2007 CDM/JI Feasibility Study
"Biogas Electricity Generation through Anaerobic Digestion of Waste"
Executive Summary Report

1. Outline of The Host Country

1.1. Background of The Project

The main objective of the project is to realize power generation, with extra electricity being sold to the power grind system, by means of methane fermentation derived from the organic wastes segregated at Tan Long landfill site in Can Tho City, Socialist Republic of Vietnam. Digested residues are supposed to be disposed at the same treatment site, although they may be utilized as fertilizer by the farms in the long run because it may take a few years before effective results are found by the farms.

In Can Tho City approx. 400 tons of wastes are damped to the disposal site every day; yet by the year 2020, they are prospected to amount to as much as 2,000 tons a day. Nowadays about 60% of those wastes are made up of organic residues such as kitchen wastes, fruits and vegetable trash and sugarcane refuses. However, there is no proper treatment measures given to such fast-increasing amount of wastes at the present stage, resulting in not only a serious environmental problem but issue on securing more sites for disposal treatment.

1.2. National Land

The Socialist Republic of Vietnam (with its capitol in Hanoi) is situated in the extreme east in the Indian-China Peninsular ; the territory land extends S-shaped vertically long and narrow between 23°2' and 8°27' in the north latitude.

From the western border (to Laos, Thailand and Cambodia) to the eastern coastline, the widest distance on the inland is as far as 500km; the narrowest is as near as 50km.

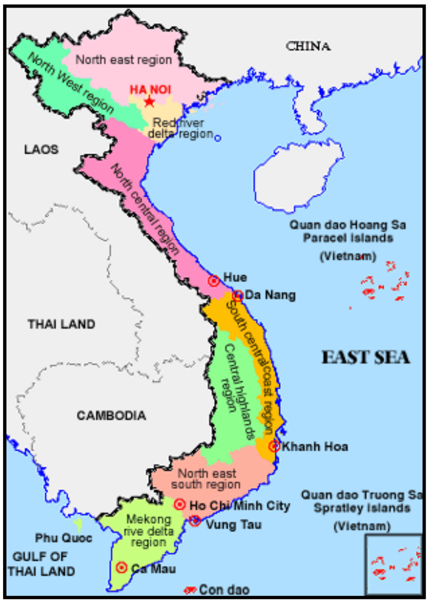

Figure 1-1. Map of Vietnam

1.3. Climate

The climate in Vietnam varies in place to place caused by her land shape and location extended from the north to the south. The southern part, where the project site is located, has the tropical monsoon climate with rainy season from May to October and dry season November to April each year.

1.4. Population

The population as of the end of year 2006 is counted as many as 84,110,000 ranked at 12th of the world population; the growth rate is 1.18% compared to the previous year. As of 2005, Hanoi has a population share of approx. 3,150,000 and Ho Chi Minh City approx. 5,890,000 respectively.

1.5. Status-quo of CDM in Vietnam

The Government Of Vietnam ratified with UNFCCC (Nov. 16,1994), and then ratified The Kyoto Protocol (Sept. 25, 2002); on practically basis MONRE (Ministry of Natural Resources and Environment of Vietnam) was assigned as the focal point, on which Vietnam has made a due commitment with The Kyoto Protocol as well as with UNFCCC. ICD (International Cooperation Department) within MONRE has been appointed as DNA (Designated National Authority) (Official Document No.502/BTNMT-HTQT dated Mar. 24 2003) under its upper organization CNECB (CDM National Executive and Consultative Board) (Decision No.553/QD-BTNMT dated July 8, 2004).

