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Project Design Document
for

PNOC EC Payatas Landfill Gas to Energy Project in the Philippines

March 2004

Mitsubishi Securities
Clean Energy Finance Committee

CONTENTS

A. GENERAL DESCRIPTION OF PROJECT ACTIVITY

A.1 Title of the project activity

PNOC Exploration Corporation (PNOC EC) Payatas Landfill Gas to Energy Project in the Philippines (the Project or the Project Activity)

A.2 Description of the project activity

The Project will utilize landfill gas (LFG), recovered from the Payatas dumpsite in Quezon City in the Philippines, for electricity generation. PNOC EC will install a gas extraction and collection system and build a 1 MW power plant in Payatas. The electricity generated by the Project will be sold to the Manila Electric Company (MERALCO), which services Metro Manila and is also the country's largest utility company. Excess recovered LFG will be flared.

Solid waste management is one of the most pressing environmental concerns of cities and municipalities in the Philippines today. Out of a population of 82 million, it is estimated that there are over 30 million city dwellers in the Philippines. In the National Capital Region or Metro Manila, 10 million people generate over 8,000 tons of municipal solid waste (MSW) every day.[1] Population growth, continuing migration into urban areas, rising living standards, and inadequate solid waste management have caused many environmental problems in densely populated urban areas. The social and environmental problems in Payatas typify those of the country's waste disposal sites, particularly uncontrolled emissions of greenhouse gases (GHG) into the atmosphere, fires due to spontaneous combustion, uncontrolled draining of leachate into bodies of water, and erosion of the massive garbage piles.

Landfill gas is produced during the decomposition of solid wastes in landfills and dumps.[2] In the Philippines, waste disposal sites are estimated to account for 12 percent of the methane released to the atmosphere.[3] Quezon City, the largest city in Metro Manila, accounts for 20% to 25% of municipal solid waste (MSW) generated in Metro Manila daily. The Payatas dumpsite currently receives 1,470 tons/day (7,000 cubic meters/day) of MSW.[4] As of October 2002, an estimated 2.46 million cubic meters of MSW was in place at the dumpsite. By its scheduled closure in 2007, Payatas is expected to have an estimated 52.3 million cubic meters of potential LFG.

In 2002, imported oil accounted for 40.8% and imported coal 9% of the primary energy mix. Indigenous energy production came from geothermal 7%, hydropower 4.8%, natural gas 4.4%, coal 1.5%, oil 1.5%, and other renewables 31.1% (biomass, mainly wood waste). The Philippine Energy Plan (2004-2013) outlines the government's policies and programs to further reduce

[1] Metro Manila Development Authority (MMDA) data

[2] This PDD uses the term "landfill gas (LFG)" in accordance with Chapter 6 of the Revised 1966 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual: 'Landfill gas is known to be produced both in managed "landfill" and "open dump" sites.'

[3] Asia Least-cost Greenhouse Gas Abatement Strategy (ALGAS), Philippines, ADB/GEF/UNDP, October 1998.

[4] Payatas Operations Group (POG), Office of the Mayor, Quezon City

reliance on imports and to encourage and stimulate the development of indigenous resources, particularly renewable energy. The target is an average of 50% self-sufficiency within the next ten years and 55% by 2013.[5]

In addition to geothermal and hydro, the government is also promoting the use of other indigenous renewable sources such as solar, wind, biomass, especially for off-grid electricity generation.[6] Methane derived from MSW is also a vast untapped source of indigenous renewable energy. The Department of Environment and Natural Resources (DENR) estimates equivalent CO_2 emissions from MSW to be 9 million tons in 2000 and will reach 31 million tons in 2025. Consequently, landfill gas recovery and utilization projects offer potential CDM opportunities in the Philippines.[7]

When implemented, the Project will be the first in the Philippines to utilize LFG for electricity generation on a commercial basis. It will assist Quezon City in mitigating the uncontrolled emissions of GHG, preventing on-site fires, controlling leachate drainage, as well as physically stabilizing the Payatas dumpsite. As a pioneering effort by PNOC EC, the Project will contribute significant environmental, social, and economic benefits through the development of:

1. appropriate technology for methane gas extraction;
2. expertise in gas extraction and utilization as a means for managing post-closure requirements of dumpsites;
3. methane as a new, indigenous, renewable energy resource for the country.

