Fiscal 2007 CDM / JI Feasibility Study

on

Municipal Solid Waste 3R Promotion & Stabilization

In Viet Nam

Final Report

Summary

March 2008

KAJIMA Corporation

1 Project Purposes and Background

Municipal solid waste treatment is becoming a serious environmental issue in most of the South Eastern Asian countries. While the waste generation amount has been increasing due to the rapid economic and population growth, the waste treatment is given low-priority in budget allocation. Therefore, no measures are taken to improve the waste treatment method and open dumping is continued, which leads several problems such as bad odour, water pollution, and land sliding. Furthermore, those issues result in a distrust of the residents in the waste treatment facilities, which makes difficult for the government to construct a new landfill site.

Amid a growing concern over the municipal solid waste issues, the Government of Viet Nam is being urged to take countermeasures, and they established a policy to introduce 3R (Reduce, Reuse, and Recycle) as a key measure for dealing with these issues. The government set a goal in the Environmental Protection Strategy" which was established in 2003, to promote recycling and to increase the recycling rate to 30 % by developing the recycling industry, and also declared in the Environmental Protection Law amended in 2005, to minimize waste disposal amount through 3R and introduction of sound treatment for each waste category.

The Government of Japan also devised a set of policy recommendation to establish a sound material-cycle through 3R, and has been proceeding this policy in many ways. For example, the "3R Initiative" was advocated by the ex-Prime Minister Junichi Koizumi in 2004, "Asia 3R Conference" was organized under a leadership of the Ministry of Japan in 2006, and the "Environmental Protection Policy" was approved in a Cabinet in 1st June 2007. Now it is required to establish a scheme to realize a sound material-cycle society through 3R. As one of the 3R promotion activities, the Japan International Cooperation Agency has commenced a technology transfer project, "the Project for Implementation Support for 3R Initiative in Hanoi City to Contribute to the Development of a Sound Material Society" in November 2006. This project aims to introduction of the source separation of the solid waste in the model areas, and enhancement of residents' awareness of 3R.

The proposed project aims to introduce 3R of the municipal waste and stabilization treatment method, consequently to solve the waste issues in Vietnam and to reduce the GHG emission.

2 Project Outlines

The most promising CDM project on waste management had been the recovery and utilisation of landfill gas. However, it was revealed that it is difficult to gain satisfactory CER through this project scheme for the following reasons: 1) this project activity requires landfill site after closure, with adequate capacity, which is very limited, and difficult to find, 2) in the South Eastern Asia,

due to its typical climate of the high temperature and humidity and insufficient soil cover at the landfill site, organic matters contained in the disposed waste are easily and rapidly decomposed, and this results in the much less collection amount of landfill gas than ex-ante estimation.

Given this factor, the more appropriate, efficient and reliable measures to solve waste issues in Vietnam and to implement as CDM project is considered to be introduction of the intermediate treatment of waste which is currently disposed of at the landfill site. Intermediate treatment of waste includes “Composting”, “Gasification”, “Anaerobic digestion” “RDF/SB processing”, and “Incineration”. Among these, “Incineration” is the most familiar measure in Japan, and Japan possesses the high level technologies on this treatment. However, because of its high initial cost and high operation & maintenance cost, incineration is difficult to be successfully introduced in the developing countries. Therefore, it is needed to pursue the intermediate treatment with appropriate cost from the sustainable standpoint.

This project aims to introduce the mechanical sorting and bio-treatment (MBT) system for the waste which is currently disposed at landfill site in the three target cities, namely, Da Nang city, Hai Phong city, and Bac Ninh city. Mechanical sorting is to collect recyclables efficiently and to promote 3R of waste, while “bio-treatment process” is to stabilize the waste through high-speed aerobic digestion of organic matters. The aerobic digestion prevents waste from being degraded under the anaerobic condition which generates methane gas, and thus contribute to the GHG emission reduction.