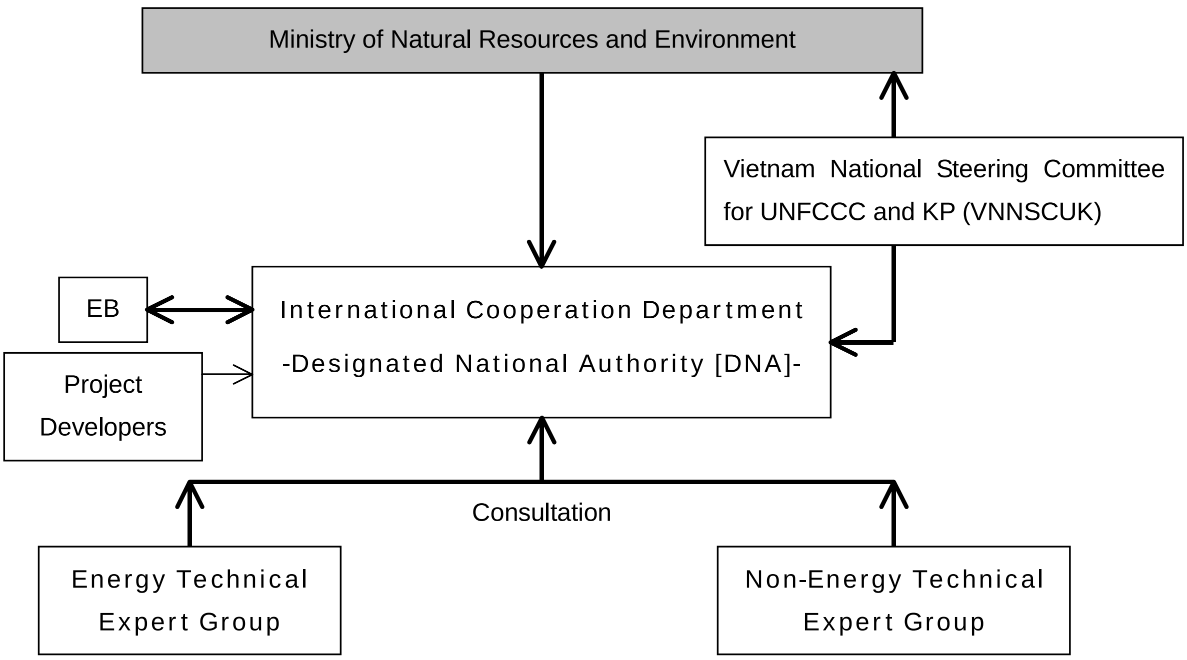

Figure 1-2. CDM organization in Vietnam

1.6. FS Implementation Organization

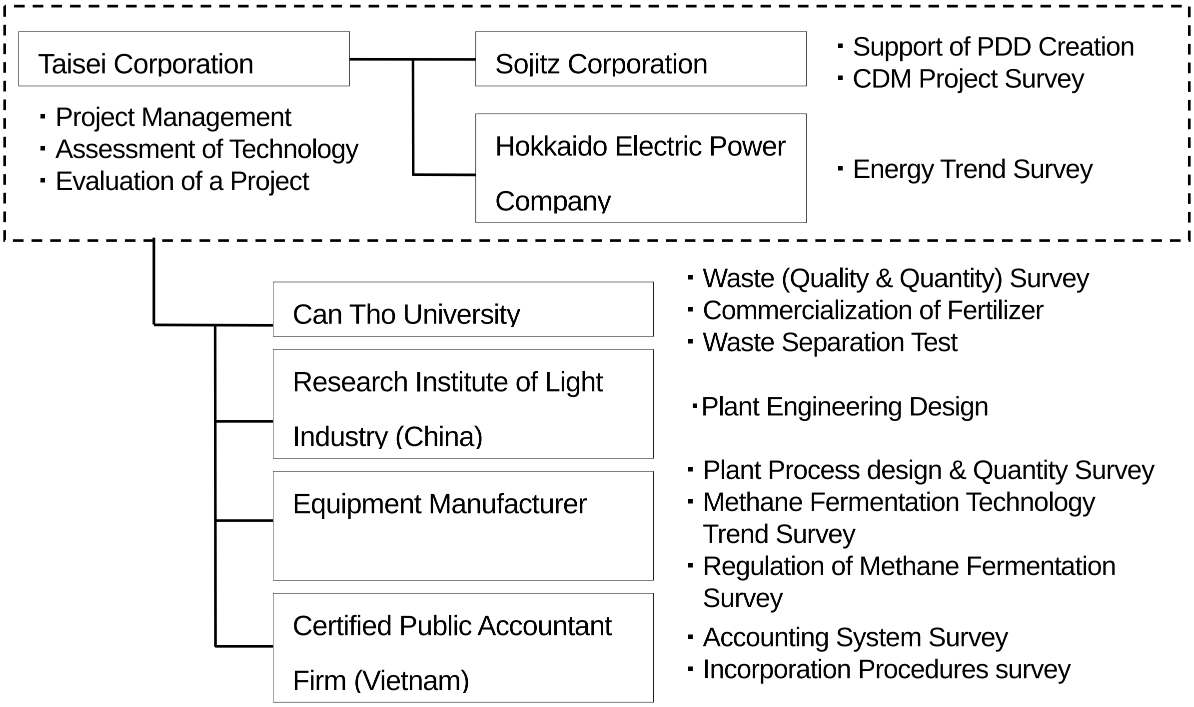

Figure 1-3. FS implementation organization

2. Project Outline

In the project the municipal wastes delivered to Tan Long landfill site from Can Tho City as well as from the neighboring regions will be segregated for mechanically recovering biogas to generate electric power to be supplied to the power grid network eventually. The disposal treatment process enables stopping the selected organic residues from being land-filled, resulting in decreasing methane gas emissions if the project not implemented.

2.1. Project Flow

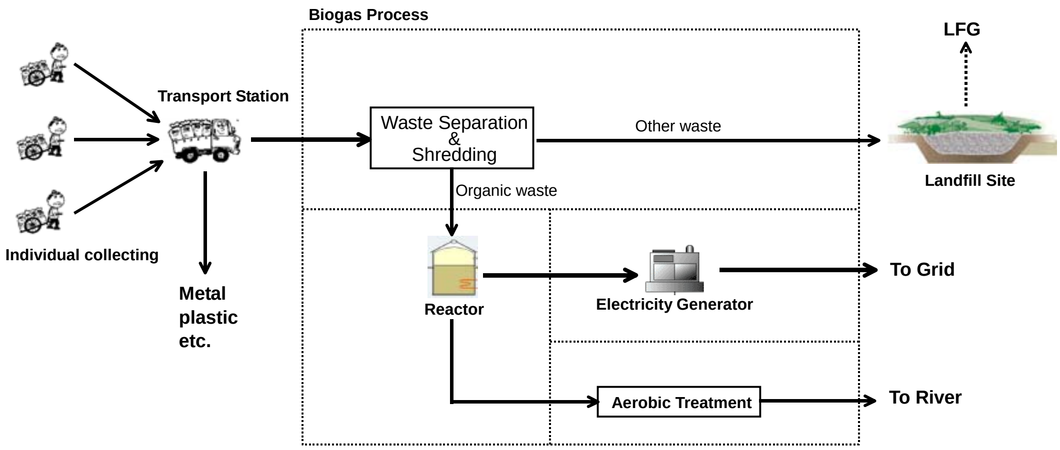

Figure 2-1. Project flow diagram

2.2. Project Implementation Site

2.2.1. Outline of Can Tho City

Can Tho City, the largest town on the Mekong Delta, is located in southern part of Vietnam, surrounded by Dong Thap Province and Ving Long Province in the east bordered by Hau river, a Greater Mekong branch; and by Kien Giang Province in the west; by Hau Giang Province in the south; and by An Giang Province in the north respectively. Can Tho City was born as one of the five special administrative Cities (including Ha Noi, Ho Chi Ming City, Da Nang City, Hi Phong City) when Can Tho Province was divided into the City and Hau Giang Province in 2004; the City is 170km southwest far from Ho Chi Ming City and 1,877km far from Ha Noi.

2.2.2. Tan Long Landfill Site

The possible project site is planned within Tan Long landfill site with its total space as wide as 202,531m^2, about 110,000m^2 of which can be used for the construction of the project plant.