A.3 Project participants

PNOC Exploration Corporation (PNOC EC) is the Project developer. Established in 1976 for oil and gas exploration, the company is a subsidiary of state-owned Philippine National Oil Company (PNOC). PNOC EC operates various onshore and offshore oil and gas exploration activities in many parts of the Philippines, including the country's first natural gas power plant in Isabela. It is now actively searching for and developing other indigenous energy sources.

The Quezon City (QC) local government unit (LGU), is owner and operator of the Payatas dumpsite. The Payatas Operations Group (POG) under the Office of the Mayor, oversees on-site operations.

PNOC EC and Quezon City signed a Memorandum of Understanding in August 2002 to develop the Project. A 100kW test plant is expected to be operational in March 2004. Following extended testing to confirm the amount of methane, PNOC EC will provide the designs for the Project and is expected to sign the contract for the Project with owner/operator QC LGU.

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[5] Philippine Energy Plan (2004-2013), Department of Energy. http://www.doe.gov.ph

[6] Ibid.

[7] "Climate Change and the Clean Development Mechanism in the Philippines", Ms. Joyceline A. Goco – Energy Management Bureau, Department of Environment and Natural Resources and Head of Secretariat , Interagency Committee on Climate Change, 26 August 2003.

The Clean Energy Finance Committee, Mitsubishi Securities Co. Ltd. is the CDM Adviser to the Project.

A.4 Technical description of the project activity

A.4.1 Location of the project activity

A.4.1.1 Host country Party(ies):

Republic of the Philippines

A.4.1.2 Region/State/Province etc.

Metro Manila

A.4.1.3 City/Town/Community etc.

Payatas, Quezon City

Figure 1 – Map of Philippines, National Capital Region, and Payatas Dumpsite

A.4.1.4 Detail on physical location, including information allowing the unique identification of this project activity

The Project will be located in the Payatas dumpsite in northeast Quezon City.

Of the nine cities and eight municipalities that comprise Metro Manila, Quezon City (QC) is the largest, with an area of 15,106 hectares and population of 2.3 million. QC accounts for 20% to 25% of the estimated 8,000 tons of MSW produced daily in Metro Manila. The Payatas dumpsite currently receives 1,470 tons/day (7,000 cubic meters/day) of MSW.[8]

The Payatas dumpsite has been receiving Metro Manila's municipal solid waste for almost 30 years. From the start, it attracted scavengers who earn a living by picking waste. The waste pickers then became illegal settlers in the same location, living in appalling, unsanitary conditions. Due to the adverse environmental and health conditions, Payatas was always under threat of closure. Attempts to close it down sometime in 1999 were strongly resisted by both the settlers and middlemen who depended on the dump for their livelihood. In July 2000, tragedy struck when heavy rains caused 60,000 cubic meters of waste to slide, killing 250 people belonging to 700 poor families.[9]

Two adjacent sites actually comprise the Payatas dump. The first, known as the old site, opened in 1973. Spanning 11 hectares with garbage piled 40 meters high, this was the site of the tragic collapse. It is now completely covered by soil and closed. Opened in 1984, the second or new site covers 9.7 hectares with garbage piled 32 meters high. It was also closed immediately after the 2000 tragedy. However, due to lack of alternative disposal sites, the new site was re-opened and continues to be an active dumpsite, but only accepts waste generated in Quezon City.

On 9 August 2003, the Department of Environment and Natural Resources (DENR) granted the Quezon City LGU a permit to convert Payatas from an open dump to a controlled dump.[10]

Figure 2 shows a simple topographic map and recent photo of the Payatas dumpsite.

