FY2009 CDM/JI Feasibility Study
Summary Report

Name of the study

Feasibility study for CDM project development on aerobic treatment of household waste in Hai Duong Province, Vietnam

Study implementation body

IKE (Ichikawa Kankyo Engineering, Co., Ltd.)

Study implementation structure

We selected following 2 counterparts to implement out study;

1) APT-Seraphin-Hai Duong (hereunder ASH, a local private company in Vietnam), as a counterpart of the particular CDM project planned at Hai Duong Province, Vietnam

2) Science/Technology/Environment Department, Vietnam Ministry of Construction (hereunder MOC, the jurisdiction ministry on municipal waste management in Vietnam and jurisdiction department of CDM projects within the ministry of construction), to consider future possibility of studying Program CDM.

We also conclude the direct contract between following 2 organizations;

1) Vietnam Japan Environmental Technology (hereunder VJ): Project survey assistance

2) （Vietnam Urban Environment and Industrial Zone Association (hereunder VUREIA): Waste analysis, composting experiment, Data collection

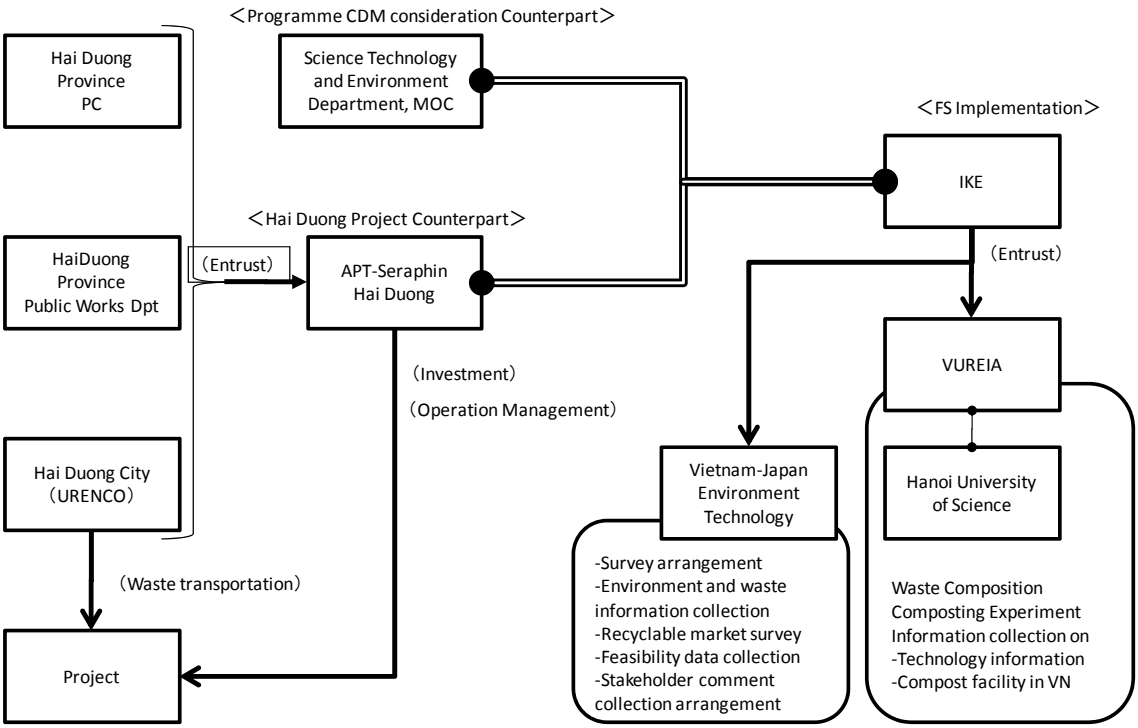

Figure 0.1: Study implementation structure

１． Outline of the Project

（1） Host Country, Area

Hai Duong Province, Socialist Republic of Vietnam

（2） Project Outline

The site of this project is located in Thanh Ha prefecture, Hai Duong province, and the project is a new waste treatment facility construction and operational project including composting facility, waste plastics and constructional waste treatment facilities (treatment capacity of the plant is 200t/d) which is to be done by the investor of this project APT-Seraphin–Hai Duong.

The composting facility will aerobically treat organic wastes contained in the municipal solid waste which discharged from Hai Duong city and also from surrounding prefectures within Hai Duong province. The starting date of plant operation will be end of 2010.

In the project activity, organic wastes will be separated by hand and machine from mixed municipal solid wastes collected and will be treated under the supply of rich oxygen (aerobic condition) at the composting line of the new waste treatment facility. The decomposable organic carbon will be decomposed into CO2 (and H2O) under this aerobic condition.

In the baseline scenario, the organic wastes will not be separated from the mixed municipal waste, and it will be directly dumped in a deep landfill site, which not much enough oxygen will be supplied (anaerobic condition). Under anaerobic condition, decomposable organic carbon will be decomposed to CH4, which gives bigger Green house effect than CO2.

The project activity converts CH4 emission to CO2 emission by implementing a new waste treatment facility including composting line, instead of continuing the direct land filling of organic waste.

CO2 reduction amount （Carbon Emission Reduction, hereunder CER） from this project was calculated to be approx. 246,000 CO2 equivalent tons in 10 years. Although ASH will receive 6 to 7 US$ per ton of treated waste from Hai Duo ng Province, Internal rate of return (hereunder IRR) of this project is 10.79% i ncluding the sales of recyclables such as waste plastics and compost products. This number is slightly over the long-term banking rate in Vietnam, which means t his project is not so attractive when considering the business risks. If the project be comes CDM project and the CER can be sold in price of 15 US$/ CO2 t equivale nt, the IRR will rise up to 15.55% which will be much attractive to invest.

Taking up the above mentioned project as a model, we also studied the possibilit y of utilizing “Program CDM” to support the implementation of policy on decreasing the amount of waste disposal to the landfill site, developed by VN Ministry of Construction.

２． Contents of the Study

（1） Studied Items

①Confirmation of adopted technology of the Project

The project is expecting to use the local technology designed and manufactured by Seraphin Green Environment Joint Stock Co.(hereunder SGE), which is the stockholding company of ASH. This technology is one of 2 technologies which Vietnam Ministry of Construction approved as technologies for municipal waste intermediate treatment so far.

We confirmed the outline of the technology and also confirmed its operation. We also confirmed the waste composition of Hai Duong city as the basic data for confirmation of the technology performance.

②Data collection and evaluation concerning the business feasibility, business continuance and profitability

We collected data and evaluated on the waste separation and recycling business itself on feasibility, continuance and profitability, based on interview and information from investment report provided by ASH.

(a) Project scheme design

・Investor information

・Information on waste management organization/division of central and provincial government

・Information on financing organization

・Information on organizations related to CDM in Vietnam

(b) Confirmation and information collection on project site

・General information, landscape information

・Specific information（Accessing road, infrastructure, surrounding environment）

・Waste information of the aimed area

(c) Confirmation of facility operation and management skill of ASH

・References of business and facility operation

・Supporting structure by the mother company

(d) Calculation of business profitability

・Investment cost, cost-income items, conditions

・Preparation of Profit & Loss, cash-flow sheet

・Calculation of IRR

・Interviewing the general investment standards, research of banking interest rate of local banks

(e) Consideration of financial plan

・Research on financing organization/ condition and present discussion between ASH and the financing organization

③Actions to provide PDD

Following actions were taken to prepare PDD for developing ASH project as a CDM project

(a) Collecting stakeholder's comments

・Site : Hai Duong Provincial/City People's Committee, Hai Duong Urban Environment Company

・Central government: : Ministry of Construction, Vietnam

・Confirmation of other necessary stakeholders to collect comments

(b) Consideration of boundary and baseline scenario

・Sort out the option which can be taken in Vietnam as the waste treatment method, and confirm whether landfill is the baseline case in Vietnam or not, by interviewing to influential individuals, Vietnam Urban Environment Industrial zone Association（VUREIA）.

(c) Consideration of project emission

・Sort out the project emission factors throughout the project activity.

(d) Consideration of monitoring plan

・Design the data collection method/accumulation and preservation method of the individual monitoring items, design the management and implementation structure, design monitoring action flow. Discuss with the project owner about the reality and possibility of the proposed design.

(e) Consideration of the adoptability of approved methodology

The project will use approved methodology for small-scale CDM "AMS-III.F". The study will confirm information as below, to confirm the adoptability of the selected methodology.

・Detail Confirmation of the Compost production procedure（source and type of water for moisture, quality management during the production process ）

・Confirm by calculation that avoided amount of CO2 is under 60ktCO2.

(f) Consideration of additionality

・Confirm that mechanical composting is not the general option in Vietnam to take for waste treatment method, by asking VUREIA and influential persons.

・Collect data of buying cost of waste plastic and utilize it to prove the existence of economical barrier.

・Confirm the general standard of compost products in Vietnam.

・Confirm the waste treatment entrustment fee from government to URENCO.

④Consideration of promoting as Programme CDM

"Decision 2149 on Strategy of Solid Waste Management up to 2025", the mid-long term vision of promotion of waste reduction/treatment/recycling, which was proposed by MOC and MONRE was approved by the prime minister in the end of2009.

CDM is mention as one of the option to promote the vision in this proposal. Based on this policy, the study team will be discussing with MOC the possibility of them being CPA for the program CDM to promote the policy utilizing CDM.

