Fiscal 2008 CDM/JI Feasibility Study

Summary

Study Title:

Feasibility Study on the MSW Intermediate Treatment Programmatic CDM in West Java Province, Indonesia

Corporate Name:

Kajima Corporation

1. Outline of the Project

(1) Host Party, Region

West Java Province, Republic of Indonesia

(2) Description of the Project

This program is to introduce the simplified Mechanical Biological Treatment (MBT) as a technology for intermediate treatment of municipal solid waste (MSW) in the 25 municipalities (16 prefectures and 9 cities) in West Java Province, applying programmatic CDM scheme. The proposed Programme of Activity (PoA) is established with the boundary of whole West Java Province, and the MBT project will be implemented in the municipalities within the province. Each of these MBT project is considered as a CDM programme activity (CPA).

The Environmental Protection Agency of West Java Province (BPLHD) would be the Coordinating/Managing Entity (CME) for the project activities under the PoA, and each CPA will be implemented by each municipality or community. CPA may also be implemented by private companies commissioned by municipalities.

The program is planned to be commenced in 2010, starting with municipalities with large and medium scale landfill site from a cost-effectiveness point of view, and expanding the activities to other municipalities with smaller-scale landfill site using the revenue from obtained carbon credit as funding resource.

Based on the study results, the GHG emission reductions through a large scale MBT project with treatment capacity of 300 t/d is estimated to be 39,000 CO_2t / year (in the first 7 years). The IRR of the large scale project activity is estimated to be 15 % on the condition that CER sales price and tipping fee are 13 USD/t and 4 USD/t, respectively. However, the financial analysis for the other model cases with medium, small-scale facilities (100 t/d, 50 t/d and 10 t/d) gave negative IRR, implying that those projects would not be feasible without additional incomes, such as revenue from compost sales or extra tipping fee.

2. Outline of the Study

(1) Study Subject

Study subjects are as described below;

- To select MSW intermediate treatment system suitable to current condition in West Java Province, and establish a concrete plan
- To promote understandings among the municipalities in West Java Province through a workshop, and select one or few municipality(ies) to participate to the program and implement a project activity
- To develop and execute a plan to expand the selected MSW treatment technology among West Java Province, applying the programmatic CDM scheme
- To make a study on aerobic treatment technology and monitoring methodology

(2) Framework of the Study Implementation

(Japan)

- Kajima Corporation Environmental Engineering Division: In charge of overall activities (especially examination of the implementation scheme)
- Kajima Technical Research Institute: In charge of study on MSW treatment method, monitoring methodology, etc.

(Indonesia)

- Environmental Protection Agency of West Java Province (BPLHD; counterpart): Incharge of coordination among the local governments, development of implementation plan, etc.
- Center of Energy Resources Development Technology (BPPT): In charge of collection on basic information and data
- Institute of Technology Bandung (ITB): In charge of waste analysis, etc.

(3) Study Content

Study team conducted four site surveys during the study period. The dates and contents of each site survey are as listed below.

Date of the Field Study	Contents
1st Field Study 7th September 2008 ~ 13th September 2008	・ Discussion with the counterpart, BPLHD ・ Discussion with ITB on method on waste analysis ・ Explanation on the project plan to the candidate cities for CPA, including Depok city and Bogor city, and visit to the existing landfill site and compost plant ・ Exchange of views and information with local companies
2nd Field Study 14th October 2008 ~ 18th October 2008	・ Discussion on joint-analysis with ITB ・ Site visit to the landfill site in Bekasi city ・ Discussion with laboratory

Date of the Field Study	Contents
3rd Field Study 1st November 2008 ~ 9th November 2008	・ Explanation on the project outline to the Ministry of Public Works (PU), and exchange of views ・ Explanation on the project outline to the DNA in the Ministry of Environment, and exchange of views ・ Holding of the workshop for local governments in West Java Province ・ Discussion with BPLHD ・ Discussion with ITB on progress of analysis
4th Field Study 26th January 2009 ~ 30th January 2009	・ Discussion with the government of West Java Province on details for CDM project ・ Discussion with the candidate local government for CPA on details for CPA implementation

The findings of the studies are as outlined below;

(Subject 1) Selection of MSW intermediate treatment system suitable to current condition in West Java Province, and establishment of a concrete plan

In Bandung City and the commuter towns around the Special Capital Territory of Jakarta, including Bekasi city, Depok city and Bogor city, several issues on municipal solid waste (MSW) management have arisen and these cities have very strong demands for minimization of MSW to improve the current situation. However, due to lack of budget and manpower, it would not be realistic to transfer to Indonesia the highly-advanced and expensive technologies which have been applied in Japan and Europe. With this awareness in mind, the study team concluded that simplified mechanical-biological treatment (MBT) would be the most appropriate to Indonesia.