It is also expected that the proposed project improves the sanitation level of the landfill site including odor and water quality control, mitigate the risk of fire at the landfill site, and prevent collapsing of the landfill, as well as emission reduction of the GHG.

Based on the site survey results, a waste treatment flow was formulated as shown in Figure 2.1, with the estimated waste treatment capacity of 500 ton/day in Da Nang, 250 ton/day in Hai Phong, and 250 ton/day in Bac Ninh. Through the proposed waste treatment, the amount waste to be disposed of is estimated to be 40~50 wt% of waste collection amount.

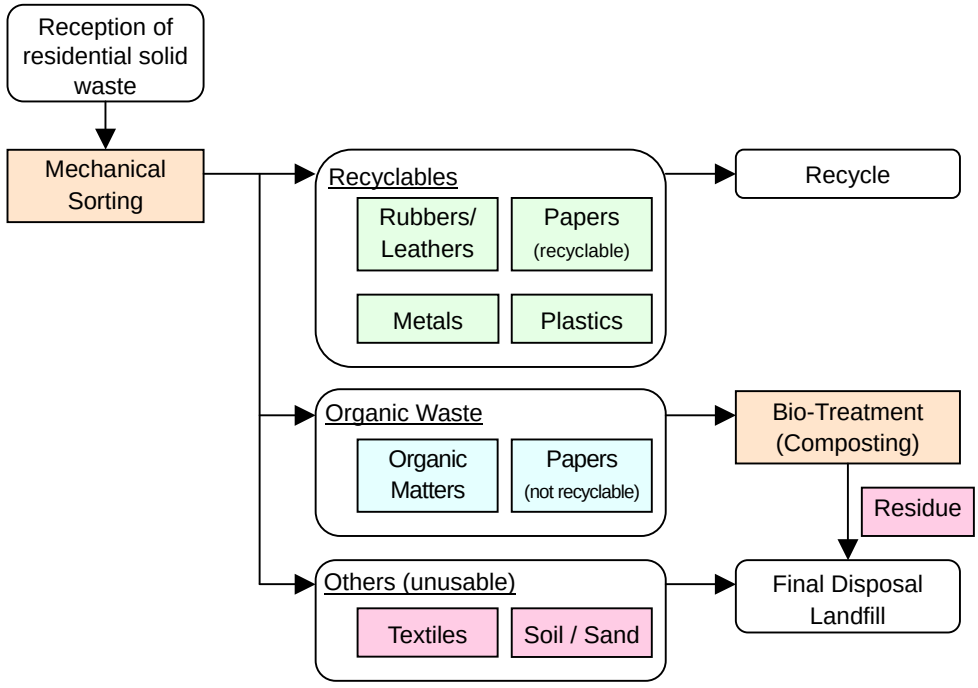

Figure 2.1 Waste Treatment Flow

Mechanical Sorting Process

In the mechanical sorting process, collected wastes are classified roughly into three categories, i.e., a) recyclable, b) organic wastes and c) others.

Recyclables include plastics, rubbers & leathers, metals, recyclable papers are sold to the existing recycling traders. Plastics and papers can also be recycled through a technical process to produce RDF, which can be utilized as a fuel / material at the cement plant. However, after the due examination, the study decided not to adopt this recycling method due to the following reasons: a) the recycling market for those items has already been developed in Vietnam, and b) the near-by cement plant has no experience in accepting the RDF, and they already have fuels (coal) available at reasonable price.

Other wastes such as textiles, inert wastes (e.g., soil, sand) are transported to the landfill sites to be disposed.

Bio-Treatment Process

The bio-treatment targets at organic wastes and papers (non-recyclable). Under the proposed project, the residues from the bio-treatment are transported to the landfill site to be disposed of,

not to be sold as organic fertilizer, taking into consideration the product quality.