(2) Contents of survey

Table 2.1 : Contents and result of field survey

Period	Contents
First survey 2009/8	・Contract with supporting organizations. Meetings on contents and schedule for data collection and composting experiment. ・Meeting with ASH. Implementation scheme, present situation information collection, facility planning, financial plan and business evaluation, planning of stakeholders comments (time, place, opponents). ・Meeting with Hai Duong province PC and Hai Duong-URENCO. Explanation on CDM, collecting their comments, collecting comments on how to proceed the comment collection from surrounding residents of project site. ・Meeting with influential person of composting technology. Data collection, evaluation of Seraphin technology, situation of diffusion and operation of mechanical composting in Vietnam. ・Site visit（Present landfill site of Hai Duong city, project site, pilot plant in Han Nam）. ・Reporting about the 1st visit activity to MOC, explanation on CDM. ・Discuss about test experiment contents and equipments for the composting experiment with the entrusting organization.
Major result of 1st visit	1）confirmation of project contents (approvals, business feasibility, schedule) Confirmed the evidence that the project is actually moving forward (such as investment report, development approval letter,

	EIA report, site information). All of these procedures were confirmed by documents and interview. The tentative price of waste treatment entrustment fee from Hai Duong Province was decided 7USD/ton. 2）Stakeholder comment collection In usual development of these projects, there are no other stakeholders besides province PC to collect comments in Vietnam rule (Province PC is entrusting organization of the waste treatment, land manager, development approving organization and business licensor). EIA requires a comment from district PC but the study team found that it was completed before December 2007. The study team was also given a advice to obtain comment from district PC if the investor decide to promote this project by CDM. 3）Confirmation of waste composition The study team decided to entrust the waste composition analysis to Hanoi University of Chemistry（HUS）. 4）Consideration of Programme CDM The policy on intermediate treatment promotion for household waste is revised and again proposed to the prime minister office now. MOC expects it to be approved within 2009. MOC considers to hold a workshop to make the person in charge in provincial and city level about this policy, and maybe able to show the idea of programme CDM and collect their comments at that time. MOC expects to hold this workshop on November or December, 2009.
2nd survey 2009/10	・Deciding the schedule and TOR of waste composition analysis and composting experiment ・Implementation of waste composition analysis and composting experiment（Sampling: Oct. 7、Composting starts the same day）, observation of activity ・Confirmation of ASH Investment report, collection of additional information ・Meeting with HaiDuong Province and Hai Duong－URENCO（Oct.7th）Collction of questionnaire
Major results	1）Confirmation of Project feasibility

of 2nd survey	ASH revised their investment report. Revised report includes the handling amount of waste plastics up to 130% and divided the plastic quality in low and high and gave each quality respective unit price. The revenue became 140% comparing to the 2008 investment report as a result Investment cost increased 200 thousand USD and annual operation cost also increased a little. But as the result, IRR increased to 9.48%. For the comparison, the local banking interstate (VietcomBank) is 9.00 % (Oct.2009). ASH is expecting CER sales income and the price increase of waste treatment entrustment fee from the Hai Duong Province. 2) Waste composition analysis The waste composition analysis of waste collected from central Hai Duong city was conducted at October 7th. The composition was analyzed at the site and the respective organic amount was brought back to Hanoi and the composting experiment have started at HUC (45days, until November 21st) . Also decided to implement second experiment from November 23rd to end of 2009. 3) Information about baseline Considering the general situation in Vietnam and from the economical reason, Landfill was selected as baseline.
3rd survey 2009/11	・Additional collection of necessary data and information ・Waste composition analysis and composting experiment of Hai Duong household wastes (Plan: November 23rd) ・Discussion with ASH on Monitoring plan ・Consideration of Co-benefit of the project ・Adjustment of schedule on Programme CDM workshop with MOC
Major result of 3rd survey	1) Composting experiment First batch completed on November 22nd. Some procedures were found to be adjusted on 2nd batch. 2nd sampling will be conducted on November 24th and the 2nd batch was started the same day. Sampling procedure was also adjusted and well-considered and upgraded to be able to use in actual CDM project. 2) MOC policy The budget for the subsidy is under discussion. Study team had

	confirmed from MOC that the basic concept of subsidy and low-interest rate loan for diffusion of the intermediate treatment has not been changed. 3) Monitoring plan Unfortunately the site visit to Seraphin/SonTay model plant was unsuccessful. Instead we visited Hanoi URENCO/CauDien composting plant, to confirm whether the monitoring plan which IKE provided is realistic way or not. Monitoring item and method is organized and submitted to ASH, for them to figure out the reality of the plan. 4) Confirmation and evaluation of ASH business plan The team visited Nam Sach district people's committee of Hai Duong province, which is included in ASH business plan as the waste collection area, to confirm whether they have a will to entrust their waste when the ASH project realizes. 40 – 50 t/day of waste is expected to be collected from this district. 5) Writing the PIN (Project Information Notes) The team started to write PIN based on Vietnam CDM rules, although we found some questions in the format. We have send the questionnaire to Vietnam DNA.
4th survey 2010/1	・Reporting the result of the study and to obtain comments from related organizations/stakeholders ・Submit PIN to DNA
Major result of 4th survey	1) Reporting to ASH Study result was reported to General Manager Mr. Nha of ASH. The report mainly explained about the economical benefit of utilizing CDM. The team asked Mr. Nha to share this result among the company and to keep the evidence such as minutes of meetings further on, when deciding the investment. 2) Technical issues of ASH project The team visited Seraphin/SonTay pilot plant and observed the improved system. Still the temperature and moisture management during the production was found necessary procedures to be reconsidered. ASH reported that the product marketability caused by insufficient quality is the problem. The team explained that the sales of compost is not a big impact in

	this business, and also need to consider the option to dump it at the landfill after minimization of the volume by treating the organics under aerobic condition. To sell the organics, ASH is also under testing of RDF, but the products are smelly and its calorific value is low and the ash ratio is high which means it is very uneasy for the users to handle. 3) Discussion on possibility of receiving the low-interest rate loan ASH received positive reply from Vietnam development bank and Vietnam environmental protection fund on December 2009. Vietnam Environment protection fund has limitation only to lend for equipments. 4) Possibility of Programme CDM with MOC Final report was given to MOC related departments and also the idea on utilization of Programme CDM was introduced. The idea of revolving fund utilizing CER sales income was also introduced. The team received a positive reply from MOC that this idea may be a good way of diffusing their policy throughout the country, so they will report the matter to the minister. The team had submitted the minutes of meeting on February 1st to MOC. 5) Reporting to Hai Duong Province PC Team reported to Vice Chairman of Hai Duong PC on the result of the study, and also asked for continuous support to ASH and CDM project. 6) Writing PIN The questionnaire which we asked to Vietnam DNA was not replied until we visited this time. We visited Vietnam DNA and was told to look the UNFCCC website. The team will check the site and prepare the PIN.

3. Study Result to Realize the CDM Project

(1) Set up of Baseline Scenario and Project Boundary

①Setting up Baseline scenario

Scenario: continuation of direct landfill into sanitary landfill site (the status quo)

 reason of adopting this baseline scenario

In general, MSW in Vietnam is transported and dumped directly into landfill sites. Governments' budget for waste management are limited in nation-wide (4-8USD/t as treatment fee), therefore, landfill is introduced because of its cheapness in investment and operation cost. There are a few cities which have been producing compost or RDF, but none of these treats entire amount of MSW of each city, and many cases of them acquired equipments by utilizing Official Development Assistance (ODA) to reduce the economical burdens.

③ Setting up Project boundary

The project boundary will be:

(A1) Landfill site of Hai Duong city

(C1) Composting treatment line and storage (located inside the new waste treatment facility)

(D2) Landfill site (located inside the new waste treatment facility)

(F1) Transportation between (C1) and Compost product user, (C1) and (D2)

Raw materials (Municipal solid waste) will be transported by cities and provinces. The raw materials will be transported to the landfill site next to the project site, if the project does not exist. Therefore the project considers transportation of raw materials are out of project boundary. Although the transportation of recyclables are considered within the boundary as it is an additional activity generated by implementing the project.

The project activity boundary includes fuel and electricity consumption of entire new waste treatment facility. Therefore, all of the fuel and electricity consumption for the transportation between lines within the new waste treatment facility is included.

In addition, there are some possibilities to dispose compost/products due to some reasons. Thus landfill site should be included in the project activity boundary(D2).

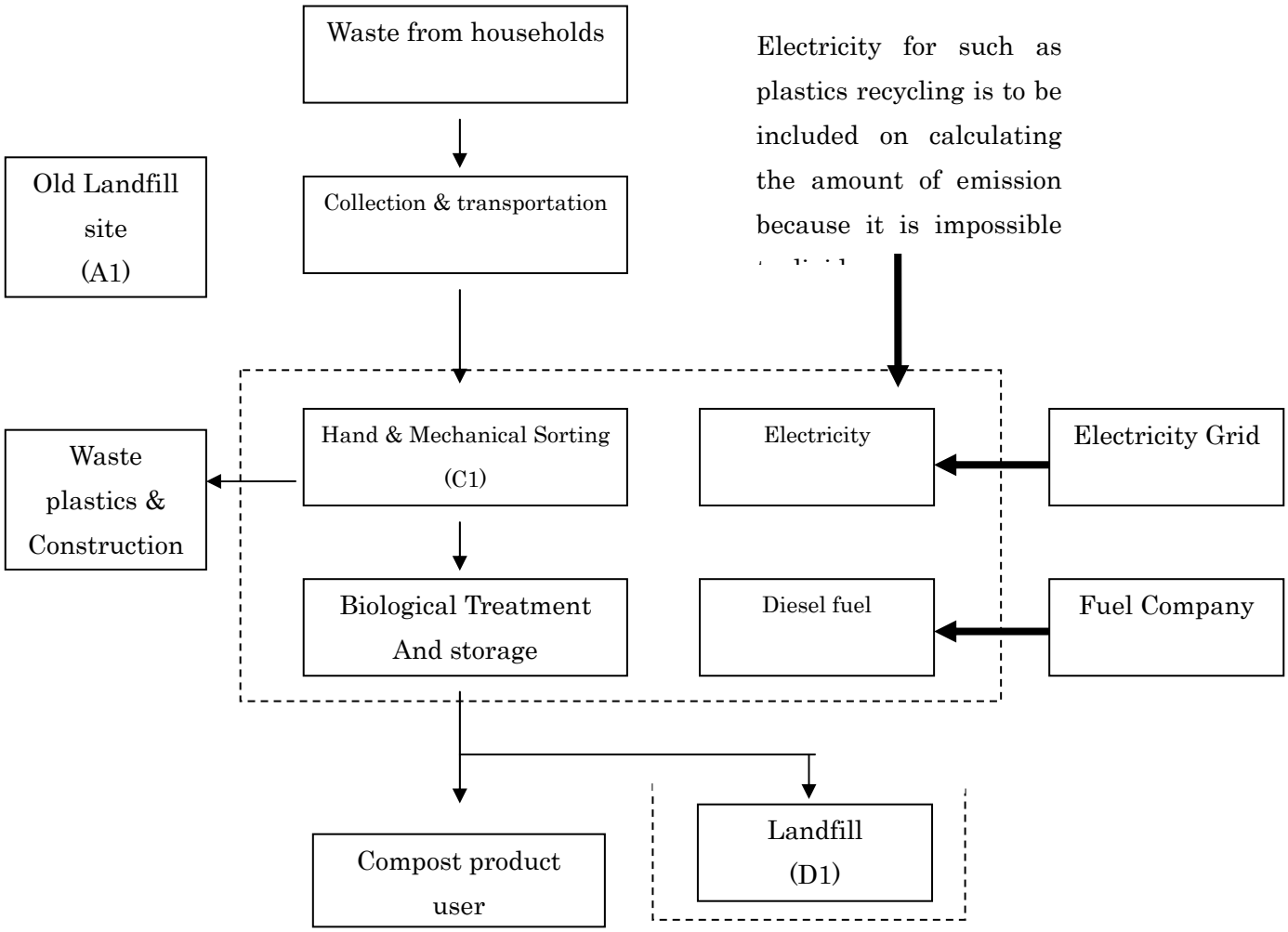

Figure 2：Project Boundary

④ Reason of adopting this project boundary

In "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories: AMS-III.F ", the project boundary is the physical, geographical site:

(a) Where the solid waste would have been disposed and the methane emission occurs in absence of the proposed project activity;

(b) In the case of projects co-composting wastewater, where the co-composting wastewater would have been treated anaerobically in the absence of the project activity;

(c) Where the treatment of biomass through composting or anaerobic digestion takes place;

(d) Where the residual waste from biological treatment or products from those treatments, like compost and slurry, are handled, disposed, submitted, to soil application, or treated

thermally/mechanically;

(e) Where biogas is burned/flared or gainfully used;

(f) And the itineraries between them (above a, b, c, and d), where the transportation of waste, wastewater, where applicable manure, compost/slurry/products of treatment or biogas occurs.

