Fiscal 2009 CDM/JI Feasibility Study

Summary

Study Title:

Feasibility Study on the CDM Project of Integrated MSW Treatment with Composting of Organic Waste and LFG Capture and Utilization in Ipoh City, Malaysia

Corporate Name:

Midac Corporation

Framework of the Study Implementation

Table 1. Framework of the Study Implementation

〔Japan〕 ・ Midac Co. Ltd.:　In charge of overall activities and preparation of the reports ・ Kajima Corporation: Provides a technical assistance in site survey
〔Malaysia〕 ・ LEETUCK CONSTRUCTION Corporation (hereinafter referred to as LT): - Counterpart of the project, and cooperates for the site survey ・ Ipoh City Council - In charge of municipal solid waste (MSW) management in Ipoh city. - Gives permission for site survey, and provides related information. ・ Ministry of Housing and Local Government (MHLG) - Supervisory authority for MSW management in Malaysia. - Provides the information on status of MSW management. ・ Ministry of Natural Resources and Environment (MNRE) - In charge of environmental policy. CDM Designated National Authority (DNA) is set within this Ministry. - Provides the latest environmental policy and CDM related information.

1. Description of the Project

The project is to introduce an integrated MSW treatment system to the landfill site located in Ipoh City of Perak State, Malaysia. Currently, about 600 tons / day of MSW is disposed of in the target landfill, wherein the common practice for disposal is open dumping and landfill gasses are not extracted. The current open-dumping causes serious problems to the ambient environment.

The project involves 1) LFG capture and utilization or 2) composting of organic wastes through mechanical Biological Treatment (MBT) in the landfill site. The proposed project activities are planned to be commenced in 2013, and the emissions reduction through the project activities over the first 7-year crediting period is estimated as follows:

- LFG Capture and Landfill: 402,570 tCO_2e (average: 57,510 t-CO_2e / year)
- Composting of Organic Waste: 272,112 tCO_2e (average: 38,873 t-CO_2e / year)

2. Outline of the Study

(1) Study Subject

[Subject 1] Selection of an optimum technology and establishment of a concrete project plan, based on deep understanding of the MSW management condition in the target landfill site

Malaysia, the Host country of the project, is facing various issues on MSW management, including a severe budget constraint and environmental pollution derived from inadequate MSW management. To solve these issues, it is required to minimize wastes through the promotion of 3R and improve the ambient environment at low cost. Taking these into consideration, the Study Team concluded that the best solution would be ”LFG capture and utilization for power generation (in case of the landfill closure)” or “composting of organic waste through MBT (in case of continuing to receive fresh waste).’”

[Subject 2] Examination of the specification and financial planning for the selected project plan

The Study Team originally intended to arrange the procurement of the necessary equipments and construction work through Japanese companies. However, it was found that using Japanese companies required higher expense than expected. Therefore, the Study Team is considering the procurement and construction through the foreign companies including Malaysian companies.

[Subject 3] Provision of explanation of the project to the stakeholders to gain understanding

To introduce the proposed project to the concerned parties, a stakeholders meeting was held in August 2009, inviting officials of Ipoh City Council and Perak State Government. The Study Team also obtained the approval of the related authority for site survey including waste composition analysis, leachate analysis, and gas analysis.

In January 2010, the Study Team reported the results of site survey to the officials of the Ipoh City Council, and gained their understanding for the proposed CDM project.

[Subject 4] Study on the monitoring methodology for gas collection and MBT

As for gas collection technology, velocity of LFG from the gas extraction pipe was measured at the target site in December 2009, and the measurements showed an average LFG velocity of 2.5 m/s. From this relatively high velocity, it is estimated that the decomposition ratio of the waste in the target landfill is higher than the default value provided in the IPCC Guidelines. Although further examination is needed, the survey indicated that LFG collection project in tropical regions could expect a large amount of methane gas in short time.

As for MBT technology, a waste composition analysis and an aerobic treatment test were conducted. The test result discovered that 45 days of aerobic treatment of waste resulted in carbon decomposition ratio of about 60%, and a period of 45 days is sufficient for the aerobic treatment duration if the decomposed residue is not be utilized as compost.

(2) Study Content

[Waste Composition Survey]

There are three sources of waste to be disposed of in the target landfill, namely, household, shop, and market in Ipoh City. The composition of MSW was analyzed by waste source to examine the difference in the waste property and composition among the three waste sources, as well as to understand the changes from the results of survey conducted in 2008. The waste was classified into 16 categories taking into consideration the organic waste and recyclables.

Based on the survey results, the composition of the waste transported to the target landfill was estimated as shown in Figure 1. Table 2 shows the properties of waste and residues by waste source.