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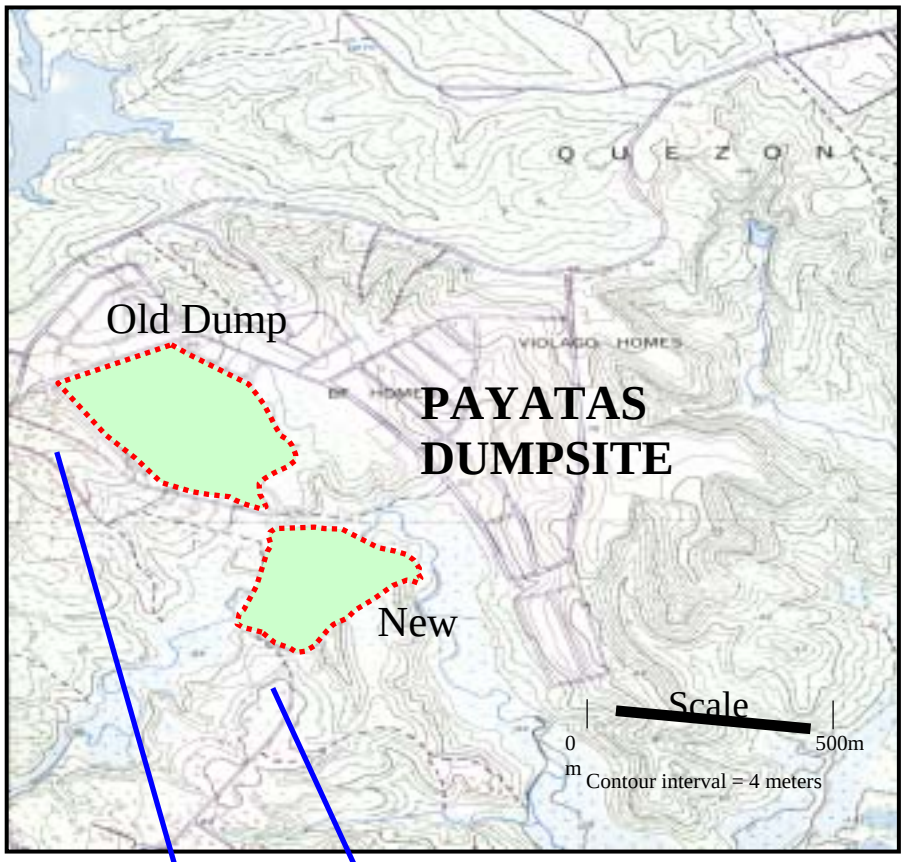
[8] Feasibility Study for Payatas Gas Extraction Project, PNOC EC, January 2004

[9] Philippines Environment Monitor 2001, The World Bank Group, December 2001. http://www.worldbank.or.ph./monitor

[10] There are 3 types of managed disposal sites in the Philippines: open dumpsite, controlled dumpsite, and sanitary landfill. Open dumps have no environmental safeguards, pose major public health threats, and affect the landscape of a city. Controlled dumps are an improvement over open dumps but do not provide full protection against environmental and public health hazards. Waste is placed, compacted, and covered on an area of land in a controlled fashion. The site is fenced, scavenging is organized, waste is covered by soil daily, fires are extinguished, and stormwater is re-routed around the site so it does not mix with the waste. In contrast, sanitary landfills are designed, built, and operated with full environmental controls including a liner, leachate treatment, and gas control system.

Figure 2 – Payatas Dumpsite



A.4.2 Category(ies) of project activity

The categories applicable to this Project are Scope 13 as "Waste management and disposal".