⑤Adopted methodology

- Methodology

＋AMS-III.F「Avoidance of methane emissions through controlled biological treatment of biomass」

- Tools

＋Methodological Tool :「Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site」（Version 04）

＋Methodological Tool :「Tool for the demonstration and assessment of additionality」(Version 05.2)

⑥Reason of adopting the approved methodology

According to following reasons, this project can apply approved methodology AMS-III.F, ”Avoidance of methane emissions through controlled biological treatment of biomass”.

-This project will introduce aerobic treatment by composting and proper soil application of the compost

-This project will treat only the organic fraction of municipal solid waste

- This project will result in emission reductions of approx. 25kt CO_2 equivalent annually, and it is less than the annual reduction volume of 60 kt CO_2 equivalent, which this approved small-scale methodology is applicable.

-The baseline of this project, which is the continuous use of the landfill site which will be newly constructed by government of Hai Duong city is planned to be operated for more than 10 years from the end of 2010. Thus, landfill will be used throughout the crediting period of ASH project.

-All of MSW collected from Hai Duong city is dumped in the landfill in present, and direct landfill is confirmed as a common method of waste treatment in Hai Duong.

-The collection points of MSW are within 20km radius of the project site, and the location where compost will be sold are also located within a radius of 20km. Thus it is not more than 200km stipulated in the approved methodology.

-This project will supply sufficient oxygen at any time during the compost production process and keep the ratio of oxygen over 10%, so there will be no possibility of causing anaerobic fermentation

at points of using composts as products.

⑦Calculation formula of the baseline emission

Calculation formula of baseline emission in AMS.III.F is;

$$BEy = BE_{CH4,SWDS,Y}-(MDy,reg*GWP\_CH4)+(MEPy,ww*GWP\_CH4)+BE_{CH4},manure,y$$

As a result the baseline emission in total 10 years will be 273,487t-CO2, 27,349 t CO2/year in average.

(2) Project Emission

Calculation formula of project emission in AMS.III.F is;

PEy = PEy,transp + PEy,power + PEy, phy,leakage + PEy,comp + PEy,runoff + PEy,landfill

The following components within the above calculation formula are related to the project emission.

PEy,transp（CO2 emission caused by increased transportation）:
＝2,257 t -CO2/10years（average 226t-CO2／year）

PEy,power（CO2 emission caused by electricity and fuel consumption）:
＝23,596t-CO2/10years（average 2,360 t-CO2／year）

PEy,runoff（CH4 emission caused by runoff water from composting process）:
＝1,604t-CO2/10years (average 160 t－CO2／year)

PEy,landfill=

$$\psi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot 16/12 \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DPC_j \cdot e^{-kj \cdot (y-x)} \cdot (1-e^{-kj})$$

（CH4 emission caused by dumping the compost into landfill）:
＝0 t-CO2

As a result the project emission in total 10 years will be 27,457t-CO2（average 2,760 t -CO2/year）. The project does not expect leakage.

The average GHG reduction amount will be 24,589 t CO2/year from above results.

(3) Monitoring Plan

① Adopted methodology

Monitoring method described in AMS-III.F. ”Avoidance of methane emissions through controlled biological treatment of biomass (Version08)” and “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site Version 04 (EB41)” will be used. The project will monitor items such as; fuel/electricity consumption, production amount of compost.

② Monitoring plan and items

Monitoring items are, such as electricity and fuel consumption, compost production amount, number of samples which is under oxygen starvation conditions, etc.

＜See attached ”Monitoring Items”＞

(4) Green House Gas Reduction Amount

GHG reduction amount during the project period is calculated as follows:

ERy = BEy － (PEy + LE y)= 273,487 – (27,457 + 0) = 246,030t-CO2／10 years

Following table shows the GHG reduction amount of each year and item during the project period.

Table 3.1：GHG reduction amount

(5) Project Period・Credit Acquisition Period

●Beginning of the project: Start of construction will be April, 2010.

●Evidential documents showing that the project was started based on utilizing CDM scheme : none

●Project term： Machine and equipment life is about 10 to 12 years. Land lease period is 50 years.

●Crediting period : 10years

●Beginning of crediting period: January 1st, 2011 (date which test operation completes)

Year		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
	$BE_{CH4,SWDS,Y}$	7,874	14,472	20,232	25,445	29,181	31,915	33,963	35,539	36,788	37,807	273,216
	$MEP_{y,ww}$	20	23	26	29	29	29	29	29	29	29	271
Baseline Emission		7,895	14,496	20,258	25,473	29,210	31,943	33,991	35,568	36,817	37,836	273,487
	PEy,transp	168	192	216	240	240	240	240	240	240	240	2,257
	PEy,power	1,757	2,008	2,259	2,510	2,510	2,510	2,510	2,510	2,510	2,510	23,596
	PEy,runoff	119	136	154	171	171	171	171	171	171	171	1,604
	PEy,landfill	0	0	0	0	0	0	0	0	0	0	0
Project Emission		2,045	2,337	2,629	2,921	2,921	2,921	2,921	2,921	2,921	2,921	27,457
Leakage		0	0	0	0	0	0	0	0	0	0	0
CO2 Reduction amount		5,850	12,159	17,629	22,552	26,289	29,022	31,070	32,647	33,896	34,915	246,030

(6) Environment Impact and other indirect effects

APT-SERAPHIN conducted EIA in 2007 based on law of Vietnam and received the approval from Hai Duong Province People's Committee in December of the same year. No negative comment was given to the EIA report.

(7) Stakeholder's Comment

The study have not collected the final comment from the stakeholders, as the project is not yet finally decided to implement as CDM project. Following table introduces the comments we received from the stakeholders during our study period.

Table 3.2 : List of stakeholder's comments received during the study period

Stakeholder	Position	Comments	Date
MOC Science, Technology and Environment Department Director and Deputy Director	Jurisdiction Ministry of MSW management, Representative of MOC on VN CDM committee member	MOC is setting up a policy to decrease amount of dumping MSW to landfill. The concept of proposed CDM project supports the policy. MOC supports the project as a model.	09/Aug/26 09/Nov/18 10/Jan/27
Hai Duong Province People's Committee Vice Chairman	Responsibility on treating the MSW in the province, Development plan and EIA approving agency, EIA	The project is welcome as it will be supporting the stabilization of the province waste management.	09/Aug/31 09/Oct/7 10/Jan/29
District People's Committee Thanh Ha, Viet Hong, Co Cham, District 6	Representative of residents	Comment to the project itself was received during the EIA procedure, but not yet for CDM. They are welcome as the project generates employment	Not yet had meeting
VUREIA	Association of URENCO	The project is welcome as it will support the waste treatment from the financial aspect.	09/Aug/27 09/Oct/5
Hai Duong City URENCO	Half state owned waste management company handling MSW generated from Hai Duong city	The project is welcome as it will be supporting the stabilization of the province waste management.	09/Aug/31 09/Oct/7 10/Jan/29

(8)Project Implementation Structure

Following structure is the present scheme of project implementation.

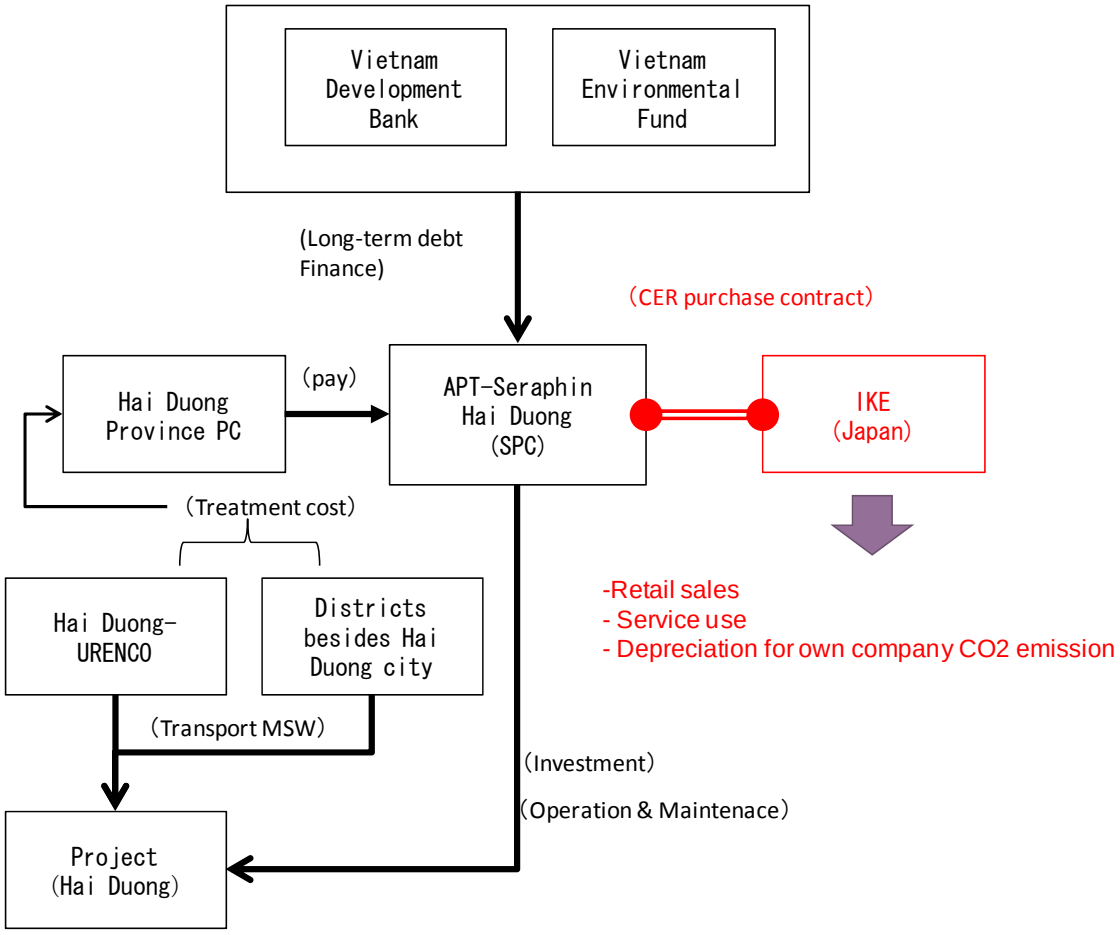

Figure 3.2 : Project implementation structure

(9) Financial plan

Besides own investment, ASH is expecting the long term and low interest rate loan from Vietnam Environmental Protection Fund and Vietnam Development Bank. This loan is expected to be executed as the technology which ASH is introducing is the approved technology by Vietnam Ministry of Construction.