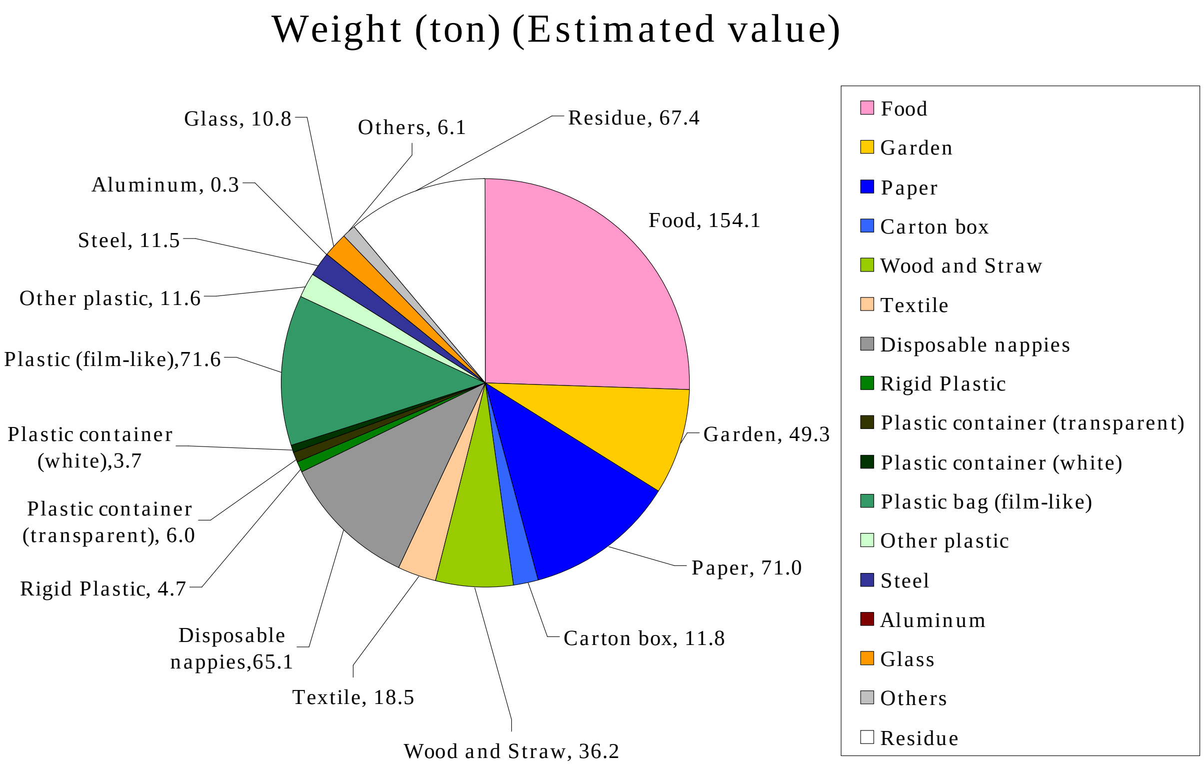
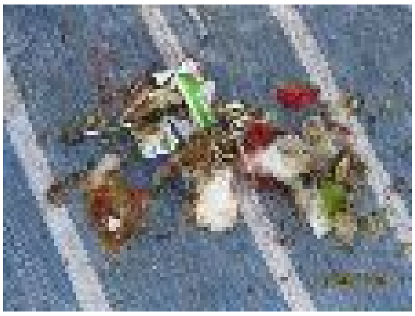


Figure 1. Waste Composition Estimated from the Survey Result

Table 2. Wastes and Residues by Waste Source

Household	Shop	Market
		
Picture of Residue	Picture of Residue	Picture of Residue
		
Inorganic Wastes in the Residue	Inorganic Wastes in the Residue	Inorganic Wastes in the Residue
Note (Waste composition for each source)		
Wastes are separated into small pieces and wrapped with plastic bags. (Usually the contents are food wastes)	Wastes are separated into small pieces and wrapped with plastic bags. (Usually the contents are food wastes)	Wastes are relatively gathered according to the categories.
Including dry batteries	Including dry batteries	Including fluorescent lights
Including lighters	Including plastics	Including plastics
Including glass pieces	—	—
Including plastics	—	—

〔Recyclables Analysis〕

Recyclable items transported to the landfill and selling price of each item were surveyed through the interview with the supervisor of the landfill site. The proposed project plans to collect recyclables through hand sorting by the workers using belt conveyors, therefore, it is assumed that not so much time can be spend for segregation of recyclables. In addition, collected wastes are usually wrapped in layers of plastic bags. Taking these factors into consideration, it is anticipated that recovery rate of recyclables will be about 80 % at the highest.