The study team conducted a questionnaire survey of all the local governments in West Java Province to study current situation on MSW management. Based on the results of surveys, study team developed a proposal for MBT facilities, with a range of options for treatment capacity, i.e., MBT facilities with capacity of 300 t/d, 100 t/d, 50 t/d and 10 t/d. The study team prepared the trial designs of these MBT facilities, and conducted cost-benefit analysis based on the unit price of equipments and labors locally available. The initial cost was estimated to be about JPY 200 million for a large scale capacity (300 t/d) and JPY 10 million for a small scale facility (10 t/d). The operation cost would be JPY 600 thousand/ton and JPY 1 million /ton for 300 t/d and 10 t/d facility, respectively.

(Subject 2) Promotion of understanding of applied technologies among municipalities and selection of candidate sites for CPA

A workshop was held in Bandung city on 5th November 2008, inviting the officers in charge of waste management in all the municipalities in West Java Province, to provide explanation on the technologies to be applied and programmatic CDM, and to promote the understandings among related agencies. After the workshop, four municipalities expressed their interests in participating to the program. After due

consideration, Depok city was selected among them by BPLHD as a candidate city to implement the fist CPA. A meeting was held in January 2009 between the study team, BPLHD and Depok city to provide a detailed proposal for CPA and discuss the detailed plan for implementation. Although Depok city showed a proactive stance in implementing the CPA, the city had some concerns; having own plans for small-scale composting facilities which were already approved by the city council, and having no experience in private consignment of waste management, etc.

On parallel with the plan in Depok City, BPLHD proposed the possible alternative, that is, implementing CPA at the three new landfill sites which are planned to be built by the Government of West Java Province.

(Subject 3) Development of a plan to expand the selected MSW treatment technology among West Java Province, applying the programmatic CDM scheme

Based on the discussion among the related parties, it was agreed that BPLHD or Waste Management Center, an extra-government organization which was established by the Governor would be the most suitable body to be coordinating/ managing entity (CME) for programmatic CDM. Final decision on CME will be made based on further discussions within the provincial governments, and necessary budget for CME will be allocated in the next year.

As examples of CPA, the study team provided a proposal with several model plans, e.g., a plan to build one large-scale MBT facility in the city, and a plan to build several medium/small-scale MBT facilities (refer to 3.2.5 of the report). Financial analysis was also conducted on the assumption that 1) tipping fee for waste treatment was assumed to be 4 USD/ton in all the model cases, 2) major income source would be only revenues from CER sales and tipping fee, and 3) no plastic sales were counted. The financial analysis showed the IRR of 15 % for the model case with the large scale facility (300t/d), and negative IRR for the other model cases (100t/d, 50t/d and 10t/d). This result revealed that the facility with 300t/d capacity would be profitable only with the income from tipping fee and CER sales, while other model cases could not be profitable without additional income, such as extra tipping fee, compost sales and subsidies from the municipalities for operation.

Taking these into consideration, the most effective implementation procedures for the proposed programmatic CDM was proposed as follows; starting with municipalities with large and medium scale landfill site from a cost-effectiveness point of view, and expanding the activities to other municipalities with smaller-scale landfill site using the revenue from obtained carbon credit as funding resource.

(Subject 4) Study on aerobic treatment technology and monitoring plan

To study the most appropriate and effective aerobic treatment technology and monitoring methodology, the study team conducted the test on aerobic treatment in cooperation with ITB. The results discovered that; 30 days would suffice for the aerobic treatment duration of the organic matters (minimum of 21 days), compost yield from the original organic wastes would be about 30 % in wet base, and 30 days of

aerobic treatment gave carbon decomposition ratio of 60 ~ 80 %, which is higher than the default value, DOC_f = 50%, provided in the IPCC guideline. Although further study is still needed to determine a low-cost and simple method for monitoring of carbon decomposition ratio, this study result indicated that the GHG emission from the decomposed waste utilized as cover soil in landfill can be calculated through the monitoring.

3. Project Implementation

(1) Project Boundary and Identification of Baseline Scenario

The boundary of PoA is the whole West Java Province, and the project boundary of CPA is the site of the project activity where the waste is segregated and composted, including the facilities for sorting, aerobic conversion and composting.

The most plausible baseline scenario of the CPA is continuation of current practice, that is, "disposal of waste at a landfill without the capture of landfill gas". This current practice can be applied at the lowest cost without any financial barriers and there are no governmental policies to buy all the compost products for a high price, therefore, any intermediate treatment facilities would be introduced without other incentives such as carbon credit.