Table 3.3 : Financial plan of APT-Seraphin-HD project

(Unit: '000 VND)

	FY 2009		FY 2010		Total
Necessary investment	**2,629,320**	**41,325,917**	**35,910,401**	**37,478,886**	**117,344,524**
Land Acquisition	0	0	0	0	0
Civil/Buildings		15,838,038	11,878,529	11,878,529	39,595,096
Machine/Equipments		15,749,769	11,812,327	11,812,327	39,374,423
Cost for investment preparation	690,448	0	0	0	690,448
Investment implementation cost		7,151,237	7,151,237	0	14,302,474
Cost after investment	0	0		170,214	170,214
Contingencee	1,938,873	1,938,873	2,908,309	2,908,309	9,694,363
Operation cash (for 1 year)	0	0	0	7,469,508	7,469,508
Interest rate (VN-EPF)	0	648,000	1,080,000	1,080,000	2,808,000
Interest rate (VNDB)	0	0	1,080,000	2,160,000	3,240,000
Finance	**2,934,452**	**41,606,714**	**45,868,905**	**26,934,452**	**117,344,524**
Own capital	2,934,452	17,606,714	5,868,905	2,934,452	29,344,524
VN Environment Protection Fund	0	24,000,000	16,000,000	0	40,000,000
VN Development Bank	0	0	24,000,000	24,000,000	48,000,000
Invome and Expenditure	**305,132**	**280,798**	**9,958,504**	**-10,544,433**	**0**
Accumulative I & E	**305,132**	**585,930**	**10,544,433**	**0**	

Capital Structure		
APT-Seraphin-HD	100%	29,344,524
	0%	0

VN Environment Protection Fund Loan Conditions			
Repayment	7 years	Grace Period	0 years
Interest rate	5.4%	Upfront	4%

VN Development Bank Loan Conditions			
Repayment	7 years	Grace Period	0 years
Interest rate	9.0%	Upfront	4%

(10) Economical Analysis

①Collected data

Data for business feasibleness consideration
・Investment cost：Civil & Buildings、Machine& Equipments、Others ・Cost items：Operation & Management cost、CDM development cost、CER commission cost、Monitoring cost ・Income items：Waste treatment fee、Selling income of recyclables ・Tax：Business tax、preferential taxation system

②Taken actions in the study

We have conducted following actions based on information of investment report which ASH made in 2009.

- ・Data collection of above mentioned items
- ・Provided Profit and Loss sheet of each operational year
- ・Provided Cash flow sheet
- ・Calculated IRR

＊Tentative price of 15US$/CER was given to calculate the case “with CER”.

③Result

●IRR of entire project was 10.79% (without CER) and 15.55% (with CER)。

●Long-term banking rate in Vietnam （VietcomBank） was 10.45% in January, 2010. It is difficult to invest if there are no CER income.

Table 3.4：P/L、Cash-flow sheet、and IRR calculations

	Construction period		Operation period									
	-2	-1	1	2	3	4	5	6	7	8	9	10
●Profit and Loss												
Revenue	0.0	0.0	168.2	192.2	216.2	240.2	240.2	240.2	240.2	240.2	240.2	240.2
Cost	0.0	6.7	88.7	94.9	101.2	107.4	107.4	107.4	107.4	107.4	107.4	107.4
Slaes Profit	0.0	-6.7	79.4	97.2	115.0	132.9	132.9	132.9	132.9	132.9	132.9	132.9
Interest payable	3.7	-6.7	79.4	97.2	115.0	132.9	132.9	132.9	132.9	132.9	132.9	132.9
Depreciation	0.0	0.0	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1	26.0	26.0
Profit before tax	**-3.7**	**-19.0**	**0.7**	**18.5**	**39.9**	**61.2**	**64.7**	**68.2**	**71.8**	**75.3**	**106.8**	**106.8**
Business tax, others	0.0	0.0	0.0	0.0	0.0	0.0	6.5	6.8	7.2	7.5	10.7	10.7
Profit after tax	**-3.7**	**-19.0**	**0.7**	**18.5**	**39.9**	**61.2**	**58.2**	**61.4**	**64.6**	**67.7**	**96.2**	**96.2**
●Cash flow statement												
Inflow	253.9	415.0	168.2	192.2	216.2	240.2	240.2	240.2	240.2	240.2	240.2	240.2
Outflow	250.5	425.0	150.3	221.6	219.1	216.5	214.2	205.7	197.3	188.8	183.2	183.2
Cash flow	**3.3**	**-10.0**	**17.9**	**-29.5**	**-2.9**	**23.7**	**26.1**	**34.5**	**42.9**	**51.4**	**57.0**	**57.0**
Accumulative cash	**3.3**	**-6.7**	**11.2**	**-18.3**	**-21.2**	**2.6**	**28.6**	**63.1**	**106.1**	**157.5**	**214.5**	**271.5**
●IRR Simulation (Without CER)												
FCF	**-246.9**	**-394.2**	**77.0**	**94.8**	**112.9**	**131.1**	**125.0**	**125.0**	**125.0**	**125.0**	**122.2**	**122.2**
Accumulative FCF	-246.9	-641.1	-564.1	-469.3	-356.4	-225.3	-100.4	24.6	149.6	274.6	396.7	518.9
IRROI	***#NUM!***	***#NUM!***	***#NUM!***	***#NUM!***	***-27.04%***	***-12.78%***	***-4.54%***	***0.92%***	***4.68%***	***7.38%***	***9.32%***	***10.79%***
●IRR Simulation (With CER)												
FCF	**-246.9**	**-394.2**	**84.7**	**110.9**	**136.3**	**160.9**	**159.8**	**163.4**	**166.1**	**168.2**	**167.0**	**168.4**
Accumulative FCF	-246.9	-641.1	-556.4	-445.5	-309.3	-148.3	11.4	174.8	340.9	509.0	676.0	844.4
IRROI	***#NUM!***	***#NUM!***	***#NUM!***	***#NUM!***	***-22.45%***	***-7.94%***	***0.48%***	***5.96%***	***9.69%***	***12.31%***	***14.18%***	***15.55%***

(11) demonstration of additionality

Based on "Methodological Tool：「Tool for the demonstration and assessment of additionality」(Version 05.2)", the survey found the existence of investment barriers (lack of income, difficulty in securing sufficient budget for operation and maintenance).

Identification of alternatives to the project activity consistent with current laws and regulations

Alternative scenario:

①Step1：Identification of alternatives to the project activity consistent with current laws and regulations

Sub-Step 1a: Define alternatives to the project activity:

（case1）Landfill to the sanitary landfill site (the status quo)

（case2）Composting（without being registered as a CDM project activity）

（case3）RDF

（case4）Incineration

（case5）Methane fermentation

（case6）Organic waste recycling becomes popular among the objective households

Sub-Step 1b: consistency with necessary regulations

There is no regulation other than the guideline to reduce volume of waste for prolonging the life of landfill site in Viet Nam.

②Step3：Barrier analysis

The existence of following barriers must be analysed in order to implement the proposed project:

A）Existence of a barrier which avoids the implementation of this type of proposed activity; and

B) Do not avoid the implementation of at least one of the alternatives.

Sub-Step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity:

a) Investment barrier

＜from the aspect of project's feasibility＞

As the result of feasibility study, internal rate of return (IRR) is 10.79%, which slightly exceeds the baking rate of 5-year fixed account of private bank in Vietnam, which is difficult to invest in general, considering the operational risk and the sales risk of recycled materials.

＜from the aspect of revenue＞

The compost products which produced in this project are organic waste separated out of MSW collected in the urban area, and their quality is unstable. Thus, the compost product might not stably meet the quality standard of products as fertilizer, so the selling price might be lower than present estimation. As the result, it is probable that the revenue by selling compost will be lower than assumption.

The main revenue source of this project activity is the tipping fee from Hai Duong Province which is about 7 USD/ton. In addition, revenue by selling waste plastics and

other materials from the MSW can be expected. However, the selling market of waste plastics depends on oil price which is unstable. Also the sales price of construction materials recycled from waste is expected to be lower because of the difficulty of quality control.

＜from the aspect of operational management＞

If the situation would be difficult to keep stable and sufficient revenue, it would be also difficult to raise fund for operational management including plant maintenance. As the result, operational time would be reduced or operation itself would be even stopped.

b) Technological barrier

Maintenance technology is possible barrier. In order to keep a plant operational at any time, it is necessary to train workers.

In addition, chemical substances such as dish washing detergents are also possibly included in final product of compost which leads to the limitation of the place where compost will be sent for sales, because the waste is collected without segregation.

Sub-Step 3b : Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

As the result of following investigation, the identified barriers would not prevent case 1: Landfill to the sanitary landfill site (the status quo).