〔Measurement for Estimation of Methane Gas Generation Amount〕

To estimate the amount of methane gas generated from the landfill, the following items were measured using the existing gas extraction pipe in the landfill site.

a. Height and Diameter of the Gas Extraction Pipe

Table 3. Specification of the Gas Extraction Pipe

Item	Measured value
Height of pipe (m)	About 1.0 (93 cm)
Diameter (cm)	15
Depth of pipe (m)	About 19

b. Velocity of LFG from Gas Extraction Pipe

Table 4. Velocity of LFG

Velocity of landfill gas generation (m/s)					
Date (Dec.)	21st	22nd	23rd	24th	Average
Morning	2.58	2.73	2.55	2.41	2.57
Around Noon	2.40	2.64	2.54	-	2.52
Evening	2.51	2.31	2.27	-	2.36
Average	2.50	2.56	2.45	2.41	2.49

*The diameter of the pipe is 15 cm.

c. Temperature in the Gas Extraction Pipe

Table 5. Temperature in the Gas Extraction Pipe

Temperature in the landfill									
Date	pm 4:25 21/12	am 9:10 22/12	am11:55 22/12	pm 3:55 22/12	am 9:10 23/12	am 11:40 23/12	pm 4:15 23/12	am 9:10 24/12	Average
Weather	cloudy	cloudy	fine	fine	fine	cloudy	fine	fine	-
Temperature of atmosphere (℃)	29.4	24.9	25.6	29.4	25.8	26.1	30.7	24.7	27.1
0 m (Depth from ground)	40.3	40.9	40.5	41.2	40.4	40.9	40.3	40.4	40.6
1 m (Depth from ground)	40.9	41.5	41.0	41.2	41.4	40.9	41.2	41.3	41.2
2 m (Depth from ground)	41.6	41.8	41.4	41.8	41.5	41.8	41.7	41.7	41.7
3 m (Depth from ground)	43.2	43.3	43.1	43.1	43.0	43.0	43.1	43.0	43.1
4 m (Depth from ground)	46.7	46.8	46.6	46.8	46.8	46.8	46.8	46.8	46.8
5 m (Depth from ground)	46.9	46.9	46.9	46.9	46.9	46.8	46.8	46.8	46.9
6 m (Depth from ground)	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.8	46.9
7 m (Depth from ground)	47.0	47.0	47.0	47.0	46.9	46.9	46.9	46.9	47.0
8 m (Depth from ground)	47.1	47.1	47.1	47.1	47.0	47.0	47.0	47.0	47.1
9 m (Depth from ground)	47.1	47.1	47.1	47.1	47.1	47.1	47.1	47.0	47.1

〔Leachate Analysis〕

Leachate from the landfill was analyzed to examine the impact of the proposed project on the ambient environment.

Table 6. Result of Leachate Analysis

Date Sample Received	27/08/2009
Date Sample Analysis	08/09/2009

Test Parameters	Unit	Sample No1	Sample No2	Sample No3	Sample No4	Sample No5	AVG	Standard B
pH Value	-	6.9	8.4	7.1	8.6	8.9	7.98	5.5 - 9.0
BOD_5 at 20°C	mg/l	41	486	18	160	1600	461	50
COD	mg/l	137	1870	71	747	4490	1463	100
Suspended Solid	mg/l	173	276	82	344	364	248	100
Hg	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.05
Cd	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.02
Cr^{6+}	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05
Cu	mg/l	0.02	0.23	< 0.01	0.2	0.25	< 0.175	1.0
As	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.1
Cyanide	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.1
Pb	mg/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.5
Cr^{3+}	mg/l	< 0.05	0.12	< 0.05	0.06	0.45	< 0.21	1.0
Mg	mg/l	0.19	0.7	0.18	0.25	0.24	0.312	1.0
Ni	mg/l	< 0.01	0.22	< 0.01	0.04	0.36	< 0.21	1.0
Sn	mg/l	< 0.1	0.2	< 0.1	< 0.1	0.3	0.25	1.0
Zn	mg/l	0.04	0.32	0.01	0.19	0.53	0.218	2.0
Br	mg/l	< 0.2	0.06	< 0.2	0.07	1.2	< 0.44	4.0
Fe	mg/l	3.24	11.9	1.94	2.55	7.76	5.478	5.0
Phenol	mg/l	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	1.0
Free Cl	mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	2.0
S	mg/l	< 0.01	0.04	0.02	0.02	0.04	< 0.03	0.5
Oil and Grease	mg/l	2	2	ND(< 1)	3	4	< 2.75	10.0
Chloride	mg/l	73	1320	57	602	2820	974.4	-

3. Results of Survey for the Implementation of the CDM Project

(1) Identification of Baseline Scenario and Project Boundary

Application of a Baseline Methodology

Two scenarios are expected in the project, i.e., 1) the existing landfill site will be closed, and 2) the existing landfill site will continuously receive MSW. Therefore, two independent projects are established as shown in Table 7. The baseline methodologies applied to each project are as described in the table.

Table7. Methodology Applied to the Project Activity

	Scenario 1: In case the landfill will be closed	Scenario 2: In case the landfill will continuously receive MSW
Project	LFG Capture and Utilization	Composting of Organic Waste (MBT)
Applied Methodology	ACM0001 “Consolidated baseline and monitoring methodology for landfill gas project activities (version 11)”	AM0025 ”Avoided emissions from organic waste through alternative waste treatment processes (version 11)”

Identification of Baseline Scenario

A：LFG Capture and Utilization

The possible alternative baseline scenarios were determined based on the approved methodology ACM0001 (ver.11). Among the alternatives, continuation of current practice, that is, atmospheric release of the landfill gas (LFG2) and usage of electricity obtained from the Grid (P6) is identified as the most credible and plausible baseline scenario. This current practice can be applied at the lowest cost without any financial barriers and other alternatives are not economically feasible without other incentives such as carbon credit.