A.4.3 Technology to be employed by the project activity:

As in most developing countries in Asia, solid waste reaching open dumpsites in the Philippines is high in moisture and organic content, thus high in leachate, and low in calorific value.[11] Collected mostly from residential areas and some commercial establishments, MSW entering the Payatas dumpsite in 2001 was estimated to be 60% organic.[12] The Payatas dumpsite, as well as other dumpsites and landfills in the Philippines, represent a field that rapidly generates landfill gas (LFG). Similar to an enhanced bioreactor, the conditions in the dumpsite optimize the formation of methane through rapid biodegradation of organic waste. Table 1 summarizes characteristics of raw waste dumped in Payatas.

Table 1 – Payatas Raw Waste [13]

Components	*% Composition*	*% Moisture*	*% Volatile Combustible Matter*	*% Ash*	*% Fixed Carbon*
Hard Plastics	10.07	1.11	94.87	0.07	3.95
Styrofoam	0.72	2.76	95.88	0.04	1.32
Paper	6.83	25.18	56.54	0.39	17.89
Foam	2.16	1.02	89.11	0.07	9.80
Textile		11.69	61.36	0.31	26.64
Yard Waste	52.88	56.58	31.50	0.65	11.27
Organic (food)		58.95	30.57	0.74	9.74
Film Plastic	15.11	36.07	57.93	0.26	5.75
Metal	2.16	0.07	-	-	-
Glass & Ceramics	6.47	-	-	-	-
Diaper	3.60	-	-	-	-

**Results were based on the analyses performed by UP Engineering Alumni Foundation Inc., Environmental Engineering Unit*

Dumpsite gas extraction and recovery

Applying its extensive oil and gas experience, PNOC EC will design for the Project an extraction and recovery system for LGF using horizontal lines and wells. Rather than the traditional

[11] Philippines Environment Monitor 2001, The World Bank Group, December 2001. http://www.worldbank.or.ph./monitor

[12] Feasibility Study for Payatas Gas Extraction Project, PNOC EC, January 2004

[13] Ibid.

vertical system for LGF[14], PNOC EC believes this horizontal design and technology is more appropriate for the characteristics of Philippine MSW as discussed above, and also for the country's climactic conditions: tropical temperatures with heavy rains during the monsoon season resulting in continuous influx of rainwater into the Payatas dumpsite. When conventional vertical wells were used in a test on another site, the Carmona Sanitary Landfill, high leachate levels and low gas extraction rates were observed. In contrast, PNOC EC's test horizontal wells in Payatas yielded extraction rates as high as 140 m³/hr and lower leachate levels due to the effectiveness of horizontal pipes for draining.

Since gas from decomposing garbage exists at all levels of Payatas, a series of horizontal wells will be strategically placed throughout the dumpsite. The wells will be connected by a series of pipes leading to larger, header pipes that deliver the gas to the processing and conversion stations. A partial vacuum will be created by blowers or fans at the processing station, causing landfill gas to migrate toward the wells. Pipes 70-meter long will be placed at a maximum distance of 40 meters from each other. Buried 3 meters below the surface, each slotted 4"ϕ[15] pipe will be enclosed by 0.5 meter x 0.5 meter of 1" gravel to prevent fine material from plugging the ¼" x 6" slits and ensure continuous flow of gas. The pipes will be joined with 6"ϕ, 2 meter-long pipes at 6-meter intervals. To prevent oxygen from entering the extraction wells during the application of vacuum pressure, the gravel will be covered with a plastic sheet. For durability, 90mm high-density polyethylene (HDPE) pipes will be used for the buried horizontal wells, and the surface pipelines. A total of approximately 1,127.5 meters of horizontal wells will be installed in both the old and new dumpsites.

In addition to extracting and collecting the generated gas, the wells will also serve as leachate drainage pipes that could be interconnected for controlled discharge. A U-tube will be installed at the end of the wells at the periphery of the dump to prevent gas from escaping while leachate is allowed to drain.