（case1）Landfill to the sanitary landfill site (the status quo)

a) Investment barrier

Budget for waste management are limited nation-wide, therefore, landfill is introduced as the cheapest way (4-8USD/t as treatment fee). There are only 5 cities out of 63 cities/provinces in Vietnam which have introduced other treatment methods than landfill, and all of these cities have larger population than 2 hundred thousand. Therefore, there is no barrier to investment in sanitary landfill.

b) Technological barrier

It is common and general that MSW is directly landfilled after collection in Viet Nam. Thus, there is no barrier to it.

（case2）Composting（without being registered as a CDM project activity）

a) Investment barrier

There are 5 composting facilities in Viet Nam, and 3 of these were constructed by ODA scheme (either grant or loan). Some of these facilities have difficulties to secure sufficient budget for operation and maintenance due to low treatment fee and unstable sales market of products. Therefore, there would be some investment barriers if the analysis was based only on market principle.

b) Technological barrier

There is no technological barrier because both mechanical composting facilities and manual ones are available in Viet Nam.

（case3）RDF

a) Investment barrier

It is still in demonstration stage in Vietnam.

b) Technological barrier

It is still in demonstration stage in Vietnam, but the producers are aiming to use it for fuel switching to coal, such as paper mill boilers, etc. There are 2 facilities in operation, but both are in demonstrating level. In addition, its calories are between 2,000 and 2,700 kcal, and its ash containing ratio is over 60%. It needs three times more calories to be competitive with coal, and the way to deal with ash generated through incineration is also an issue. Therefore, RDF shall not be so convenient for users.

（case4）Incineration

a) Investment barrier

According to a incinerator constructing plan which calculated in Ha Noi in the past, unit price for construction was 3,800,000,000VND/t(≒215,730USD/t, also approximately 20,000,000yen/t), and unit price for composting facility including equipments given by

ODA was 600,000,000VND/t(≒33,707USD/t, and also approximately 3,100,000yen/t). Additionally, the cost for operation and maintenance of incineration is higher than composting. Therefore, it is not realistic to introduce an incinerator for budgetary reason (it is also easy to expect another cost of supplementary fuel due to its lower calories).

b) Technological barrier

There are no skills in incineration operation and maintenance technology in Vietnam because it has no experience of introducing large incinerators.

（case5）Methane fermentation

a) Investment barrier

It is assumable that the cost to construct and operate methane fermentation facilities is higher than that of sanitary landfill, although it is lower than that of incinerator. Considering the budget situation, it is quite difficult to invest to methane fermentation system comparing to sanitary landfill.

b) Technological barrier

Methane fermentation is more suitable for hydrated waste than incinerator, however, there is no experience or feasibility study of methane fermentation whose subject is MSW in Viet Nam. In addition, there are some cases introducing methane fermentation method regarding small facilities at piggeries, but their operational rate is low and they lack operational technology.

（case6）Organic waste recycling becomes popular among the objective households

a) Investment barrier

Tipping fee for MSW collection and treatment collected from each household in Hanoi is now 2,500VND/head/month. There is no incentive to promote organic waste recycling at least they receive monetary or non-monetary benefit of more than 2,500VND/head/month. Therefore, MSW treatment will be handled by municipalities as present, until law/regulation or subsidy will be in effect to make each household to recycle organic waste.

b) Technological barrier

Establishment of the custom of separation at source of waste requires a few year in

general. The model project of separation at source that was demonstrated by Japan International Cooperation Agency (JICA) in Ha Noi is already 3 years since starting the activity but not yet a custom. It needs time and education, and it will not be done by the starting date of ASH project.

③Step 4: Common practice analysis

In order to complement the result of Step3, analyze the extent to which the proposed project type has already diffused in the relevant sector and region.

Sub-step 4a: Analyze other activities similar to the proposed project activity:

There are 5 composting facilities in operation in Viet Nam. They were introduced in cities which have over 200,000 populations and many of these have 100t/d level of treatment capacity. And 3 of these have received equipments by ODA.

As for business operation, the entrustment fees for waste management paid by local governments are not sufficient, and sales market of recycled materials is unstable. Thus, it is difficult to fulfill the necessary budget for operation and maintenance, and there are some facilities whose operational rate is very low. Therefore, the introduction of composting facilities is difficult if analysis does not have any additional support.

Sub-step 4b: Discuss any similar Options that are occurring:

If the analysis of Sub-Step 4a as mentioned above was considered, it would be difficult to maintain and diffuse composting as far as the source of revenue for stable operation would not be ensured.

As discussed above, a similar project to this project activity is not likely to be implemented, and being registered as a CDM project is necessary to implement this project activity. Therefore, this proposed project activity is additional.

４． Study results on Co-Benefit aspects

(1) Environmental protection evaluation of the project in the host country

Vietnam Ministry of Construction is aiming to reduce the amount of waste to be land filled to 15% until 2050. The project contributes to expanding the life of landfill site. 38.5%in volume is expected to be decreased if the organics in household waste will be composted. The landfill site which is the baseline of this project has 18,000m3 of capacity and planned to be using it for 10 years. The life of landfill site can be expanded to 16 years if the project exists.

Amount of land-filling waste can be decreased much more, if other waste compositions (plastic, paper,…) will be recycled.

5. Study result concerning the contribution to sustainable development of Vietnam

"Exclusive Criteria" and "Priority Criteria" which is the component of VN CDM standard shows keywords that can evaluate whether the project contributes to the sustainable development of Vietnam or not. Following describes that the project will contribute to the sustainable development of Vietnam;

The project "decrease GHG emission" and will generate "CER income". The project also "decrease air pollution material/gas besides GHG gas", and decrease "waste generation" through recycling. The project also produces 140 direct "employment in rural area" and also "improves the living environment" in the area by proper waste management.

Attachments

- ○ Economical analysis attachment sheets
- ○ Monitoring items

○Economical analysis attachment sheets

1）Project Schedule

●Project Mile Stone	FY 2009					FY 2010												FY 2011											
	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
＜CDM Promotion＞																													
Validation																													
Approval（VN and JPN）												VN / JPN Approval																	
UN registration																													
＜APT-Seraphin-HD Project＞																													
EIA, Approval	（Completed in 2007･2008）																												
Design, Construction	Design		Civil start							Machine set				Test run/ Start up															

●Exchange	0.0057	Yen/VND

●Inflation	

2）Financing, Condition and Schedule

(Unit: '000 VND)

	FY 2009		FY 2010		Total
Necessary investment	**2,629,320**	**41,325,917**	**35,910,401**	**37,478,886**	**117,344,524**
Land Acquisition	0	0	0	0	0
Civil/Buildings		15,838,038	11,878,529	11,878,529	39,595,096
Machine/Equipments		15,749,769	11,812,327	11,812,327	39,374,423
Cost for investment preparation	690,448	0	0	0	690,448
Investment implementation cost		7,151,237	7,151,237	0	14,302,474
Cost after investment	0	0		170,214	170,214
Contingencee	1,938,873	1,938,873	2,908,309	2,908,309	9,694,363
Operation cash (for 1 year)	0	0	0	7,469,508	7,469,508
Interest rate (VN-EPF)	0	648,000	1,080,000	1,080,000	2,808,000
Interest rate (VNDB)	0	0	1,080,000	2,160,000	3,240,000
Finance	**2,934,452**	**41,606,714**	**45,868,905**	**26,934,452**	**117,344,524**
Own capital	2,934,452	17,606,714	5,868,905	2,934,452	29,344,524
VN Environment Protection Fund	0	24,000,000	16,000,000	0	40,000,000
VN Development Bank	0	0	24,000,000	24,000,000	48,000,000
Invome and Expenditure	**305,132**	**280,798**	**9,958,504**	**-10,544,433**	**0**
Accumulative I & E	**305,132**	**585,930**	**10,544,433**	**0**	

●Capital Structure		
APT-Seraphin-HD	100%	29,344,524
	0%	0

●VN Environment Protection Fund Loan Conditions			
Repayment	7 years	Grace Period	0 years
Interest rate	5.4%	Upfront	4%

●VN Development Bank Loan Conditions			
Repayment	7 years	Grace Period	0 years
Interest rate	9.0%	Upfront	4%

3) Simulation conditions

●Facility capacity and operation	capacity (t/h)	Operation (hrs/day)	Operation (d/y)	Waste amount (t/y)
HaiDuong 市内	20.00	10	360	72,000
HaiDuong 市外	18.25	4	360	26,280

Operation ratio			
Year 1	Year 2	Year 3	Year 4 -
70%	80%	90%	100%
70%	80%	90%	100%

●Products and residues	Year 1	Year 2	Year 3	Year 4 -
Compost	15,120	17,280	19,440	21,600
High quality plastics	1,764	2,016	2,268	2,520
Low quality plastics	17,640	20,160	22,680	25,200
Construction materials	6,720	7,680	8,640	9,600
Residue	504	576	648	720
Waste water	2,520	2,880	3,240	3,600

●Raw material input	Year 1	Year 2	Year 3	Year 4 -
MSW from HaiDuong city	50,400	57,600	64,800	72,000
Waste Plastic	18,396	21,024	23,652	26,280
Bags (pc.)	378,000	432,000	486,000	540,000
Cement(t)	504	576	648	720
Rocks (m3)	3,024	3,456	3,888	4,320
Other materials(kg)	17,640	20,160	22,680	25,200

●Utilities	Year 1	Year 2	Year 3	Year 4 -
Electricity	2350 MWh	2686 MWh	3022 MWh	3357 MWh
Fuel (disel)	139230 L	159120 L	179010 L	198900 L

●Management fee		
Soscial security cost	Personnel cost	25%
Offiice cost	Fixed ('000VND)	56,400
Others	Fixed ('000VND)	362,190

●Product sales price	unit	unit(VND)	unit(Yen)	
MSW treatment fee	kg	112.0	0.6	
Compost	kg	250.0	1.4	350.0
H-quality plastics	kg	6,500.0	37.1	7,500.0
L-quality plastics	kg	450.0	2.6	
Constructionmaterial	kg	100.0	0.6	
CER sales revenue	tCO_2	236,842	1,350	15
Residuw treatment cost	kg	0.0	0.0	Own treatment

●Material cost	unit	unit(VND)	unit(Yen)
MSW	kg	0.0	0.0
Waste plastics	kg	0.0	0.0
Bags	個	4,000.0	22.8
Cement	kg	1,000.0	5.7
Rocks	kg	120.0	0.7
Othe materials	kg	500.0	2.9

●Utility	unit	unit(VND)	unit(Yen)
Electricity	kWh	960.00	5.5
Fuel (disel)	L	13,143	74.9