(2) Monitoring Plan

This PoA can apply the approved methodology; AM0025 "Avoided emissions from organic waste through alternative waste treatment process", Version 11 (EB44). This methodology addresses project activities where fresh waste, originally intended for landfilling, is treated through either one or a combination of the processes listed below, and methane emissions from the landfill is avoided. The proposed project activity corresponds to a) a composting process in aerobic conditions.

a) composting process in aerobic conditions;
b) gasification to produce syngas and its use;
c) anaerobic digestion with biogas collection and flaring and/or its use;
d) mechanical / thermal treatment process to produce refuse-derived fuel (RDF)/stabilized biomass (SB) and its use;
e) incineration of fresh waste for energy generation, electricity and/or heat

Baseline Emissions

Baseline emissions are calculated using the following equation;

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

$$BE_{y,a} = BE_y \cdot \left(1 - RATE^{Compliance}{}_y\right), \quad MB_y = BE_{CH4,SWDSy}$$

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

The table below shows the major parameters and values used for estimation.

Table 1 Parameters and Values Used for Estimation

Parameter		Value / Descripiton	Source of data used / Measurement method
φ	model correction factor to account for model uncertainties	0.9	
OX	oxidation factor	Use 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost.	Assess the type of cover of the solid waste disposal site through a site visit
F	Fraction of methane in the SWDS gas (volume fraction)	0.5 (IPCC defined value)	IPCC2006 Guidelines for National Greenhouse Gas Inventories
DOC_f	Fraction of degradable organic carbon (DOC) that can decompose	0.5 (IPCC defined value)	IPCC2006
MCF	Methane correction factor	•1.0 ：anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e., waste directed to specific deposition area, a degree of control of scavenging and a degree of control of fires) and will included at least one of the following; (i) cover material; (ii) mechanical compacting; or (iii) leveling of the waste. •0.5 ：semi-aerobic managed solid waste disposal sites. These must have controlled placement of waste and will included all of the following structures for introducing air to waste layer: (i) permeable cover material; (ii) leachate drainage system; (iii) regulating pondage; and (iv) gas ventilation system; •0.8 ：unmanaged solid waste disposal sites – deep and/or with high water table. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of greater than or equal to 5 metres and/or high water table at near ground level. Latter situation corresponds to filling inland water, such as pond, river or wetland, by waste; • 0.4 ：unmanaged-shallow solid waste disposal sites. This comprises all SWDS not meeting the criteria of managed SWDS and which have depths of less than 5 metres.	IPCC2006

<table>
<tr><th colspan="2">Parameter</th><th>Value / Descripiton</th><th>Source of data used / Measurement method</th></tr>
<tr><td>DOC_j</td><td>Fraction of degradable organic carbon (by weight) in the waste type j</td><td>
<table>
<tr><th>Waste type j</th><th>DOC_j (% wet waste)</th><th>DOC_j (% dry waste)</th></tr>
<tr><td>Wood and wood products</td><td>43</td><td>50</td></tr>
<tr><td>Pulp, paper and cardboard (other than sludge)</td><td>40</td><td>44</td></tr>
<tr><td>Food, food waste, beverages and tobacco (other than sludge)</td><td>15</td><td>38</td></tr>
<tr><td>Textiles</td><td>24</td><td>30</td></tr>
<tr><td>Garden, yard and park waste</td><td>20</td><td>49</td></tr>
<tr><td>Glass, plastic metal, other inert waste</td><td>0</td><td>0</td></tr>
</table>
</td><td>IPCC2006</td></tr>
<tr><td>k_j</td><td>Decay rate for the waste type j</td><td>
<table>
<tr><th colspan="2" rowspan="2">Waste type j</th><th colspan="2">Boreal and Temperate (MAT≦20℃)</th><th colspan="2">Tropical (MAT>20℃)</th></tr>
<tr><th>Dry (MAP/PET<1)</th><th>Wet (MAP/PET>1)</th><th>Dry (MAP<1000mm)</th><th>Wet (MAP>1000mm)</th></tr>
<tr><td rowspan="2">Slowly degrading</td><td>Pulp, paper, cardboard (other than sludge), textile</td><td>0.04</td><td>0.06</td><td>0.045</td><td>0.07</td></tr>
<tr><td>Wood, wood products and straw</td><td>0.02</td><td>0.03</td><td>0.025</td><td>0.035</td></tr>
<tr><td>Moderately degrading</td><td>Other (non-food) organic putrescible garden and park waste</td><td>0.05</td><td>0.10</td><td>0.065</td><td>0.17</td></tr>
<tr><td>Rapidly degrading</td><td>Food, food waste, sewage sludge, beverages and tobacco</td><td>0.06</td><td>0.185</td><td>0.085</td><td>0.40</td></tr>
</table>
NB: MAT-mean annual temperature, MAP-mean annual precipitation, PET-potential evapotranspiration, MAP/PET-ratio between the mean annual precipitation and the potential evapotranspiration
</td><td>IPCC2006

Document in the CDM-PDD the climatic conditions at the SWDS site (temperature, precipitation and, where applicable, evapotranspiration). Use long-term averages based on statistical data, where available.

Privide references.</td></tr>
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Project Emissions

Project emission 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.