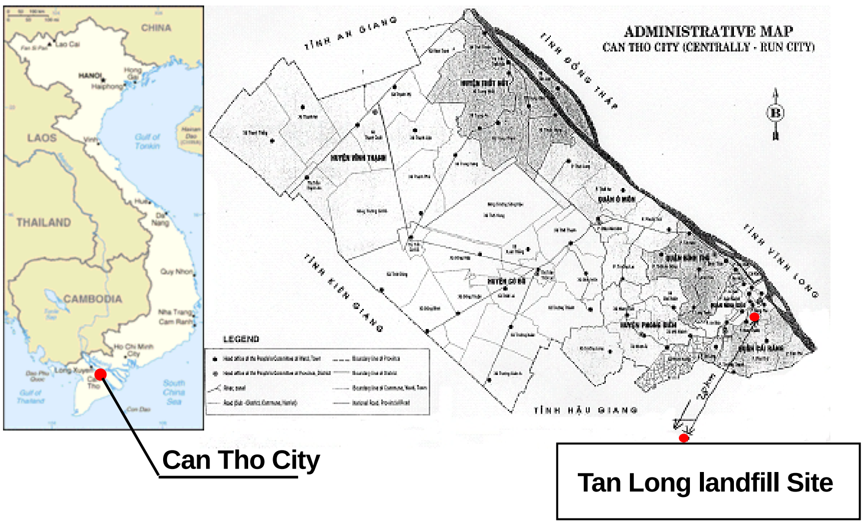

Figure 2-2. Location of the project site

2.3. Operating Organization for Waste Disposal Treatment Works

Waste disposal works (collection, transportation and landfill) are now operated by UPWC (Urban Public Works Company), a government-owned company; the whole operation used to be managed directly by Can Tho PC (Can Tho Peoples Committee), which came under the control of TPWS (Transportation and Public Work Service) about 2 years ago. The number of employees is 1,431, among of whom 540 people are engaged in waste disposal works.

