoto Protocol after 2012, the second commitment period, have been revealed and are becoming major hurdles for the project to be launched. To overcome the new hurdles, Japanese government's support such as providing a program purchasing CER produced after 2012 is considered to be critical.

(4) Validation/Determination (In case of doing the process)

■ Outline of Validation (Determination) or Desk Review

■ The Process of Talks with OE