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

$$PE_{elec,y} = EG_{PJ,FF,y} * CEF_{grid}$$

$$PE_{fuel,y} = F_{cons,y} * NCV_{fuel} * EF_{fuel}$$

$$PE_{c,N2O,y} = M_{compost,y} * EF_{c,N2O} * GWP_{N2O}$$

Leakage

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. There is no increase of transportation related to the proposed project activity or use of stabilized biomass, therefore, the leakage emissions of the proposed project activity can be estimated using the following simplified equation.

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

$$L_{t,y} = NO_{vehicles,i,y} * DT_{i,y} * VF_{cons,i} * NCV_{fuel} * D_{fuel} * EF_{fuel}$$

$$L_{r,y} = M_{compost,y} * DT_{i,y} * VFT_{cons,i} * NCV_{fuel} * D_{fuel} * EF_{fuel}$$

Table 2 shows the parameters to be monitored under the project activities

Table 2 Parameters to be Monitored

Parameter	Description	Source of data used / Measurement method	Frequency
$EG_{PJ,EF,y}$	Electricity generated in an on-site power plants or consumed from the grid due to the project activity (MWh)	Electricity meter	Continuously
CEF_{elec}	The emission factor for electricity generation corresponding to electricity used in the project activity (tCO_2/MWh)	Calculated according to the "Tool to calculate the emission factor for an electricity system"	Annually or ex-ante
$F_{cons,y}$	Mass or volume units of fuel	Purchase invoices and/or metering	Annually
NCV_{fuel}	Net calorific value of fuel(Mj/mass or volume units of fuel)	Project specific data, country specific data. If those are not available, IPCC default values can be used.	Annually or ex-ante
EF_{fuel}	Emission factor of fuel (tCO_2/MJ)		Annually or ex-ante
$M_{compost}$	Total quantity of compost produced in a year (tones)	Plant record	Annually
CCW_i	Fraction of carbon content in fissil carbon waste (fraction)	IPCC or other reference data	Annually
FCF_i	Fraction of fossil carbon in fossil carbon waste (fraction)	To be determined through sampling	Annually
MB_y	Quantity of methane produced in the landfill in the absence of the project activity in year y (tCH_4)	Calculation	Annually
$NO_{vehicles,i,y}$	Number of vehicles for transport with similar loading capacity (Number)	Counting	Annually
$RATE_{Compliance,y}$	Rate of compliance	Annual reporting of the municipal bodies	Annually
$DT_{i,y}$	Average additional distance travelled by vehicle type "i" compared to baseline in year "y" (km)	Expert estimate Assumption to be approved by DOE	Annually
VF_{cons}	Vehicle fuel consumption for vehicle type "i' (litters /kilometer)	Fuel consumption record	Annually
$S_{a,y}$	Share of the waste that degrades under anaerobic conditions in the composting plant in year "y" (%)	Oxygen concentration will be measured by using a standardized mobile gas detection instrument. A statistically significant sampling procedure will be set up that consists of multiple	Weekly
$S_{OD,y}$	Number of samples per year with an oxygen deficiency (e.g. samples with an oxygen deficiency below 10 %)		
$S_{total,y}$	Total number of samples taken per year		

Parameter	Description	Source of data used / Measurement method	Frequency
S_{LE}	Share of samples anaerobic (%)	measurements throughout the different stages of the composting process according to a predetermined pattern.	
$S_{OD,LE}$	Number of samples with oxygen deficiency		
$S_{LE,total}$	Total number of samples		
$A_{j,x}$	Amount of organic waste type "j" prevented from disposal in the landfill in the year "x" (tones/year)	Weighbridge	Annually
$A_{ci,x}$	Quantity of residual waste type "ci" from the anaerobic digestion, gasification, or processing/combustion of RDF and SB		

(3) GHG Emission Reductions

GHG emission reductions are calculated using the following equation. Equations to calculate baseline emissions (BE), project emissions (PE) and leakage are as described in the previous section.

$$ER_y = BE_y - PE_y - L_Y$$

ER_y..... : is the emissions reductions in year y (tCO_2e)
BE_y..... : is the emissions in the baseline scenario in year y (tCO_2e)
PE_y..... : is the emissions in the project scenario in year y (tCO_2e)
L_y ..... : is the leakage in year y (tCO_2e)

Table 3 shows the GHG emission reductions for the project activity with treatment capacity of 300 t/d calculated using the equations provided. Note that this estimation was made on the assumption that the products are utilized as compost after treatment, not disposed at landfill site. GHG emission reduction is estimated to be about 280,000 CO_2t in total of seven years and 40,000 CO_2t per year.