2.4. Project Implementation Scheme

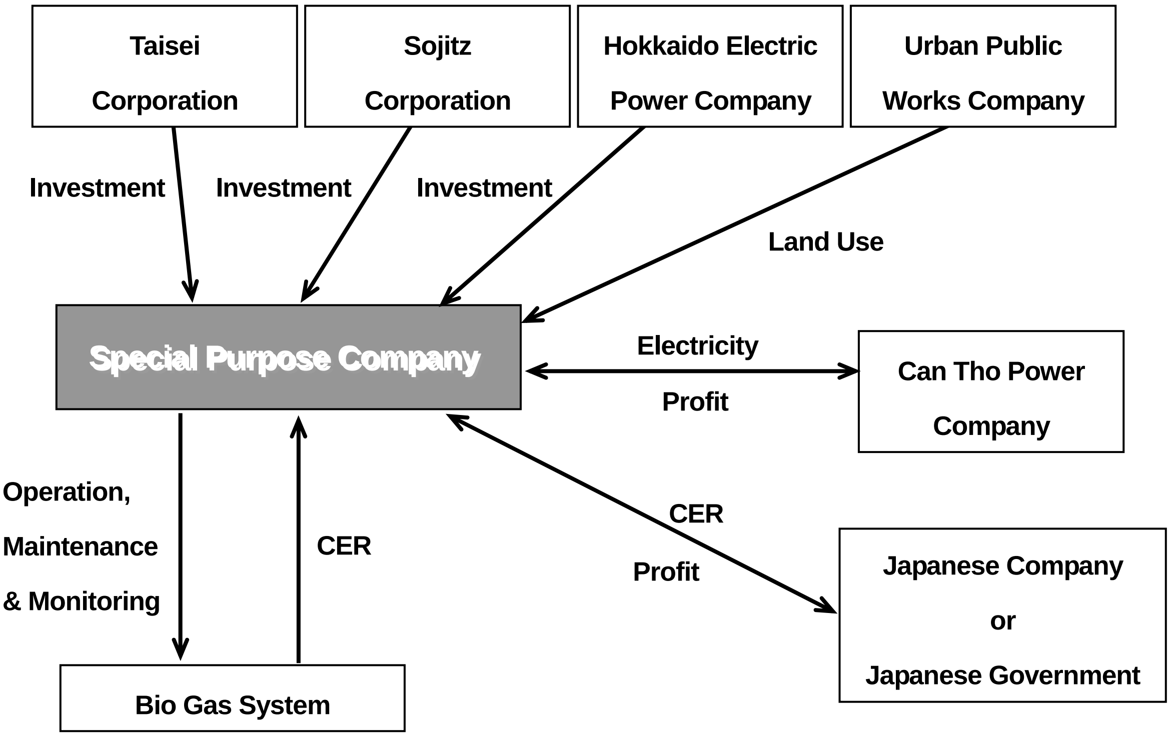

Figure 2-3. Project implementation scheme

2.5. Project Time Schedule

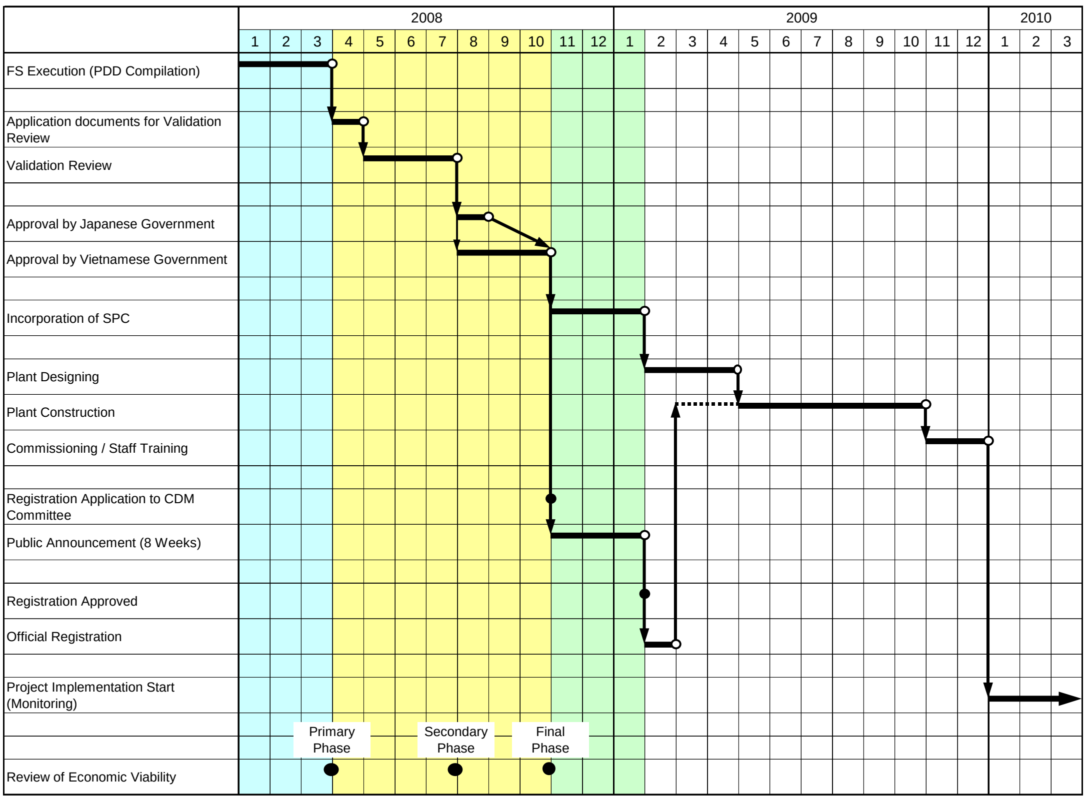

Figure 2-4. Project schedule

3. Application to CDM

3.1. Applicable Methodology

The approved methodology AM0025 “Avoided emissions from organic waste through alternative waste treatment processes” (version 10) (EB35, valid from 02 November 2007) is applied to the project.