The national standard of Vietnam requires the organic fertilizer producers to assure the product quality and implement two-year field tests before start selling the organic fertilizer produced through the bio-treatment of wastes. To maintain the product quality, steady supply of good quality organic waste is essential. However, it is difficult to keep the steady supply in the current situation under which a compactor collects wastes from market, roadside, and household mixed together, without segregation. Moreover, two-year field tests required by the national standard can also be a barrier to early implementation of the project. Therefore, this project does not sell the residues from the bio-treatment, but utilize them as soil cover at the landfill site.

3 Baseline Scenario

The baseline methodology applied to the project activity is the AM0025 "Avoided emissions from organic waste through alternative waste treatment processes (version 10)", approved by the CDM Executive Board. This methodology addresses project activity where fresh waste (i.e., the organic matter present in new domestic, and commercial waste/municipal solid waste), originally intended for landfilling, is treated either through one or a combination of the following process: composting, gasification, anaerobic digestion, RDF processing/thermal treatment without incineration, and incineration.

The proposed project activity corresponds to the waste treatment option a), "composting process in aerobic conditions", and satisfies all the applicability criteria provided in the AM0025. Therefore, the approved methodology AM0025 is applicable to the proposed project.

In line with AM0025, the project identified the most plausible baseline scenario, and assessed and demonstrated its additionality according to the "Tool for the demonstration and assessment of additionality".

4 Monitoring Plan

Based on the monitoring methodology AM00025, the parameters to be monitored under the project are clarified as listed in the Table 4.1.

Table 4.1 Monitoring Parameters and Measurement Methods

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 measurements throughout the different stages of the composting process according to a predetermined pattern.	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		
S_{LE}	Share of samples anaerobic (%)		
$S_{OD,LE}$	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		
$Q_{COD,y}$	Amount of wastewater treated anaerobically or released untreated from the project activity in year "y" (m^3/yr)	Measured value by flow meter	Monthly aggregated annually
$P_{COD,y}$	Chemical Oxygen Demand (COD) of waste water (tCOD/m^3)	Measured value by purity meter	Monthly and averaged annually

5 GHG Emission Reduction

Based on the study results, the amount of GHG emission reduced through the project activity was calculated as shown in Table 5.1 and Figure 5.1.

It is expected that the annual emission reductions will increase gradually in the first 10 years after initiation of the project, and then become stable. Total GHG emission reduction in each city throughout the project period (7 years) is estimated to be 460,000 tCO2e in Da Nang City, 250,000 tCO2e in Hai Phong, and 96,000 tCO2e in Bac Ninh City.

Table 5.1 GHG Emission Reduction

・Da Nang

yr	BE: Baseline Emissions ①	PE: Project Emissions ②	L: Leakage ③	ER: Emissions Eeductions = ①-②-③	
1	27,350	1,390	0	25,970	
2	47,180	1,390	0	45,790	
3	61,780	1,390	0	60,390	
4	72,720	1,390	0	71,330	
5	81,070	1,390	0	79,690	
6	87,580	1,390	0	86,190	Total (7 yrs)
7	92,750	1,390	0	91,360	460,720

[tCO_2e/yr]

・Hai Phong

yr	BE: Baseline Emissions ①	PE: Project Emissions ②	L: Leakage ③	ER: Emissions Eeductions = ①-②-③	
1	15,400	820	0	14,590	
2	26,370	820	0	25,560	
3	34,280	820	0	33,460	
4	40,060	820	0	39,240	
5	44,340	820	0	43,530	
6	47,570	820	0	46,750	Total (7 yrs)
7	50,040	820	0	49,230	252,360

[tCO_2e/yr]

・Bac Ninh

yr	BE: Baseline Emissions ①	PE: Project Emissions ②	L: Leakage ③	ER: Emissions Eeductions = ①-②-③	
1	6,000	390	0	5,610	
2	10,230	390	0	9,840	
3	13,240	390	0	12,860	
4	15,420	390	0	15,030	
5	17,010	390	0	16,620	
6	18,180	390	0	17,800	Total (7 yrs)
7	19,070	390	0	18,680	96,440

[tCO_2e/yr]