Gas Pumping and Processing Station

The gas pumping station will contain all the necessary equipment for proper delivery, metering, and regulation of the dumpsite gas. The station will have a roots-type compressor, capable of pumping 2000 m³/hr and differential pressure of 200 mbars. It will have manual control and check valves, piping and flange connections and fittings, gas sampling ports, pressure and temperature indicators, filters, flow meters, condensate traps, an electric control unit, and gas analyzers.

An enclosed flare unit equipped with a combustion chamber will provide complete oxidation with sufficient excess air. Flame arrestors and temperature controls will protect the gas conduits, leading to the proportioning mixers, from the ignition source. The flare unit will also have a motorized quick shut valve and thermocouples.

Gas Utilization System

[14] Vertical systems are used in sanitary landfills in temperate areas such as the United States, Europe, Australia, and New Zealand.

[15] The symbol ϕ stands for diameter.

PNOC EC will install a 1MW power plant using four 250kW reciprocating internal combustion engines (ICs). Reciprocating ICs are capable of achieving efficiencies of 25% to 35% conversion of landfill gas to electricity, operate over a wide range of speeds and loads, are easy to install, and thus require a shorter time for plant construction. These smaller-sized engines can be used as modular units which are suitable for Payatas since the volume of LFG is expected to increase while the site is still in use, then gradually decrease following closure.

The results gathered from the 100kW test plant, expected to be operational in March 2004, will provide the basis for the final design of the Project.

A.4.4 Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The Project's anthropogenic greenhouse gas (GHG) emission reductions will come from:

- The active collection, flaring, and utilization of LFG from the Payatas dumpsite for electricity generation. Otherwise, the LFG would be emitted uncontrollably into the atmosphere, and

- the sale of the generated electricity to MERALCO, displacing fossil fuel-based electricity.

The Project will generate an estimated 427,314 tons CO2 emission reductions over 10 years.

A.4.5 Public funding of the project activity:

The financial plans for the Project will not involve public funding from Annex I countries.

B. BASELINE METHODOLOGY

B.1 Title and reference of the methodology applied to the project activity:

Baseline methodology for methane recovery from landfill gas used for electricity generation (NM0010).

B.2 Justification of the choice of the methodology and why it is applicable to the project activity

The Project satisfies the conditions under which the chosen baseline methodology, NM0010, is applicable to other potential CDM project activities:

A. It will recover methane, additional to that recovered in fulfillment of national policy, from landfill gas for electricity generation.

B. It will be a more costly investment compared to current and future fossil fuel-based generation projects.

There are, however, some minor differences between the Payatas Landfill Gas to Energy Project in the Philippines and the Durban, South Africa Landfill Gas to Electricity Project:

Investment Analysis

The baseline is the scenario that represents 48 (b) of the Marrakech Accords: "Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment". Unlike Durban which is a municipality which aims to minimize costs, PNOC EC is a corporation that bases its investment decisions on maximizing profit. Due to the type of developer/investor of the Project, it is more appropriate to use internal rate of return (IRR) to determine the economic attractiveness of the Project, rather than cost analysis used for the Durban project. It is noted that IRR for investment analysis was used in AM0003, an approved baseline and monitoring methodology for landfill gas capture.

Grid CEF

In South Africa, the main generation and transmission company provides the carbon emission factors (CEFs). In the Philippines, such data is not available in the same form from comparable sources. While the Department of Energy provides data on the fuel mix for the major Philippine grids, it does not determine CEFs. Therefore, CEFs for the Philippine grids will be calculated using International Energy Agency (IEA) fuel consumption data and IPCC default factors.

B.3 Description of how the methodology is applied in the context of the project activity:

In the context of the Project, the NM0010 baseline methodology is applied to determine the baseline scenario as outlined through the following steps:

1. The geographic and system boundaries for the Project were determined as described in B.5.

2. Several scenarios were identified as future developments:

   Scenario A– Business as Usual

   In compliance with the law known as the Ecological Solid Management Act or Republic Act (RA) 9003, Payatas will continue being converted from an open dump to a controlled dump. To prevent spontaneous combustion and stabilize the massive pile, the Quezon City LGU will undertake passive venting of LFG through vent pipes to be spread throughout site. However, since the law does not require collection, flaring, nor utilization of LFG for open and controlled dumps, these activities will not be undertaken in Payatas. LFG will still be emitted uncontrollably into the atmosphere.