3.2. Project Boundary

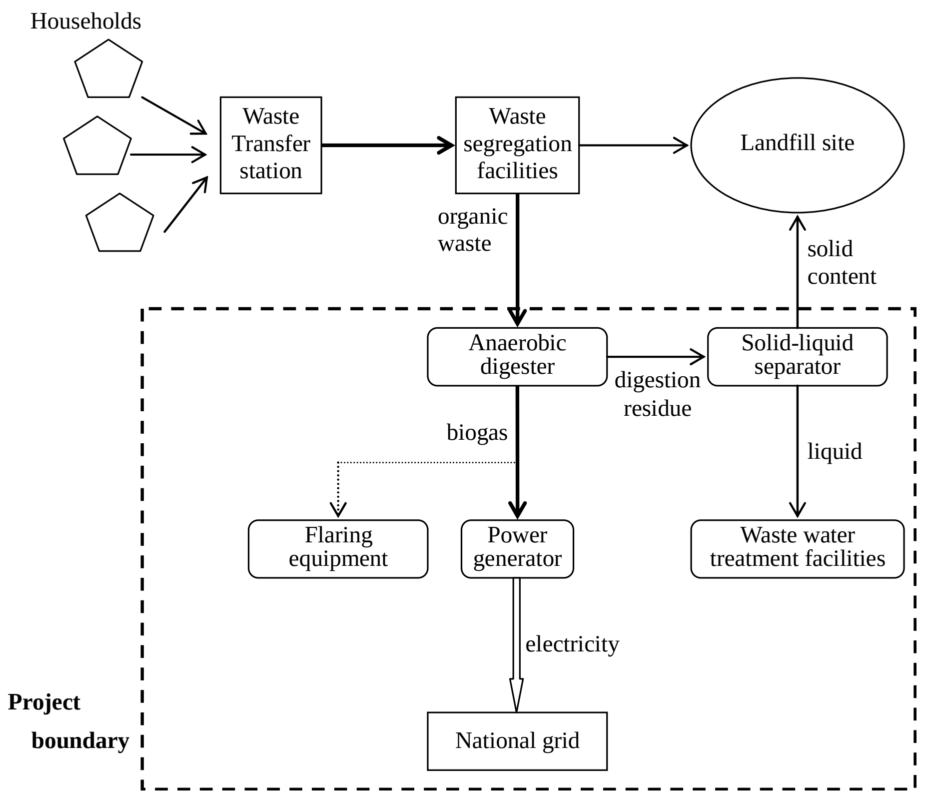

Figure 3-1. Project boundary

AM0025 defines that the spatial extent of the project boundary is the site of the project activity where the waste is treated. This includes the facilities for processing the waste, on-site electricity generation and/or consumption, onsite fuel use, thermal energy generation, waste water treatment plant and the landfill site. The project boundary does not include facilities for waste collection, sorting and transport to the project site. In the case of the project, thermal energy generation is not included in the project activity and flaring equipment is installed for emergencies at the project site, which shall be included within the project boundary.

Since the project provides electricity to a national grid, the spatial extent of the project boundary will also include those plants connected to the energy system to which the plant is connected.

3.3. Identification of Baseline Scenario

Step 1 of the “Tool for the demonstration and assessment of additionality” (as of Jan., 2008 Version 4) (EB36, Annex 13, Nov. 30, 2007) is used to identify all realistic and credible baseline alternatives.

3.3.1. Baseline Scenario (for Waste Disposal Treatment)

Substitute scenarios are shown as under:

M1: The project activity (anaerobic digestion and electricity generation) not implemented as a CDM project

M2: Disposal of the waste at a landfill where landfill gas captured is flared

M3: Disposal of the waste on a landfill without the capture of landfill gas

3.3.2. Baseline Scenario (for Electric Power Generation)

Substitute scenarios are shown as under:

P1: Power generated from by-product of one of the options of waste treatment as listed in M1 above, not undertaken as a CDM project activity

P2: Existing or Construction of a new on-site or off-site fossil fuel fired cogeneration plant

P3: Existing or Construction of a new on-site or off-site renewable based cogeneration plant

P4: Existing or Construction of a new on-site or off-site fossil fuel fired captive power plant

P5: Existing or Construction of a new on-site or off-site renewable based captive power plant

P6: Existing and/or new grid-connected power plants

3.3.3. Identification of Baseline Scenario

It is demonstrated that the baseline option for waste treatment is M3 and the baseline option for power generation is P6, therefore the baseline scenario is applicable to the methodology. The baseline scenario for the project activity is described as “the disposal of the waste in a landfill site without capturing landfill gas and the electricity obtained from the grid”.

3.4. Assessment and demonstration of Additionality

For proving the additionality of the project, “Tool for the demonstration and assessment of additionality” can be applied as under:

<u>Step 1. Identification of alternatives to the project activity consistent with current laws and regulations</u>

Step 3. Barrier analysis

Step 4. Common practice analysis

Close study and analyses being done based on Step1、Step3、Step4 have proven the project to be additional.