Table 3 GHG Emission Reduction (300 t/d)

年	BE_y ①	PE_y ②	L_y ③	ER_y =①-②-③
1	16,296	796	0	15,500
2	28,119	796	0	27,323
3	36,855	796	0	36,059
4	43,512	796	0	42,716
5	48,657	796	0	47,861
6	52,731	796	0	51,935
7	56,070	796	0	55,274
			Total of 7 years	276,059

*Products will be used as compost, therefore, leakage is estimated to be zero.

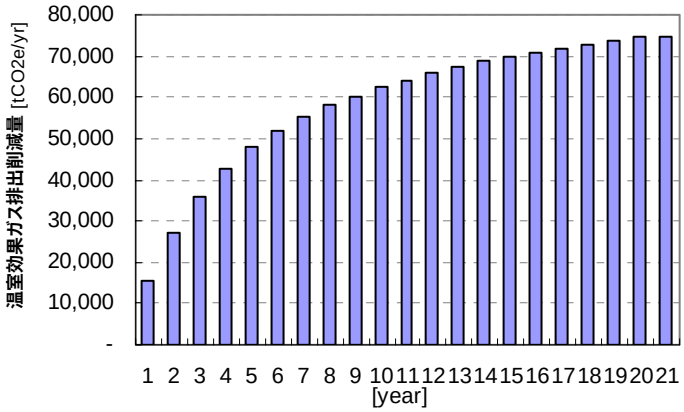

Figure 1 GHG Emission Reduction (300 t/d)

*Products will be used as compost.

(4) Duration of Project Implementation / Crediting Period

The starting date of the project would be early 2010 at the earliest. Duration of the PoA implementation is planned to be 28 years and each CPA will take renewable crediting period with the first crediting period of 7 years.

(5) Environmental Impact and Other Indirect Impact

Environmental Impact

This program is to stabilize the waste through aerobic treatment, and thus is expected to have no major negative impacts on environment. Leachate from the waste will be collected and utilized to add the treated waste to keep moisture, or released to rivers after appropriately treated at a leachate treatment facility.

According to the EIA system in Indonesia, the capacity of the proposed facilities is below the stipulated size, therefore, the proposed projects are not required an EIA report called AMDAL, but is required a simplified environmental management plan (UKL) and environmental monitoring plan (UPL).

Other indirect impacts derived from the proposed project activity can be summarized as follows;

Social Impact

- Extension of life time of landfill site
- Improvement of the image of the landfill site among the residents
- Promotion of 3R

Economical Impact

- Alleviation of financial burden on municipalities imposed by waste management
- Creation of Job Opportunity
- Enhancement of 3R industry

(6) Stakeholders' Comments

CDM-PoA-DD (version 01) requires program owners to indicate the level at which local stakeholder comments are invited, either PoA level or CPA level, as well as a justification of the choice.

The local stakeholders of the program include the local authorities such as government of West Java Province, BPPS and municipalities, residents living in the vicinity of the project site, local social/environmental NGOs and academics. Since there are many social movements in Indonesia by the residents to oppose the construction / operation of landfill site and intermediate treatment facility, it is considered that the stakeholder meeting at the CPA level is required before the commencement of the project. However, to minimize the time and cost required for project development, it is decided to hold a workshop at the PoA level to collect comments at the same time from those who can gather in Bandung City, including national/local governmental agencies.

In this study, a workshop was hold in Bandung City on 5th November 2008, inviting the government of West Java Province, municipalities, national authorities concerned, NGOs and private companies, to collect comments from the participants. Generally, the project was welcomed and received no negative opinions to the project scheme.

The meeting with the local community has not yet been completed. It will be arranged and carried out before the project implementation.

(7) Implementation Framework of the Program

The Government of West Java Province would be CME of the proposed program and each municipality would be implementer of each CPA. As consignment of the waste management to the private sectors is allowed in Indonesia, implementation of the CPA may also be outsourced to private companies.

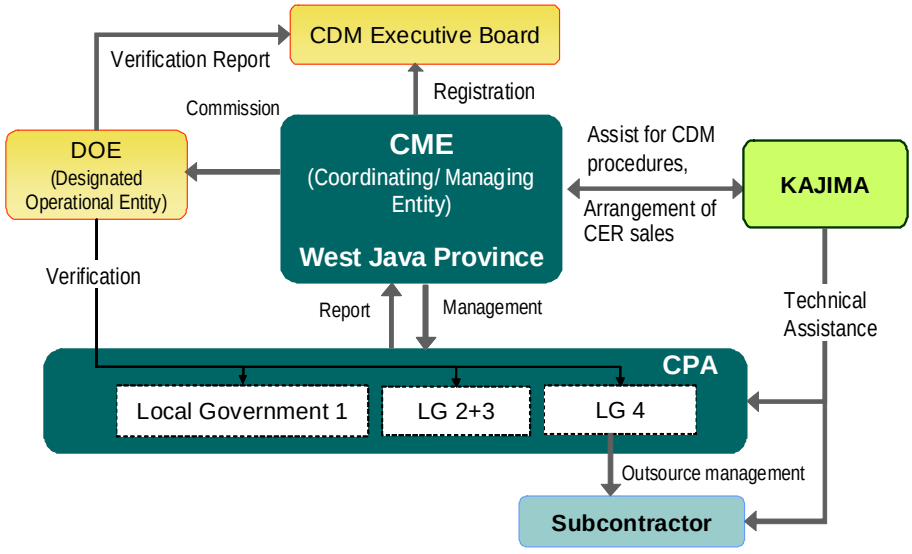

Figure 2 Project Implementation Framework

(8) Financial Plan

Estimation of the cost and revenues received for the project activities with treatment capacity of 300ton/day and 10t/day are as shown in Table 2 and 3, respectively.