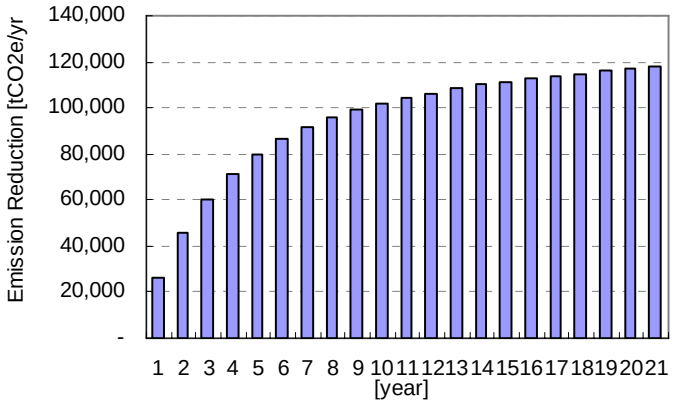

Figure 5.1 GHG Emission Reduction (Da Nang)

6 Environmental Impact Analysis

According to the Vietnamese laws on Environmental Impact Analysis (EIA) system, the proposed project falls under the "reprocessing and treatment facility for municipal solid waste" which is covered by the EIA system, hence, the project is obligated to conduct EIA and prepare EIA Report in accordance with the law.

The study also analyzed the possible environmental impact caused by the proposed project activity and measures to mitigate impacts.

7 Project Implementation Plan

The proposed project activities in three cities are implemented by the Special Purpose Company (SPC) jointly established by the Japanese companies (including Kajima Corporation) and People's Committee of each city. Peoples' Committee of the corresponding city will finance the SPC, entrust project implementation to the SPC and pay tipping fee for the work. However, the actual project activity related to the waste treatment will be outsourced to the Urban Environment Company (URENCO) of each city, the current agency in charge of waste managemetn.

Another possible option is to implement project using Build-Operate-Transfer (BOT) system in which the SPC receives a franchise from the People's Committee to implement the project, and the ownership is transferred back to the People's Committee after a certain period.

Regardless of project implementation structure, the first refusal right of carbon credit sales should be given to the Japanese side as long as the project is implemented using CDM scheme. Further discussion with the corresponding agencies is needed to formulate a detailed business plan.

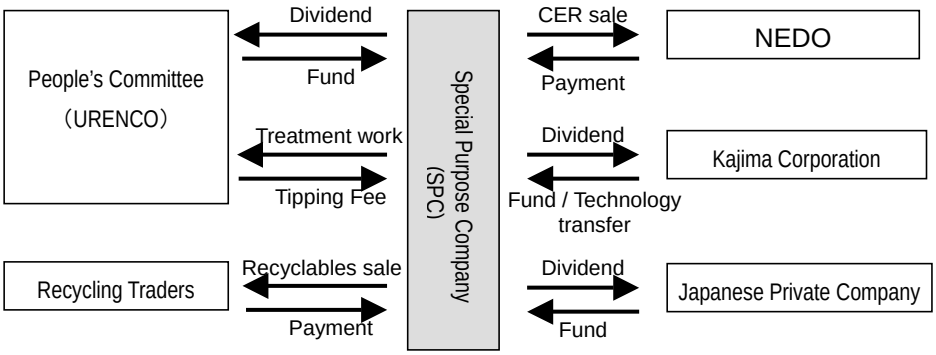

Figure 7.1 Implementation Structure

Table 7.1 shows the project implementation schedule. It is planed to obtain the approval of the government and CDM Executive Board in 2008, then formulate a detailed design and construct facilities, and start operation from the middle of 2009. Project period is seven years (maximum 21 years with two extensions)

Table 7.1 Implementation Schedule

	2007				2008				2009				2010			
Feasibility Study																
PDD																
EIA																
Validation																
National Approval																
UN Registration																
Detailed Design																
Construction Work																
Operation																

8 Financial Analysis

Profitability of the project was analyzed using benchmark analysis method, with IRR as a financial indicator.