3.5. Reduction of GHG Emissions

3.5.1. Baseline Emissions

Baseline emissions per year can be calculated by the Formula 17 in AM0025 as follows:

$$BE_y = (MB_y - MD_{reg,y}) + BE_{EN,y} \quad (2)$$

MB_y: the methane produced in the landfill in the absence of the project activity in year y (t_4CO_2e)

$MD_{reg,y}$: the methane that would be destroyed in the absence of the project activity in year y (t_4CO_2e)

$BE_{EN,y}$: the baseline emissions from generation of energy displaced by the project activity in year y (tCO_2e)

Table 3-1. Baseline emissions (tCO_2e)

Year	Methane generation in the absence of the project activity (tCO_2e)	Baseline emissions from electricity (tCO_2e)	**Baseline emissions (tCO_2e)**
1	3,432	1,829	**5,261**
2	6,066	1,829	**7,895**
3	8,112	1,829	**9,941**
4	9,720	1,829	**11,549**
5	10,998	1,829	**12,827**
6	12,023	1,829	**13,852**
7	12,852	1,829	**14,681**
8	13,527	1,829	**15,356**
9	14,082	1,829	**15,911**
10	14,538	1,829	**16,367**
Total for the crediting period	**105,350**	**18,290**	**123,640**

3.5.2. Project Emissions

Annual possible volume of emissions cause by the project implementation can be calculated by the Formula 1 of AM0025 which includes various methods for waste disposal treatment, so that the simplified version Formula has been chosen by extracting unrelated methods to the project as follows:

$$PE_y = PE_{elec,y} + PE_{fuel,on-site,y} + PE_{a,y} + PE_{w,y} \qquad (12)$$

$PE_{elec,y}$: the emissions from electricity consumption on-site due to the project activity in year y (tCO_2e)

$PE_{fuel,\ on-site,y}$: the emissions due to fuel on-site consumption in year y (tCO_2e)

$PE_{a,y}$: the emissions from the anaerobic digestion process in year y (tCO2e)

$PE_{w,y}$: the emissions from waste water treatment in year y (tCO_2e)

Table 3-2. Project emissions (tCO_2e)

Year	Emissions from anaerobic digestion (tCO_2e)	Emission from electricity cunsumption (tCO_2e)	**Total project emissions (tCO_2e)**
1	2,195	0	2,195
2	2,195	0	2,195
3	2,195	0	2,195
4	2,195	0	2,195
5	2,195	0	2,195
6	2,195	0	2,195
7	2,195	0	2,195
8	2,195	0	2,195
9	2,195	0	2,195
10	2,195	0	2,195
Total for the crediting period	**21,950**	**0**	**21,950**

3.5.3. Leakage

Leakage can be calculated by Formula 26 in AM0025, with those methods unrelated to the project excluded, as follows:

$$L_y = L_{t,y} + L_{r,y} \qquad (16)$$

$L_{t,y}$: the leakage emissions from increased transport in year y (tCO_2e)

$L_{r,y}$: the leakage emissions from the residual waste from the anaerobic digester in case it is disposed of in landfills in year y (tCO_2e)

There will be no need to calculate $L_{r,y}$ value since the project plants and equipments are built within the same disposal site (center), which makes no major difference in kilometers to transport wastes as done now. Therefore, it can be pre-estimated that there will possible N_2O emissions only as leakage yet as small as 49tCO_2/year.

3.5.4. GHG Reductions Effects

Effects of GHG reductions are calculated as shown in the table below:

Table 3-3. Total estimated emission reductions (tCO_2e)

Year	Baseline emissions (tCO_2e)	Project emissions (tCO_2e)	Leakage (tCO_2e)	**GHG emission reductions (tCO_2e)**
1	5,261	2,195	49	**3,017**
2	7,895	2,195	49	**5,651**
3	9,941	2,195	49	**7,697**
4	11,549	2,195	49	**9,305**
5	12,827	2,195	49	**10,583**
6	13,852	2,195	49	**11,608**
7	14,681	2,195	49	**12,437**
8	15,356	2,195	49	**13,112**
9	15,911	2,195	49	**13,667**
10	16,367	2,195	49	**14,123**
Total for the crediting period	**123,640**	**21,950**	**490**	**101,200**

4. Study of Commercial Viability

In assessing commercial viability of the project, the applied yardstick is IRR (Internal Rate of Return), which is calculated by the difference between project cash flow and initial investment. The projected IRR will be minus when this project is completed in 2020 (10^{th} year after CER revenue is fixed), and the prospective effect of this project will not be worth its investment cost.

Therefore, it is concluded that this project will not be a successful CDM project, and that this project should be resigned to implement.