B：Composting of Organic Waste

According to the approved methodology AM0025, there are three alternatives for the disposal/treatment of the fresh waste in the absence of the project activity to be determined, namely, “M1: The project activity is not implemented as a CDM project”, “M2: Disposal of waste at a landfill where landfill gas is captured and flared”, and “M3: Disposal of waste at a landfill without the capture of landfill gas”.

Since the compost product will not be sold but utilized as cover soil in the landfill, Project will not be able to obtain additional income from compost sales. Therefore, M1 cannot be financially attractive without CDM revenue. In scenario M2, if the collected LFG will not be used to generate electricity, Project is not able to produce any income, and thus, M2 is economically unattractive without additional revenue from CER credit. Hence, the most credible and plausible baseline scenario is continuation of current practice, that is, the disposal of waste at a landfill without the capture of landfill gas (M3).

Project Boundary

A：LFG Capture and Utilization

ACM 0001 defines the project boundary as the site of the project activity where the gas is captured and destroyed / used. In addition, since the renewable electricity exported by the project would have been generated by power generation sources connected to the grid, the project boundary includes all these power generation sources, as well as the target landfill site in Ipoh city.

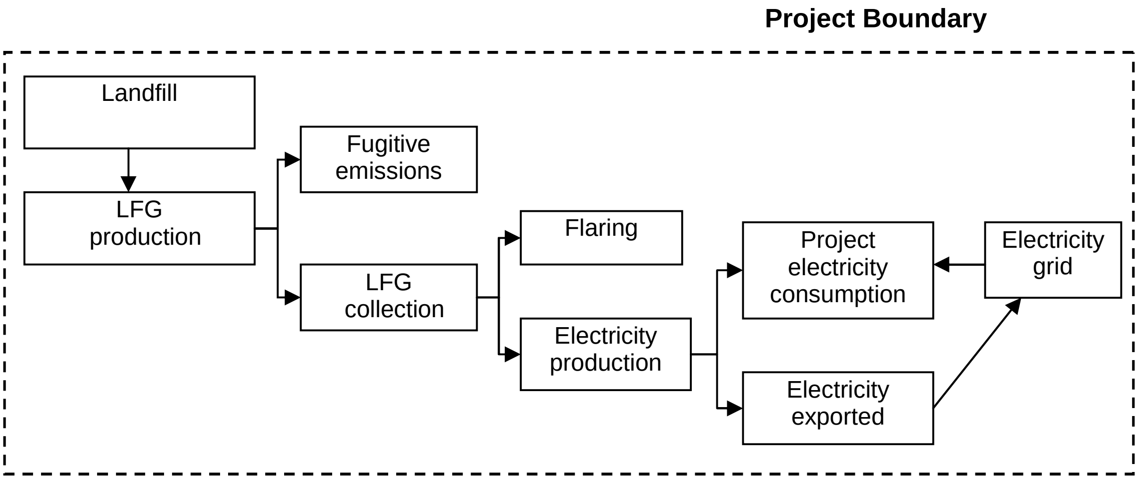


Figure 2. Project Boundary of the LFG Capture and Utilization

The GHG included in the Project is CO2 emission from on-site electricity use.

B：Composting of the Organic Waste

According to the methodology AM0025, the project boundary is the site of the project activity where the waste is segregated and composted. This includes the facilities for sorting, aerobic conversion and composting. The project boundary does not include facilities for waste collection, prior sorting (before reaching project site) nor transport to the project site. Hence, the project boundary of the proposed project is the treatment facilities within the landfill site.