●Personnel cost	Unit	00VND	('000Yen)	No. of people
Engineer	Year	30,000	171	6
Worker	Year	18,000	103	115
Laboratory	Year	24,000	137	3
General Director	Year	60,000	342	1
Deputy Director	Year	48,000	274	2
Manager	Year	30,000	171	5
Sales	Year	24,000	137	5
Doctor	Year	15,600	89	3
Security	Year	14,400	82	4

●Depreciation	Civil/Bldg	Mach/Equip	Inc. Assets
Depreciation method	Fixed cost		
Remaining value	0%	0%	0%
Dep. Period	12 Years	8 Years	12 Years

●Taxes		
Business tax	From 5th year	10%

●Maintenance cost	Mach,Equip+Bldg	5%
●Sales cost	Compost and Plastic sales	5%
●CDM Management fee		5%

4) Overall Input-Output

	Construction		Operation period									
	-2	-1	1	2	3	4	5	6	7	8	9	10
Inside HD-city t/y	0	0	50,400	57,600	64,800	72,000	72,000	72,000	72,000	72,000	72,000	72,000
Outside HD-C t/y	0	0	18,396	21,024	23,652	26,280	26,280	26,280	26,280	26,280	26,280	26,280
Compost t/y	0	0	15,120	17,280	19,440	21,600	21,600	21,600	21,600	21,600	21,600	21,600
CO_2 Reduction t/y	0	0	5,850	12,159	17,629	22,552	26,289	29,022	31,070	32,647	33,896	34,915

5）Profit and Loss Sheet

(Unit: mil Yen)

●PL	Construction		Operation period									
	-2	-1	1	2	3	4	5	6	7	8	9	10
Revenue	**0.0**	**0.0**	**168.2**	**192.2**	**216.2**	**240.2**	**240.2**	**240.2**	**240.2**	**240.2**	**240.2**	**240.2**
MSW from HaiDu	0.0	0.0	32.2	36.8	41.4	46.0	46.0	46.0	46.0	46.0	46.0	46.0
Compost	0.0	0.0	21.5	24.6	27.7	30.8	30.8	30.8	30.8	30.8	30.8	30.8
High quality plastic	0.0	0.0	65.4	74.7	84.0	93.4	93.4	93.4	93.4	93.4	93.4	93.4
Low quality plastic	0.0	0.0	45.2	51.7	58.2	64.6	64.6	64.6	64.6	64.6	64.6	64.6
Construction mate	0.0	0.0	3.8	4.4	4.9	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Cost	**0.0**	**6.7**	**88.7**	**94.9**	**101.2**	**107.4**	**107.4**	**107.4**	**107.4**	**107.4**	**107.4**	**107.4**
Personnel		4.1	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3
Social Security		1.0	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Office cost		0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Other cost		0.5	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Material		0.4	13.6	15.6	17.5	19.4	19.4	19.4	19.4	19.4	19.4	19.4
Electricity		0.4	12.9	14.7	16.5	18.4	18.4	18.4	18.4	18.4	18.4	18.4
Fuel		0.3	10.4	11.9	13.4	14.9	14.9	14.9	14.9	14.9	14.9	14.9
Residue treatment		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Maintenace		0.0	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Sales		0.0	6.6	7.6	8.5	9.4	9.4	9.4	9.4	9.4	9.4	9.4
Sales profit	0.0	-6.7	79.4	97.2	115.0	132.9	132.9	132.9	132.9	132.9	132.9	132.9
Interest payable	3.7	12.3	24.6	24.6	21.1	17.6	14.1	10.6	7.0	3.5	0.0	0.0
Interest payable	0.0	18.5	36.9	36.9	31.7	26.4	21.1	15.8	10.6	5.3	0.0	0.0
Depreciation	0.0	0.0	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1	26.0	26.0
Income before tax	**-3.7**	**-19.0**	**0.7**	**18.5**	**39.9**	**61.2**	**64.7**	**68.2**	**71.8**	**75.3**	**106.8**	**106.8**
Tax	0.0	0.0	0.0	0.0	0.0	0.0	6.5	6.8	7.2	7.5	10.7	10.7
Invome	**-3.7**	**-19.0**	**0.7**	**18.5**	**39.9**	**61.2**	**58.2**	**61.4**	**64.6**	**67.7**	**96.2**	**96.2**

6）Cash flow Statements

●CF statement	Construction		Operation									
	-2	-1	1	2	3	4	5	6	7	8	9	10
Inflow	**253.9**	**415.0**	**168.2**	**192.2**	**216.2**	**240.2**	**240.2**	**240.2**	**240.2**	**240.2**	**240.2**	**240.2**
Sales revenue	0.0	0.0	168.2	192.2	216.2	240.2	240.2	240.2	240.2	240.2	240.2	240.2
Capital	117.1	50.2										
Loan 1	136.8	91.2										
Loan 2	0.0	273.6										
Subsidy	0.0	0.0										
Outflow	**250.5**	**425.0**	**150.3**	**221.6**	**219.1**	**216.5**	**214.2**	**205.7**	**197.3**	**188.8**	**183.2**	**183.2**
Initial Investment	246.9	387.5										
Operation cost	0.0	6.7	88.7	94.9	101.2	107.4	107.4	107.4	107.4	107.4	107.4	107.4
Repayment	0.0	0.0	0.0	65.1	65.1	65.1	65.1	65.1	65.1	65.1	65.1	65.1
Interest payable	3.7	30.8	61.6	61.6	52.8	44.0	35.2	26.4	17.6	8.8	0.0	0.0
Tax	0.0	0.0	0.0	0.0	0.0	0.0	6.5	6.8	7.2	7.5	10.7	10.7
Cash	**3.3**	**-10.0**	**17.9**	**-29.5**	**-2.9**	**23.7**	**26.1**	**34.5**	**42.9**	**51.4**	**57.0**	**57.0**
Accumulated cash	**3.3**	**-6.7**	**11.2**	**-18.3**	**-21.2**	**2.6**	**28.6**	**63.1**	**106.1**	**157.5**	**214.5**	**271.5**

７） IRR Simulation （Mid price case）

Compost sales price：250VND/kg

High Quality Plastic Sales Price：6500VND/kg

●IRR Simulation (Without CER)	Construction		Operation Period									
	-2	-1	1	2	3	4	5	6	7	8	9	10
Investment co (－)	-246.9	-387.5										
Profit after tax (＋)	-3.7	-19.0	0.7	18.5	39.9	61.2	58.2	61.4	64.6	67.7	96.2	96.2
Depreciation (＋)	0.0	0.0	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1	26.0	26.0
Interest payabl (＋)	3.7	12.3	24.6	24.6	21.1	17.6	14.1	10.6	7.0	3.5	0.0	0.0
Interest-tax ef (－)	0.0	0.0	-2.5	-2.5	-2.1	-1.8	-1.4	-1.1	-0.7	-0.4	0.0	0.0
FCF	**-246.9**	**-394.2**	**77.0**	**94.8**	**112.9**	**131.1**	**125.0**	**125.0**	**125.0**	**125.0**	**122.2**	**122.2**
Accumulated FCF	-246.9	-641.1	-564.1	-469.3	-356.4	-225.3	-100.4	24.6	149.6	274.6	396.7	518.9
IRROI	***#NUM!***	***#NUM!***	***#NUM!***	***#NUM!***	***-27.04%***	***-12.78%***	***-4.54%***	***0.92%***	***4.68%***	***7.38%***	***9.32%***	***10.79%***

●IRR Simulation (With CER)	Construction		Operation Period									
	-2	-1	1	2	3	4	5	6	7	8	9	10
Investment co (－)	-246.9	-387.5										
Profit after tax (＋)	-3.7	-19.0	0.7	18.5	39.9	61.2	58.2	61.4	64.6	67.7	96.2	96.2
CER sales rev (＋)	0.0	0.0	7.9	16.4	23.8	30.4	35.5	39.2	41.9	44.1	45.8	47.1
Cost for CER s (－)	0.0	0.0	-0.2	-0.3	-0.5	-0.6	-0.7	-0.8	-0.8	-0.9	-0.9	-0.9
Depreciation (＋)	0.0	0.0	54.1	54.1	54.1	54.1	54.1	54.1	54.1	54.1	26.0	26.0
Interest payabl (＋)	3.7	12.3	24.6	24.6	21.1	17.6	14.1	10.6	7.0	3.5	0.0	0.0
Interest-tax ef (－)	0.0	0.0	-2.5	-2.5	-2.1	-1.8	-1.4	-1.1	-0.7	-0.4	0.0	0.0
FCF	**-246.9**	**-394.2**	**84.7**	**110.9**	**136.3**	**160.9**	**159.8**	**163.4**	**166.1**	**168.2**	**167.0**	**168.4**
Accumulated FCF	-246.9	-641.1	-556.4	-445.5	-309.3	-148.3	11.4	174.8	340.9	509.0	676.0	844.4
IRROI	***#NUM!***	***#NUM!***	***#NUM!***	***#NUM!***	***-22.45%***	***-7.94%***	***0.48%***	***5.96%***	***9.69%***	***12.31%***	***14.18%***	***15.55%***

8） IRR Simulation （Low price case）

Compost sales price：150VND/kg

High Quality Plastic Sales Price：5500VND/kg

●IRR Simulation (Without CER)												
FCF	**-246.9**	**-394.2**	**59.2**	**74.5**	**90.1**	**105.7**	**102.2**	**102.2**	**102.2**	**102.2**	**99.4**	**99.4**
Accumulated FCF	-246.9	-641.1	-581.9	-507.4	-417.2	-311.5	-209.3	-107.2	-5.0	97.2	196.5	295.9
IRROI	***#NUM!***	***#NUM!***	***#NUM!***	***#NUM!***	***#NUM!***	***-18.68%***	***-10.03%***	***-4.23%***	***-0.17%***	***2.78%***	***4.93%***	***6.57%***
●IRR Simulation (With CER)												
FCF	**-246.9**	**-394.2**	**67.0**	**90.6**	**113.4**	**135.6**	**136.9**	**140.6**	**143.3**	**145.4**	**144.2**	**145.6**
Accumulated FCF	-246.9	-641.1	-574.1	-483.5	-370.1	-234.5	-97.6	43.0	186.3	331.6	475.8	621.4
IRROI	***#NUM!***	***#NUM!***	***#NUM!***	***#NUM!***	***-28.01%***	***-13.15%***	***-4.30%***	***1.54%***	***5.55%***	***8.40%***	***10.45%***	***11.99%***

9） IRR Simulation （High price case）

Compost sales price：350VND/kg

High Quality Plastic Sales Price：7500VND/kg

●IRR Simulation (Without CER)												
FCF	**-246.9**	**-394.2**	**94.7**	**115.0**	**135.7**	**156.4**	**147.8**	**147.8**	**147.8**	**147.8**	**145.0**	**145.0**
Accumulated FCF	-246.9	-641.1	-546.4	-431.3	-295.6	-139.2	8.6	156.4	304.2	452.0	596.9	741.9
IRROI	***#NUM!***	***#NUM!***	***#NUM!***	***#NUM!***	***-21.50%***	***-7.53%***	***0.37%***	***5.52%***	***9.04%***	***11.52%***	***13.29%***	***14.61%***
●IRR Simulation (With CER)												
FCF	**-246.9**	**-394.2**	**102.4**	**131.1**	**159.1**	**186.3**	**182.6**	**186.2**	**188.9**	**191.0**	**189.8**	**191.2**
Accumulated FCF	-246.9	-641.1	-538.6	-407.5	-248.4	-62.2	120.4	306.6	495.4	686.4	876.2	1,067.4
IRROI	***#NUM!***	***#NUM!***	***#NUM!***	***#NUM!***	***-17.38%***	***-3.19%***	***4.86%***	***10.04%***	***13.52%***	***15.94%***	***17.64%***	***18.89%***

10） Sensitive analysis

＜Income aspects＞

There are 5 major income items, but we selected to use Compost sales price and High Quality Plastic Sales Price for the sensitivity analysis.