Table 4 Costs and Revenues for the Facility with Treatment Capacity of 300t/d

Cost USD			Income USD									
Initial (a)	1,834,745	Payment to CME *	CERs	Comission to UN-EB	CER Sales	Treated MSW	Tipping fee	Plastics Production	Plastics Sales	Compost Production	Compost Sales**	Income Total	Profit
O/M (b)		(c)	tonCO2	USD	13	ton	4	ton	0	ton	40	(d)	d-b-c
1 year	190,622	19,747	15,500	1,600	197,470	99,000	396,000	18,810	0	21,087	0	591,870	381,501
2 year	190,622	34,810	27,323	3,965	348,095	99,000	396,000	18,810	0	21,087	0	740,130	514,699
3 year	190,622	45,939	36,059	5,712	459,392	99,000	396,000	18,810	0	21,087	0	849,680	613,119
4 year	190,622	54,420	42,716	7,043	544,202	99,000	396,000	18,810	0	21,087	0	933,159	688,116
5 year	190,622	60,975	47,861	8,072	609,749	99,000	396,000	18,810	0	21,087	0	997,677	746,080
6 year	190,622	66,165	51,935	8,887	661,652	99,000	396,000	18,810	0	21,087	0	1,048,765	791,978
7 year	190,622	70,419	55,274	9,555	704,191	99,000	396,000	18,810	0	21,087	0	1,090,636	829,595
O/M Total	1,334,354	352,475	276,668	44,834	3,524,750	693,000	2,772,000	131,670	0	147,609	0	6,251,917	4,565,088
IRR (7 years)			15%										
Payback Period			5 years										

Table 5 Costs and Revenues for the Facility with Treatment Capacity of 100t/d

Cost USD			Income USD									
Initial (a)	113,234	Payment to CME *	CERs	Comission to UN-EB	CER Sales	Treated MSW	Tipping fee	Plastics Production	Plastics Sales	Compost Production	Compost Sales::	Income Total	Profit
O/M (b)		(c)	tonCO2	USD	13	ton	4	ton	0	ton	40	(d)	d-b-c
1 year	19,615	637	500	50	6,373	3,300	13,200	627	0	703	28,116	47,639	27,387
2 year	19,615	1,139	894	89	11,393	3,300	13,200	627	0	703	28,116	52,620	31,866
3 year	19,615	1,510	1,186	119	15,103	3,300	13,200	627	0	703	28,116	56,301	35,176
4 year	19,615	1,793	1,407	141	17,930	3,300	13,200	627	0	703	28,116	59,106	37,698
5 year	19,615	2,012	1,579	158	20,115	3,300	13,200	627	0	703	28,116	61,273	39,647
6 year	19,615	2,185	1,715	171	21,845	3,300	13,200	627	0	703	28,116	62,990	41,191
7 year	19,615	2,326	1,826	183	23,263	3,300	13,200	627	0	703	28,116	64,397	42,456
O/M Total	137,303	11,602	9,107	911	116,023	23,100	92,400	4,389	0	4,920	196,812	404,324	255,419
IRR (7 years)			11%										
Payback Period			5 years										

The municipalities and private sectors may utilize the followings funding source to secure the budget for project activity;

Municipalities	・Secure cost for the project from the own budget（In the big and medium cities such as Bekasi city, Depok city, Bogor city and Bandung City which can secure the sufficient budget for waste management） ・Utilize ODA or international grants such as World Bank (Discussion with central government is needed before request) ・Utilize advanced payment of carbon credit
Private sectors	・Utilize bank loan ・Obtain funding from private sectors ・Utilize advanced payment of carbon credit

(9) Financial Analysis

Table 6 shows the results of financial analysis for four models, i.e., project that build a facility with treatment capacity of 300t/d, 100t/d, 50t/d and 10t/d. In addition to the basic case in which the project revenue include only tipping fee for waste treatment and income from CER sales, the study team examined the case that additional income could be gained through 100 % compost product sales. In case that the basic case was found to be unprofitable, minimum compost sales ratio to make a project profitable was also determined. In the estimation, tipping fee for waste treatment was assumed to be 4 USD/ton in all the model cases, and no plastic sales were counted.