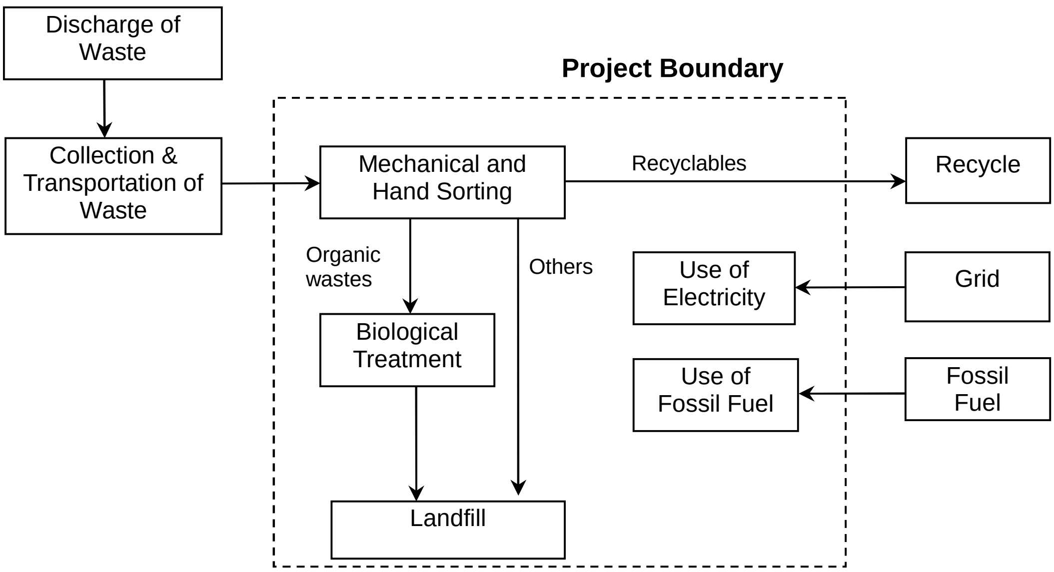


Figure 3. Project Boundary of Composting Project

The GHGs included in the Project are CH4 emitted from decomposition of waste at the landfill site and CO2 emitted from on-site electricity and fossil fuel consumption.

(2) Project Emissions

Baseline Emissions

A：LFG Capture and Utilization

As the proposed project activity does not include a thermal energy component, equation to calculate the baseline emissions can be modified for simplification.

$$BE_y = (MD_{project,y} - MD_{BL,y}) * GWP_{CH4} + EL_{LFG,y} * CEF_{elec,BL,y}$$

BE_y : Baseline emissions in year y (tCO_2e/yr)

$MD_{project,y}$: The amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH_4) in project scenario

$MD_{BL,y}$: The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement, in tonnes of methane (tCH_4)

GWP_{CH4} : Global Warming Potential value for methane for the first commitment period (21 tCO_2e/tCH_4)

$EL_{LFG,y}$: Net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the grid or by an on-site/off-site fossil fuel based captive power generation, during year y, in megawatt hours (MWh)

$CEF_{elec,BL,y}$: CO_2 emissions intensity of the baseline source of electricity displaced (tCO_2e/ MWh)

Ex-ante estimation of $MD_{project,y}$ is done using the following calculation:

$$MD_{project,y} = BE_{CH4,SWDSy} * \varepsilon_{PR,y} / GWP_{CH4}$$

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=l}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot \left(1-e^{-k_j}\right) \quad (A)$$

The detailed explanation for the above parameters is abbreviated.

B：Composting of Organic Waste

Baseline emissions are calculated using the following equations:

$$BE_y = \left(MB_y - MD_{reg,y}\right) + BE_{ENy}$$

BE_y : Baseline emissions in year y ($tCO2e/yr$)

MB_y : Methane produced in the landfill in the absence of the project activity in year y ($tCO2e/yr$)

$MD_{reg,y}$: Methane that would be destroyed in the absence of the project activity in year y ($tCO2e/yr$)。 $MD_{reg,y} = MD_{project,y} \cdot AF$

$BE_{EN,y}$: Baseline emissions from generation of energy displaced by the project activity in year y ($tCO2/yr$)

Since this project does not involve any energy generation and AF is considered to be zero, baseline emission is equal to the quantity of methane produced in the landfill in the absence of the project activity ($BE_y = MB_y$).

In cases where there are regulations that mandate the use of one of the project activity treatment options and which is not being enforced, the baseline scenario should be adjusted sing the following equation:

$$BE_{y,a} = BE_y \cdot \left(1 - RATE^{Compliance}{}_y\right)$$

BE_y..................: Baseline emissions in year y (tCO_2e/yr)
$RATE^{Compliance}{}_y$: State-level compliance rate of the MSW Management Rules in that year y. The compliance rate shall be lower than 50%. If it exceeds 50% the project activity shall receive no further credit.

The amount of methane that is generated each year (MBy) is calculated with equation (A).

Project Emissions

A：LFG Capture and Utilization

According to the approved methodology ACM0001, project emissions include emissions from electricity consumption due to the project activity, and emissions due to fuel consumption on-site. In this project, no fuel is utilized. Project emissions are calculated using the equation below.

$$PE_y = PE_{EC,y}$$

$PE_{EC,y}$: Project emissions from electricity consumption by the project activity during the year y (tCO_2e/yr)

B：Composting of Organic Waste

Project emissions include 1) emissions from electricity consumption due to the project activity, 2) emissions due to fuel consumption on-site, 3) emissions during the composting process, 4) emissions from anaerobic digestion process, 5) emissions from gasification process or combustion of RDF/stabilized biomass and 6) emissions from wastewater treatment. Emissions 4), 5), 6) are excluded from calculation since the proposed project activity involves only composting. Project emissions are calculated using the equation below.

$$PE_y = PE_{elec,y} + PE_{fuel,y} + PE_{c,N2O,y}$$

$PE_{elec,y}$: Emissions from electricity consumption due to the project activity during the year y (tCO_2e/yr)

$PE_{fuel,y}$: Emissions due to fuel consumption on-site in year y (tCO_2e/yr)

$PE_{c,N2O,y}$: Emissions during the composting process in year y (tCO_2e/yr)

Leakage

A：LFG Capture and Utilization

No leakage effects need to be accounted under this methodology.