Project expenses are calculated as follows: initial cost and O&M cost in Da Nang are 224 M yen and 34 M yen/year, respectively, 124 M yen and 19 M yen/year in Hai Phong, and 46 M yen and 12 M yen /year in Bac Ninh. The project incomes was calculated with the following assumptions: a) CER sale price: 10 USD/tCO2e (exclude the registration fee for CDM Executive Board, b) CER sale price to be paid to the Government of Viet Nam, c) Tipping fee for the waste treatment work: 0.5 USD/ waste-ton, and d) Profit on sales of recyclables: 600 VND/kg. The benchmark of the project profitability is the international bond rate of the Government of Viet Nam which is 7.125 %. (Issued in October, 2005 period of redemption; 10years)

The results of the financial analysis (refer to Table 8.1.) showed the negative project IRR for all regions, indicating that the project is not financially viable without the CDM revenue. With CDM revenue, only the project in Da Nang project results in higher IRR than the interest rates provided by government of Viet Nam.

Table 8.1 Financial Analysis Results of the Project

	Da Nang	Hai Phong	Bac Ninh
Without CDM	-	-	-
With CDM	7.8	2.3	-

IRR:[%]

Table 8.2 shows the project IRR calculated using the different project duration, including the originally planned project period of 7 years, and project IRR when the project duration is extended to 10 years and 14 years. Based on the study results, it is expected that the project in Hai Phong can be financially viable by extending the project duration. On the other hand, the project in Bac Ninh shows the negative IRR regardless of the project duration, indicating low-potential to be a financially viable.

Table 8.2 Financial Analysis Results (With Extended Project Duration)

		Da Nang	Hai Phong	Bac Ninh
Project Duration	7years	7.8	2.3	-
	10 years	14.1	9.0	-
	14 years	17.0	12.2	-

IRR:[%]

9 Conclusion

This study examined the feasibility and profitability of waste composting project, whose goal is to promote the 3R (reduce, reuse and recycle) and stabilization of the waste disposed of at the landfill sites in the three cities in Viet Nam (Da Nang, Hai Phong, and Bac Ninh), and consequently to reduce the GHG emission.

Since the amount of methane gas emission largely depends on the waste composition, the study surveyed the composition of the waste transported to the landfill site in the target cities to obtain more accurate estimation of the methane gas emission. To promote the 3R of the solid waste, it is essential to grasp the flows of the waste/recyclables after segregation. On this account, the current condition of the recycling activities in the target cities was also studied, and efficiently-incorporated in the project scheme.

As a result of financial analysis, it was concluded that the only the project in Da Nang City can be financially viable and economically attractive. The project in Hai Phong can also be profitable if the several conditions are improved, and the project in Bac Ninh, on the other hand, has very low potential to be feasible under the current condition. However, those assessments were made on the assumption that the CER revenue can be generated continuously after the first commitment period. The final decision for project implementation should be made taking into account the circumstances after the first commitment period.

The study intends to implement the project at the earliest possible time, targeting the Da Nang City at the first step. It is planned to proceed the CDM procedures, including validation, getting approval from the Government of Viet Nam and Japan, and registration by the CDM Executive Board of UN. It is also necessary to prepare for the business operation including the detailed design of the facilities, establishment of SPC.

The proposed project is to contribute to the settlement of the solid waste issues in Viet Nam, as well as to GHG emission reduction. Therefore, the project team received a lot of positive feedbacks from the national and local governments, which reflect their expectations for the project implementation. In Viet Nam, there are currently two CDM projects approved by the CDM Executive Board. It is hoped that the project implementation leads to further development of the CDM projects in Viet Nam, and contributes to the enhancement of partnership between Viet Nam and Japan, in the field of environment.

Last of all, we would like to express our sincere gratitude to the corresponded agencies including People’s Committee, especially URENCO, who provided active cooperation to the implementation of the FS.