The financial analysis revealed that model case with the large scale facility (300t/d) was profitable only with the income from tipping fee and CER sales, while other model cases could not be profitable without some additional income source, such as compost sales, extra tipping fee, or plastic sales, etc.

In the other model cases, a certain volume of compost sales is necessary to make projects profitable. In the model case 2 (100 t/d) and 3 (50t/d), over 15 % of compost produced needs to be sold, and model case 4 (10 t/d) require sales ratio of over 70 %. However, it is expected that it would not be difficult to achieve those targets on compost sales, as the production amount itself is very few in those model cases.

Table 6 Result of Financial Analysis

	Model case 1 300t	Model case 2 100t	Model case 3 50t	Model case 4 10t
IRR and pay-back time without compost sales	15% 5 year	Negative	Negative	Negative
IRR and pay-back time with compost sale (100 %)	73% 2 年	33% 3 年	34% 3 年	11% 5 年
Minimum sale rate of compost product needed to become profitable in 7 years 7	-	15%	15%	70%

(10) Demonstration of Additionality

Additionality of the proposed program 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 are identified as follows, and all are in compliance with the mandatory laws and regulations that are set by the Government of Indonesia.

M1. The project activity not implemented as a CDM project;

M2. Disposal of waste at a landfill where landfill gas is captured and flared;

M3. Disposal of waste at a landfill without the capture of landfill gas.

Based on the results of barrier analysis and common practice analysis, it was demonstrated that, among the three alternatives, the proposed project activity (M 3) faced investment barrier and technological

barrier, and any similar activity would not be implemented without the incentive provided by the CDM. Therefore, the proposed project activity is additional.

(11) Prospect and Concerns for Implementation of the Program

As described in the previous sections, the study team conducted a workshop in November to provide explanation on the project scheme to the municipalities, and is now under the discussion with candidate municipalities for a detail project development. Generally, the government of West Java Province and municipalities welcome the project and have expectations of early implementation of the project.

However, there are still some issues to be addressed for implementation of the project, as summarized below;

- Authorization of CME
- Selection of Municipalities Implementing CPAs
- Development of detailed plan for CPA
- Rulemaking between CME and CPAs
- Barriers to the Private Consignment of the Project Implementation

4. Pre-validation

(1) Outline of pre-validation

Pre-validation was not conducted in the Study

(2) Progress of the Discussion with DOE

Not yet implemented.

5. Realization of Co-benefit in the Host Party

(1) Evaluation on Pollution Control in Host Party

To evaluate the contribution of the proposed activity to pollution control in the Host Party, the study team established an assessment system with three major factors, i.e., Odour, Water Pollution Control and Air Pollution Control. Each factor is evaluated on a five-point scale. Bigger number represents higher efficiency.

① Assessment Indexes for Pollution Control

a: Odor

（Landfill Site）

	Condition	Applicable technology
1	Strong odor is clearly recognized near the landfill site (odor intensity 4 or 5)	Open-dumping in very poor condition
2	Odor is clearly recognized within the landfill site (odor intensity 4 or 5)	Open-dumping
3	Odor is recognized in the part of plant (odor intensity 2 or3)	Controlled Landfill (covered with soil frequently, possess leachate treatment facility)
4	Weak odor is perceived (odor intensity 1 or 2)	Controlled landfill in very good condition
5	No odor or very weak (odor intensity 0 or 1)	Intermediate treatment (Organic matters are decomposed through aerobic treatment)

（Transportation）

	Condition	Applicable technology
1	Receive complains from the residents frequently (odor intensity 4 or 5)	
2	Receive complains from the residents frequently (odor intensity 3 or 4)	
3	Receive complains from the residents infrequently (odor intensity 2 or 3)	
4	Very weak odor and receive no complains from the residents (odor intensity 1 or 2)	Intermediate treatment (Organic matters are decomposed through aerobic treatment)
5	No odor or very weak	

b：Water Quality

	Condition	Applicable technology
1	Water quality is far below the Indonesian Standard	Landfill site without leachate treatment facility
2	Water quality is below the Indonesian Standard	
3	Comply with the Indonesian and Japanese standard	Landfill site with simple leachate treatment facility e.g. aeration or lagoon
4	Comply with the more stringent prefectural standard in Japan in most of time	Landfill site with advanced leachate treatment facility or intermediate treatment facility
5	Comply with the more stringent prefectural standard in Japan on a steady basis	