B：Composting of Organic Waste

Leakage emissions include; 1) leakage emissions from increased transport, 2) leakage emissions from the residual waste from the anaerobic digester, the gasifier, the processing/combustion of RDF/stabilized biomass, or compost in case it is disposed of in landfills and 3) leakage emissions from end use of stabilized biomass. The project does not involve the use of stabilized biomass, so there is no leakage emission associated with 3). Therefore, the leakage emissions of the proposed project activity can be estimated using the following simplified equation.

$$L_y = L_{t,y} + L_{r,y}$$

Where:

$L_{t,y}$: Leakage emissions from increased transport in year y (tCO2e/yr)

$L_{r,y}$: Leakage emissions from the residual waste from the anaerobic digester, the gasifier, the processing/combustion of RDF/stabilized biomass, or compost in case it is disposed of in landfills in year y (tCO2/yr)

Emission Reductions

A：LFG Capture and Utilization

By using the above parameters, emission reductions are calculated as follows.

$$ER_y = BE_y - PE_y$$

B：Composting of Organic Waste

By using the above parameters, emission reductions are calculated as follows.

$$ER_y = BE_y - PE_y - L_Y$$

(3) Monitoring Plan

The proposed project activities are 1) to collect and utilize LFG for electricity generation, and 2) to avoid methane emissions through the aerobic treatment of fresh organic wastes that would have been disposed of in the landfill. LFG capture and utilization project satisfies the requirements described in the approved methodology ACM0001 "Consolidated baseline and monitoring methodology for landfill gas project activities (version 11)", and composting project satisfies the requirements described in the AM0025 "Avoided emissions from organic waste through alternative waste treatment processes". Hence, each project can apply the corresponding methodology for monitoring.

A：LFG Capture and Utilization

According to the monitoring methodology ACM0001, the project owner shall monitor and manage the parameters including total quantity of methane destroyed ($MD_{project,y}$), quantity of methane destroyed by flaring ($MD_{flare,y}$), quantity of methane destroyed by generation of electricity ($MD_{electricity,y}$), quantity of electricity produced using LFG ($EL_{LFG,y}$), and quantity of electricity consumption by the project activity ($PE_{EC,y}$), etc. The monitoring will be based on direct and continuous measurement of the amount, temperature, pressure, and methane content of LFG captured and fed to the gas engine / flare platform, as well as the electricity generated using LFG, and electricity consumed for the project activity.

B：Composting of Organic Waste

Based on the monitoring methodology AM0025, the monitoring plan is designed to directly measure the relative parameters, which includes quantity of on-site fossil fuel and electricity consumption ($PE_{fuel,y}$, $PE_{elec,y}$), amount of compost production, and number of samples with oxygen deficiency. The project owner shall also survey the condition of the landfill site wherein the MSW would be disposed of in the absence of the project activity.

(4) GHG Emission Reductions

Table 8 shows the GHG emission reductions for the proposed project activities over the first 7-year crediting period (2013 – 2019).

Table 8. GHG Emission Reductions

Unit: tCO2e/yr

Project	2013	2014	2015	2016	2017	2018	2019
LFG Capture & Utilization	91,505	74,316	61,789	52,875	45,809	40,321	35,956
Composting of Organic Waste	14,437	26,091	34,947	41,841	47,344	51,844	55,609

(5) Duration of Project Implementation / Crediting Period

The starting date of the project would be 2013 at the earliest. PDD will be prepared in 2010, and submitted to CDM-EB for approval. Upon approval (expected to be 2012), necessary construction work will be started, which will require about 1 year for completion. Consequently, the operation of the project is expected to be commenced in 2013.

Duration of the project implementation is planned to be 22 years. Both projects will take renewable crediting period with the first crediting period of 7 years.

(6) Environmental Impact and Other Indirect Impact

The proposed project activities are to stabilize the landfill / waste through LFG capture and utilization / aerobic treatment, and thus expected to have no major negative impacts on environment.

The project might have some environmental impacts such as air pollution, noise and vibration, etc. which may occur along with construction and operation of the facility. However, the project's overall impact on environment will be small, and be reduced to minimum by taking the appropriate mitigation measures.