・MSW treatment entrustment fee from the PC is basically fixed price
・Low quality plastic is already set up in the minimum selling price
・Construction material revenue is absolutely small comparing to other income

As a result, the price of high quality plastic sales price has the most influence.

Low price case
・IRR (Without CER) 6.57%
・IRR (With CER) 11.99%

High price case
・IRR (Without CER) 14.61%
・IRR (With CER) 18.89%

For comparison with Operation cost influence, we also considered when the total income changed in the field between minus 10% to Plus 10%. The result is as follows.

Minus 10% Case
・IRR (Without CER) 9.02%
・IRR (With CER) 14.04%

Plus 10% Case
・IRR (Without CER) 12.61%
・IRR (With CER) 17.13%

＜Cost aspects＞

①Investment cost

We conducted the sensitivity analysis on invest cost difference, on Mid price case shown in above. The necessary investment cost will be fulfilled by additional capital.

Investment cost 5% Plus case
・Investment cost : 122,909,350,000VND
・Capital : (Up%) : 3,4909,350,000VND (119.0%)
・IRR (Without CER) : 9.64%
・IRR (With CER) : 14.36%

Investment cost 10% Plus Case

・Investment cost : 128,582,176,000VND
・capital : (Up%) : 40,582,176,000VND (138.3%)
・IRR (Without CER) : 8.56%
・IRR (With CER) : 13.24%

②Operation cost

The large numbers are maintenance cost, personnel cost, electricity cost and fuel cost.

Fuel cost changes by influence of oil market, although if the oil price becomes high, the sales price of plastic will also be high. Therefore, we considered fuel cost is not a big problem. Electricity cost in VN is stable, Personnel cost is corresponding to Inflation rate, but this study does not consider inflation.

In this section we considered if the maintenance cost will be 10% higher than planned.

Plus 10% Case

・IRR (Without CER) 10.40%
・IRR (With CER) 15.21%

○Monitoring Items

Chart5.1-1 Monitoring items and implementation structure (project emissions)

frequency of monitoring	monitoring items				monitoring location		monitoring method				responsibility personnel	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use way of measurement	QA/QC measure What	QA/QC procedure who	QA/QC procedure How	person in charge	manager frequency
	$PE_{y,transp} = ((Q_{y\,sw}/CT_{y\,sw}) * DAFw * EFCO2) + ((Q_{y\,pl}/CT_{y\,pl}) * DAF_w * EF_{CO2}) + (Q_{y,treatment,i}/CT_{y,treatment,i}) * DAF_{treatment,i} * EF_{CO2}$											
every time when delivered to the facility	$Q_{y\,sw}$	Quantity of raw waste/manure treated and/or wastewater co-treated in the year y (miscellaneous MSW emitted from Hai Duong	t	on-site weighing by truck scale	On-site measurement	documents and electronic data	This amount will be measured at the truck scale which will be located at the entrance of the facility by comparing the difference of amounts before and after unloading.	the truck scale	truck scale manufacturer	Periodical calibration will be done.	the person in charge of weighing	once a year
every time when delivered to the facility	$Q_{y\,pl}$	Quantity of raw waste/manure treated and/or wastewater co-treated in the year y (waste plastics emitted from outside of Hai	t	on-site weighing by truck scale	Entrance of the facility	documents and electronic data	This amount will be measured at the truck scale which will be located at the entrance of the facility by comparing the difference of amounts before and after unloading.	the truck scale	truck scale manufacturer	Periodical calibration will be done.	the person in charge of weighing	once a year
every time when delivered to the facility	$CT_{y\,sw}$	Average truck capacity for transportation	t/truck	visual test by whom in charge of monitoring	Entrance of the facility	documents and electronic data	After registering numbers of licence plate and other data of vehicles (company name, car sizes, approximate location of parking lots) on the first delivery, connection between these data and electronic database will be made. Additionally, visual test will be done for cross check.	items shown left are to be confirmed	the person in charge of weighing	1) every time the vehicle with unregistered number enters into the facility 2) confirmation will be done with the owners of vehicles (once a year)	the person in charge of weighing	once a year
every time when delivered to the facility	$CT_{y\ pl}$	Average truck capacity for transportation	t/truck	visual test by whom in charge of monitoring	Entrance of the facility	documents and electronic data	After registering numbers of licence plate and other data of vehicles (company name, car sizes, approximate location of parking lots) on the first delivery, connection between these data and electronic database will be made. Additionally, visual test will be done for cross check.	items shown left are to be confirmed	the person in charge of weighing	1) every time the vehicle with unregistered number enters into the facility 3) confirmation will be done with the owners of vehicles (once a year)	the person in charge of weighing	once a year
once a year	DAF_{wsw}	CO2 emission factor from fuel use due to transportation	km/truck	This value will be 0 in the baseline scenario because raw solid waste will be transferred to the landfill site which is located next to the site of this project.		-		baseline scenario	project manager	confirmation whether or not any change has been made in baseline scenario (see the items for monitoring additionality).	the person in charge of technology	once a year
every time when delivered to the facility	DAF_{wpl}	Average incremental distance for raw solid waste/manure and/or wastewater transportation	km/truck	confirmation by the person in charge of monitoring	Entrance of the facility	documents and electronic data	After registering numbers of licence plate and other data of vehicles (company name, car sizes, approximate location of parking lots) on the first delivery, connection between these data and electronic database will be made. Additionally, confirmation on drivers will be done for cross check. In case the check reveals that there are any registered collection points which have been missed to be collected, these points will be registered by confirmation of place for loading.	distance for transportation	the person in charge of collection	Run test will be done.	the person in charge of weighing	once a year
once a year	EF_{CO2}	CO2 emission factor from fuel use due to transportation	kg/CO2/km	confirmation of IPCC default value	IPCC database	documents and electronic data		the truck scale	project manager	confirmation of IPCC default value	the person in charge of technology	once a year
once a year	i	Type of residual waste/products and/or compost	-	confirmation of the numbers of kinds for shipping products (into ones which itemized as large items)				distance for transportation	project manager	every time that a change has been made	the person in charge of technology	once a year
every time when products are shipped	$Q_{y,treatment,i}$	Quantity of residual waste/products and/or compost i produced in year y	t	1)weighing by the truck scale 2)cross check by confirmation of shipping slips	Entrance of the facility Shipping Section	the truck scale: electronic inventory management: electronic (connection between delivery points and the	The quantity concerning each type of waste will be confirmed through comparing the difference of the weight of truck both before and after shipping (when a truck is empty and when it is filled with products). After confirming the amount of shipping products by inventory management, then the weight of plastic bags will be deducted from entire amount.	the truck scale	truck scale manufacturer	Periodical calibration will be done (once a year).	the person in charge of weighing the person in charge of shipping management	once a year
every time when shipped	$CT_{y,treatment,i}$	Average truck capacity for residual waste/products/compost i transportation	t/truck	1)visual test on information by the person in charge of monitoring 2)weighing by the truck scale	Entrance of the facility	documents and electronic data	After registering numbers of licence plate and other data of vehicles (company name, car sizes, approximate location of parking lots) on the first delivery, connection between these data and electronic database will be made in the phase of practical business. Additionally, visual test will be done for cross check. The quantity will be confirmed through comparing the difference of the weight of truck both before and after shipping (when a truck is empty and when it is filled with products. Total amount of loading will be divided by the total number of trucks).	the truck scale	truck scale manufacturer	Periodical calibration will be done(once a year).	the person in charge of weighing	once a year
every time when shipped	$DAF_{treatment,i}$	Average distance for residual waste/products/compost i transporatation	km/trucks	1)visual test on information by the person in charge of monitoring 2)weighing by the truck scale	Entrance of the facility	documents and electronic data	After registering numbers of licence plate and other data of vehicles (company name, car sizes, approximate location of parking lots) on the first delivery, connection between these data and electronic database will be made. Additionally, confirmation on drivers will be done for cross check. In case the check reveals that there are any registered collection points which have been missed to be collected, these points will be registered by confirmation of place for loading.	distance for transportation	the person in charge of collection	Run test will be done.	the person in charge of weighing	once a year
					Shipping Section	shipping management: electronic (connection between delivery points and the numbers of vehicles)	The place of sales will be kept in the shipping record (according to sales slips).	distance for transportation	the person in charge of collection	Run test will be done.	Shipping Section	once a month