② Assessment Indexes for Disaster Control

c：Fire

	Condition	Applicable technology
1	Wastes are not covered with soil and generate a large amount of methane, therefore, some wastes such as plastics easily catch fire due to methane oxidation, which cause a massive fire in dry season	Open-dumping without cover soil
2	Methane oxidation frequently occurs in dry season due to insufficient cover soil and a large methane emission amount at the landfill	
3	Fewer risk of fire due to an adequate management including cover soil or small methane emission amount at the landfill	Controlled Landfill (covered with soil frequently, possess leachate treatment facility)
4	Few risk of fire due to an adequate management including cover soil and small methane emission amount at the landfill	Intermediate treatment (Organic matters are decomposed through aerobic treatment)
5	Very few fire risk	

d：Land Slide

	Condition	Applicable technology
1	High risk of wide-scale land slide because waste are piled up to higher than 30 m without insufficient compaction, or dumped randomly to a slope	Open-dumping in very poor conditions without cover soil
2	High risk of land slide but not in wide scale (e.g. open-dump type landfill with the landfill layer of less than 30 m	Open-dumping
3	Controlled at a certain level, but still have risk of land slide in the part of landfill area	Controlled landfill
4	Not applicable	
5	No risk of land slide due to a sufficient management including compaction of waste	

③ Assessment Index for Social Contribution

e：Waste Reduction Rate

	Condition	Applicable technology
1	Nearly zero	Open-dumping
2	Over 20 %	
3	Over 40 %	
4	Over 60 %	Landfill mining
5	Over 80 %	MBT, Incineration

f：Life-time of Landfill Site

	Condition	Applicable technology
1	No plans for life-extension for the landfill	Continuation of current practice, or LFG collection CDM
2	Not applicable	
3	Can extend the remaining life-time of the landfill operation	Landfill Mining*
4	Expected to have a significant effect on extension of life-time of the landfill under the right conditions	
5	Expected to have a significant effect on life-extension for landfill	3R activity such as source separation, other intermediate treatment

*Measure to mine the existing landfill for valuables

g：Understanding of the Residents

	Condition	Applicable technology
1	Receive strong oppositions from the residents living in the vicinity of the landfill site, and face concrete actions to oppose the land filling taken by the residents	Open-dumping in very poor conditions without cover soil
2	Receive oppositions from the residents frequently	Open-dumping
3	Receive some oppositions but no concrete problems	
4	Gain public understanding generally, but still have possibility to have issues in the future	
5	Win sufficient understandings of the residents	

6. Proposal for Co-benefit Assessment Index

A comprehensive evaluation matrix was established bringing the concept of comprehensive assessment system for building environmental efficiency (CASBEE).That is, score for pollution / disaster control "P" and score for social contribution "Q" are calculated by summing up the grade points after multiplying the original grade point of each item by the corresponding weighting coefficient, and converting it to 100-point scale. The total score is rated on 1-5 scale, i.e., S rank, A rank, B+ rank, B- rank, C rank, as shown in the table below. Table 7 shows the e of Pollution Control Assessment for the some examples of waste treatment technologies.

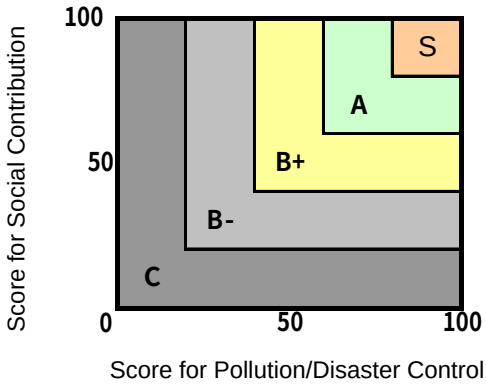

Figure 3 Correlation between Scores and Ranking

Table 7 Evaluation Results per Treatment Methods

Category	Weighting Coefficient	Justification for Weighting coefficient	Examples of Waste Treatment: Open-dumping	LFG Collection	MBT
a. Odor	0.4	Have only limited impact	1	3	4
b. Water Quality	0.6	Have big impact on ambient environment and human health	2	2	4
	0.5	Pollution Control Index	1.6	2.4	4
c. Fire	0.3	Have only limited impact	1	4	5
d. Land Slide	0.7	Have a great possibility to cause casualties	2	3	4
	0.5	Disaster Control Index	1.7	3.3	4.3
		Score for Pollution/Disaster Control: P	1.7	2.85	4.2
		25*(P-1)	16.3	46.3	78.8
e. Waste Reduction Rate	0.3	Both "e" and "f" are most important factors which form the backbone of waste management issues.	1	1	5
f. Life-time of Landfill Site	0.3		1	2	4
e. Understanding of the Residents	0.4	Ditto	1	3	4
		Score for Social Contribution: S	0.7	1.8	4.3
		25*(Q-1)	-7.5	20.0	82.5

Overall Judgment	C	B-	S
Comments	Have problems in all the categories of pollution and disaster control. Also considered to be socially-inappropriate.	Have a certain level of effects on decrease in odor and fire risks through the soil-covering and LFG collection, but will not contribute to waste reduction.	Enables waste stabilization and drastic waste minimization. Also contribute to expansion of life time of landfill site. Will be easy to get the understandings of the residents.