Positive environmental impacts of the project activity are as follows;

<LFG Capture and Utilization>

- Efficient use of methane gas contribute to reduction of GHG emission to the atmosphere
- LFG as renewable energy sources – cleaner fuel that replaces fossil fuel based grid power
- Diminishing the odor problem
- Improvement of landfill's stability

・ Mitigation of fire / explosions risk in the landfill

<Composting of Organic Waste>

・ Significant decrease in methane generation due to organic waste degradation in the landfill, which contributes to the GHG emissions reduction
・ Decrease in leachate generation and its contaminant load in the landfill.
・ Extension of the landfill life time due to smaller amount of disposed waste
・ Improvement of landfill's stability
・ Mitigation of fire / explosions risk in the landfill caused by methane gas emissions from disposed organic wastes
・ Recovery of recycling materials and saving of new raw materials

(7) Stakeholders' Comments

①Ministry of Natural Resources and Environment (MNRE) (DNA for CDM project in Malaysia)

According to the MNRE officers in charge, some CDM projects similar to the proposed project have been implemented in Malaysia. Since the Government of Malaysia put great importance on transfer of technology through the CDM project, they expect that the proposed project will promote technical transfer, as well.

②Perak State Government

In August 2009, a meeting with the Perak State Government was held under the auspices of the Ipoh City Council, and the outline of the CDM project was introduced to the participants. The state government officials mentioned that the project should be implemented under the leadership of Ipoh City Council, and requested the Study Team to proceed the project in close cooperation with Ipoh City Council.

③Ipoh City Council

A meeting with Ipoh City Council officers was held in October 2008 to provide an explanation of the feasibility study on the project and to exchange opinions. In August 2009, the outline of the CDM project was explained to the Ipoh City Council and Perak State Government officers. Ipoh City showed a favorable attitude toward this project, on the other hand, it suggested there is a competitor on this matter.

④LEE TUCK CONSTRUCTION SDN.BHD. (LT)

LT is handling actual waste collection and transportation, as well as management of landfill site on consignment from the Ipoh City Council. LT is the project collaborator who will establish a Special Purpose Company (SPC) jointly with Midac. LT requests Midac for provision of technical assistance for project implementation, and for waste treatment in Ipoh City as well.

⑤Neighborhood Inhabitants

There are no residents who live in a nearby area to the landfill site, therefore, the study team had interview with the business entities (incl. privately owned restaurants, general stores, etc.) located relatively close to the landfill site.

At the moment, they have no serious environmental issues derived from the landfill, except for odor. After receiving an explanation of the project outline, most of them made very favorable comments for the project implementation, as they found it would improve local environment.

⑥Banks

A meeting with bank officials was held to explain the outline of the proposed project, and to discuss the possibility for funding loan. The bank officials expressed a strong interest in the CDM project, and they requested more detailed timetable and simulation of investment plan.

(8) Implementation Framework of the Project

The proposed project is implemented by the SPC jointly established by LT (Counterpart) and Midac Co., Ltd. and the SPC will self-finance the project.

However, before the establishment of the SPC, it is necessary to carefully examine the feasibility of the project, the financing method for the project, as well as the social/international condition. Figure 4 shows the proposed implementation framework of the project.

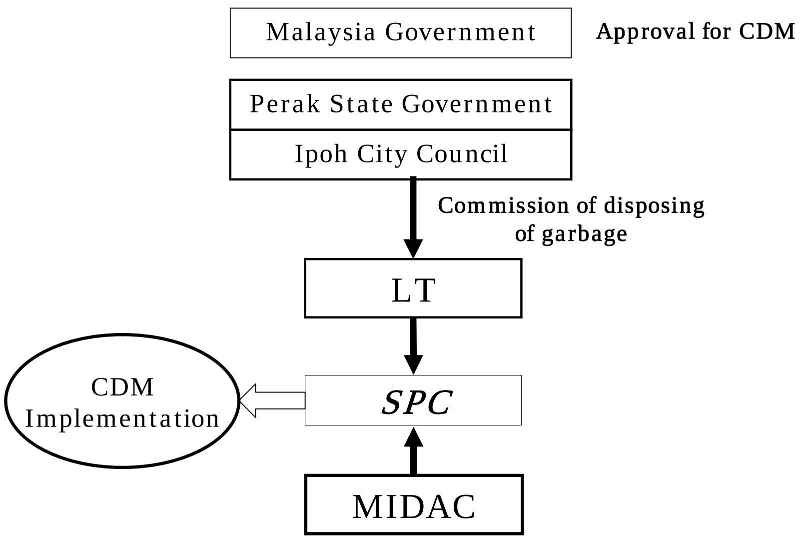


Figure 4. Implementation Framework of the Project

(9) Financial Plan

The proposed project activities are implemented by SPC, and the SPC will cover the initial cost of the project by its own funds. Currently, the project cost (incl. initial construction cost and O&M cost for the first year) is estimated to be about JPY 700 million, which can be self-financed by SPC. O&M cost is estimated to be about JPY 80 million /year, which is planned to be financed by proceeding of the project activity.

(10) Financial Analysis

A：LFG Capture and Utilization

Profitability of the project was analyzed using benchmark analysis method, with Internal Rate of Return (IRR) as a financial indicator. While the project IRR is calculated to be 5.2% with CER, project IRR without CER is negative. Hence, it is obvious that the project activity is not economically feasible without additional revenue from CDM..