Chart5.1-2 Monitoring items and implementation structure (project emissions)

frequency of monitoring	monitoring items				monitoring location		monitoring method				responsibility personnel	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use / way of measurement	QA/Qcmeasure What	QA/QC procedure who	QA/QC procedure How	person in charge	manager frequency
	$PE_{y,power} = EC_y * EF_{power} + DC_y * EF_{diesel}$											
every time collecting fees	EC_y	Electricity consumption in the composting plant in year	MWh	confirmation of the bill of electric power company	general affairs section	slips and electronic data	confirmation of the record written in the bill of electric power consumption	watt-hour meters	electric power company	Periodical calibration	general affairs section technolocical section	once a month
once a year	EF_{power}	Emissions factor for grid electricity	tCO_2/MWh	confirmation of the record written in	Home page of EVN research institute	documents and electronic data	Confirmation of CO2 emission factor by Calculation, where using electricity in northern area of Viet Nam	items shown left are to be confirmed	electric power company	periodical updating	the person in charge of technology	once a year
every time collecting fees	DC_y	Diesel fuel consumption in the composting plant in year	L/Y	confirmation of fuel company's bill	general affairs section	slips and electronic data	Confirmation of quantity of purchased fuel by checking the record of the bills				general affairs section technolocical section	once a month
once a year	EF_{diesel}	Emissions factor for diesel fuel	kgCO2/L	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of CO2 emissions factor for diesel fuel				the person in charge of technology	once a year

frequency of monitoring	monitoring items				monitoring location		monitoring method				responsibility personnel	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use / way of measurement	QA/Qcmeasure What	QA/QC procedure who	QA/QC procedure How	person in charge	manager frequency
	$PE_{y,composting} = Q_y * EF_{composting} * GWP\_CH4$											
once a year	Q_y	Quantity of raw waste/manure treated and/or wastewater co-treated in the year y	t	on-site weighing by truck scale	-	documents and electronic data	The quantity will be measured by using a truck scale to compare the weight of truck both before and after unloading.	the truck scale	truck scale manufacturer	calibration will be done once a year.	the person in charge of weighing	once a year
once a year	$EF_{composting}$	Emission factor for composting of organic waste and/or manure. Emission factors can be based on facility/site-specific measurements, country specific values of IPCC default values.	tCH4/ton waste treated)	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value(the unit amount of CO2 emissions through composting organic waste)				the person in charge of technology	once a year
once a year	GWP_CH4	Global warming potential for CH4	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	once a year

frequency of monitoring	monitoring items				monitoring location		monitoring method				responsibility personnel	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use / way of measurement	QA/Qcmeasure What	QA/QC procedure who	QA/QC procedure How	person in charge	manager frequency
	$PE_{y,runoff} = Q_{y,ww,runoff} * COD_{y,ww,runoff} * B_{o,ww} * MCF_{ww,treatment} * UF_b * GWP\_CH4$											
once a day	$Q_{y,ww,runoff}$	Volume of runoff water in the year y	m3	on-site measurement by integrating flowm	exit of the measure of runoff water	documents and electronic data	the record of the value shown in the quantity indicator of integrating flowmeter	integrating flowmeter	manufacturer of integrating flowmeter	Periodical calibration	the person in charge of technology	once a month
once a month	$COD_{y,ww,runoff}$	Chemical oxygen demand of the runoff water leaving the omposting facility in the year y (COD)	t/M3	on-site measurement by simple COD measure	exit of the measure of runoff water	documents and electronic data	the record of the value indicated in the simple COD measure	simple COD measure	manufacturer of COD measure	Periodical calibration	the person in charge of technology	once a month
once a year	$B_{o,ww}$	Methane producing capacity of the wastewater, as described in fottnote 1	kgCH4/kg COD	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	once a year
once a year	$MCF_{ww,treatment}$	Methane correction factor for the wastewater treatment system where the runoff water is treated	-	confirmation of IPCC default value (Chapter6 of volume 5) Anaerobic shallow lagoon (depth less than 2meters)	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	once a year
once a year	UF_b	Model Correction factor to account for model uncertainties	-	Reference: FCCC/SBSTA/2003/10/Add.2 page 25	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	once a year
once a year	GWP_CH4	Global warming potential for CH4	-	confirmation of IPCC default value (Chapter6 of volume 5) Anaerobic shallow lagoon (depth less than 2meters)	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	once a year

Chart5.1-3　Monitoring items and implementation structure（project emissions）

frequency of monitoring	monitoring items				monitoring location		monitoring method				responsibility personnel	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use way of measurement	QA/Qcmeasure What	QA/QC procedure who	QA/QC procedure How	person in charge	manager frequency
	$PE_{y,landfill} = \varphi \cdot (1-f) \cdot GWPCH4 \cdot (1-OX) \cdot 16/12 \cdot F \cdot DOC_f \cdot MCF \cdot \Sigma\Sigma_j Wj,x \cdot DOC_j \cdot e^{-kj} \cdot (y-x) \cdot (1-e^{-kj})$											
once a year	φ	Model correction factor to account for model uncertainties (0.9)	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	f	Fraction of methane captured at the SWDS and flared, combusted or used in another manner	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value	baseline scenario	project manager	confirm weather or not any change has been made（see monitoring items of additionality）	the person in charge of technology	
once a year	$GWPCH4$	Global Warming Potential (GWP) of methane, valid for the relevant commitment period（21）	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	OX	Oxidation factor (reflecting the amount of methane from SWDSthat is oxidised in the soil or other material covering the waste)	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	F	Fraction of methane in the SWDS gas (volume fraction) (0.5)	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	DOC_f	Fraction of degradable organic carbon (DOC) that can decompose（0.5）	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	MCF	Methane correction factor	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	Wj,x	Amount of organic waste type j prevented from disposal in the SWDS in the year x	tons	on-site weighing by truck scale	the exit of facility	documents and electronic data	This amount will be measured at the truck scale which will be located at the facility by comparing the difference of amounts before and after unloading.	the truck scale	truck scale manufacturer	calibration will be done once a year.	the person in charge of weighing the person in charge of technology	
once a year	DOC_j	Fraction of degradable organic carbon (by weight) in the waste type j	-	IPCC Guidelines for National Greenhouse Gas Inventories	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	kj	Decay rate for the waste type j	-	IPCC Guidelines for National Greenhouse Gas Inventories	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	j	Waste type catetgory (index)	-	IPCC Guidelines for National Greenhouse Gas Inventories	IPCC database	documents and electronic data	confirmation of the content. The analysis will be done if needed.					
once a year	x	Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)	-	-								
once a year	y	Year for which methane emissions are calculated	-	-								

Chart5.2 Monitoring items and implementation structure （baseline emissions）

frequency of	monitoring items				monitoring location		monitoring method				responsibility personnel	
							how to use	QA/QC measure	QA/QC procedure		person in charge	manager
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	way of measurement	What	who	How		frequency
BEy = BECH4,SWDS,Y-(MDy,reg*GWP_CH4)+(MEPy,ww*GWP_CH4)+BECH4,manure,y												
	BECH4,SWDS,Y	yearly methane generation potential of the solid waste composted or anaerobically digested by the project activity during the years "x" from the biginning of the project activity(x=1) up to the year y estimated as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site(tCO2e)"	t	see items below								
	MDy,reg	Amount of methane that would have to be captured and combusted in the year y to comply with the prevailing regulations (tonne)	t	There is no regulation on this matter in Viet Nam, and methane gas will not be recovered or incinerated, thus the value of this parameter is 0 in the baseline scenario.								
	MEPy ww	Methane emission potential in the year y of the wastewater co-composted. The value of this term is zero if co-composting of wastewater is not included in the project activity (tonne)	t	The value is 0 because runoff waste water will not be co-composted.								
	BE CH4, manure, y	Where applicable, baseline emissions from manure composted by the project activities, as per the procedures of AMS-III.D		The value is 0 because this project will not treat manure.								
	BECH4,SWDS,Y=φ・(1-f)・GWPCH4・(1-OX)・16/12・F・DOCf・MCF・ΣΣjWj,x・DOCj・e-kj・(y-x)・(1-e-kj)											
once a year	*φ*	Model correction factor to account for model uncertainties (0.9)	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	*f*	Fraction of methane captured at the SWDS and flared, combusted or used in another manner	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value	baseline scenario	project manager	confirm weather or not any change has been made（see monitoring items of additionality)	the person in charge of technology	
once a year	*GWPCH4*	Global Warming Potential (GWP) of methane, valid for the relevant commitment period（21）	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	*OX*	Oxidation factor (reflecting the amount of methane from SWDSthat is oxidised in the soil or other material covering the waste)	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	*F*	Fraction of methane in the SWDS gas (volume fraction) (0.5)	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	*DOC f*	Fraction of degradable organic carbon (DOC) that can decompose（0.5）	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	*MCF*	Methane correction factor	-	confirmation of IPCC default value	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	*Wj,x*	Amount or organic waste type j prevented from disposal in the SWDS in the year x	tons	on-site weighing by truck scale	the entrance of facility	documents and electronic data	This amount will be measured at the truck scale which will be located at the facility by comparing the difference of amounts before and after unloading.	the truck scale	truck scale manufacturer	Calibration will be done once a year.	the person in charge of weighing the person in charge of technology	
once a year	*DOC j*	Fraction of degradable organic carbon (by weight) in the waste type j	-	IPCC Guidelines for National Greenhouse Gas Inventories	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	*kj*	Decay rate for the waste type j	-	IPCC Guidelines for National Greenhouse Gas Inventories	IPCC database	documents and electronic data	confirmation of the value				the person in charge of technology	
once a year	*j*	Waste type catetgory (index)	-	IPCC Guidelines for National Greenhouse Gas Inventories	IPCC database	documents and electronic data	confirmation of the content. The analysis will be done if needed.					
once a year	*x*	Year during the crediting period: x runs from the first year of the first crediting period (x=1) to the year y for which avoided emissions are calculated (x=y)	-	–								
once a year	*y*	Year for which methane emissions are calculated	-	–								

Chart5.3　Monitoring items and implementation structure（additionality）

frequency of monitoring	monitoring items				monitoring points		way of monitoring				person who implements monitoring	
frequency	parameter	content(definition)	unit	way of calculation, etc.	position/name	data preservation	how to use way of measurement	QA/Qcmeasure What	QA/QC procedure who	 How	person in charge	manager frequency
once a year		existence or nonexistence of the way to reduce GHG emission	-	hearing with the person who addressed the information	Ministry of Natural Resource and Environment	documents and electronic data	research of laws and regulations at MONRE				the person in charge of technology	once a year
twice a year		diffusion rate of composting	-	hearing with the person who addressed the information	MOC, division of science and technology	documents and electronic data	research about business permits to develop composting business will be conducted at MOC.				the person in charge of technology	once a year
four times a year		Legislating of collection after sorting at households, subsidy, and the start of sorting and collection by relevant government	-	hearing with the person who addressed the information	Natural Resource and Environment Division of Hai Duong province	documents and electronic data	Studying about laws, regulations and decree will be done at MONRE, and if possible, it includes confirmation of the customs, voluntary agreement by conducting hearings.				the person in charge of technology	once a year

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