Table 9. IRR of LFG Capture and Utilization Project

Scenario	**Project IRR**
With CERs	5.2%
Without CERs	Negative

B：Composting of Organic Waste

Profitability of the project was analyzed using benchmark analysis method, with IRR as a financial indicator. While the project IRR is 8,0% with CER, the project IRR without CER is calculated to be negative. Hence, it is obvious that the project activity is not economically feasible without additional revenue from CDM.

Table 10. IRR of Composting Project

Scneario	**Project IRR**
With CERs	8.0%
Without CERs	－13.2 %

(11) Demonstration of Additionality

A：LFG Capture and Utilization

Additionality of the proposed project is demonstrated using the “Tool for the demonstration and assessment of additionality version 05.2”.

In line with the applied methodology ACM0001, realistic and credible alternatives available for the disposal/treatment of the waste in the absence of the project activity are identified as follows, and all are in compliance with the mandatory laws and regulations that are set by the Government of Malaysia.

Scenario1 (LFG2 + P6): Atmospheric release of LFG, no capture based on legislation, etc. (Maintenance of status quo);

Scenario2 (LFG1 + P6): The proposed activity is undertaken without being registered as a CDM project activity, capturing the LFG and combusting by flaring;

Scenario3 (LFG1 + P1): Power generated from LFG undertaken without being registered as a CDM project activity.

Based on the results of investment analysis and common practice analysis, it was demonstrated that all the above alternatives face investment barrier giving negative Project IRR, and any similar activities would not be implemented in Malaysia without the incentive provided by the CDM. Therefore, the proposed project activity is additional.

B：Composting of Organic Waste

Additionality of the proposed project is demonstrated using the “Tool for the demonstration and assessment of additionality version 05.2”.

In line with the applied methodology AM0025, realistic and credible alternatives available for the disposal/treatment of the waste in the absence of the project activity are identified as follows, and all are in compliance with the mandatory laws and regulations that are set by the Government of Malaysia.

Scenario1 (M1): The project activity not implemented as a CDM project;
Scenario2 (M2): Disposal of waste at a landfill where landfill gas is captured and flared;
Scenario3 (M3): Disposal of waste at a landfill without the capture of LFG.

Based on the results of investment analysis and common practice analysis, it was demonstrated that all the above alternatives face investment barrier giving negative Project IRR, and any similar activity would not be implemented in Malaysia without the incentive provided by the CDM. Therefore, the proposed project activity is additional.

(12) Prospect for Project Implementation

As described in the previous sections, the proposed projects are deemed unprofitable without revenues from CER sales. However, having other income source than CDM, such as electricity sales or recyclable sales, the proposed projects can be economically feasible if implemented as CDM project. Besides the profitability, the project is expected to contribute to sustainable development in South East Asia that facing problems of environmental pollution due to rapid economic growth.

The project stakeholders including counterpart, governmental officials and bank officials are expressing a strong interest and place expectations in the implementation of the proposed project. However, further negotiation and coordination is still needed for the realization of the project. In addition, Ipoh city has another plan of constructing a new landfill site, which will affect the implementation of the proposed projects. Therefore, a final decision for project implementation should be made after due consideration of stakeholders’ interests and the social condition.

4. Evaluation on Co-benefit

(1) Evaluation on Pollution Control in Host Party

① Waste Amount

Through the introduction of the intermediate treatment, i.e., composting of organic waste (which can apply the methodology AM0025), the project is expected to reduce the volume of organic waste and promote recycling and consequently realize the minimization of waste to be disposed of in the landfill site.

According to the “Manual for quantitative assessment of Co-benefit (ver.1)” issued by Japanese Government, the efficacy of the proposed project on waste reduction is assessed as follows;

$$D_{volume} = D_{volume,PJ} - D_{volume,BL}$$

D_{volume} : Reduction of waste disposal (ton)

$D_{volume,PJ}$: Amount of disposal waste before the project implementation (ton)

$D_{volume,BL}$: Amount of disposal waste after the project implementation (ton)

$D_{volume} = D_{volume,PJ} - D_{volume,BL}$

= 338.27 (tons/day) – 600.0 (tons/day)

= −261.73(tons/day)

Hence, the project is expected to achieve 78,519 tons / year(300 day) waste reduction.

② Chemical Oxygen Demand (COD)

The proposed project involves the introduction of intermediate treatment, i.e., composting of organic waste, and thus expected to reduce COD of the leachate from the waste by aerobic fermentation of the organic waste. The efficacy of the proposed project activity on reduction of COD, the indicator for the organic content in the leachate, is assessed as follows;

$$ER_{COD} = BE_{COD} - PE_{COD}$$

ER_{COD} : Chemical oxygen demand removed by the project activity (mg/l)

BE_{COD} : Chemical oxygen demand of the leachate in the baseline scenario (mg/l)

PE_{COD} : Chemical oxygen demand of the leachate in the project scenario (mg/l)

Hence, COD removed by the proposed project activity is calculated as:

$ER_{COD} = BE_{COD} - PE_{COD}$

= 1463 (mg/l) − 850 (mg/l)

= 613 (mg/l)