   Furthermore, the Quezon City LGU will close the Payatas dumpsite by 2007 and provide post-closure maintenance for 10 years. Since the law also does not require gas control measures for closed controlled dumpsites, uncontrolled LFG emissions will still continue, but gradually decrease over time.

   Scenario B

   PNOC EC in cooperation with the Quezon City LGU will invest in a system that actively collects the LFG for flaring and for use as fuel for electricity generation (the proposed Project Activity). The electricity will be sold to MERALCO. This scenario greatly reduces the amount of LFG emissions into the atmosphere and marginally replaces electricity generated by more carbon-intensive fuels.

   Scenario C

   As an alternative to the closed dumpsite in 2007, the Quezon City LGU will establish a new solid waste disposal facility, a sanitary landfill with gas control measures within Payatas or another site within its jurisdiction. The LFG from the sanitary landfill will be either flared or utilized, only if economically feasible. Uncontrolled LFG emissions will be minimized, with a possibility of further reductions through electricity generation.

3. Regulatory requirements governing waste management, existing landfilling capacity, and financial considerations were identified as key factors that might influence the realizations of the above scenarios.

4. Based on the analysis on current Philippine regulations below, the implausible alternative was eliminated.

Ecological Solid Waste Management Act, RA 9003 and Barriers to Its Implementation

Until recently, solid waste management in the Philippines was covered piecemeal through several laws; there was no clear national framework nor strategy. For example, under the Local Government Code (RA 7160) of 1991, LGUs were made responsible for solid waste, collection, transportation, and disposal. However while the law existed, it did not give LGUs the basic tools nor institutional capacity for solid waste management.[16] Consequently, many LGUs resorted to such disposal practices as dumping the waste on the curb or in vacant lots. Nationally 10 percent of MSW is composted and a small portion is recycled. Only 2 percent is disposed of in sanitary landfills or controlled dumps, most of which are operationally inadequate and do not protect either public health or the environment. The rest is thrown in open dumps. Except for Marikina and Malabon, the Metro Manila region used to dispose of its waste in the Payatas open dump, and the Carmona and San Mateo landfills. With the closure of the two landfills, Metro Manila now disposes of its garbage in open and controlled dumpsites in other locations. The Payatas dumpsite in Quezon City now only accepts waste generated in Quezon City.[17]

In December 2000, the Philippine Congress passed the Ecological Solid Management Act, also known as Republic Act (RA) 9003. Signed by the President in January 2001 and made effective in 2002, RA 9003 provides an unprecedented, integrated, environmentally-friendly national framework for solid waste management. It also gives provisions for institutional mechanisms, waste management targets for the local government units, and penal measures. Under this Act:

- waste segregation at the source into compostable, non-recyclable, recyclable, special and other waste becomes mandatory.

- no open dumps are to be established, and all open dumps are to be converted to controlled dumps within three (3) years from effectivity.

- as an alternative to open dumps, and eventually controlled open dumps, sanitary landfills with gas control measures are to be established.[18]

Relevant excerpts from the Implementing Rules and Regulations of RA 9003 are attached as Appendix 1.

Although RA 9003 is very comprehensive, it is also very ambitious. Implementation and achievement of targets will be a major challenge for all sectors of Philippine society. Apart from a handful of LGUs, the performance of cities and municipalities in solid waste collection and disposal services has been very poor due to limited understanding of

[16] Environmental Management Bureau, Department of the Environment and Natural Resources

[17] Philippines Environment Monitor 2001, The World Bank Group, December 2001. http://www.worldbank.or.ph./monitor

[18] http://www.emb.gov.ph/nswmc/ra9003/RA9003new.htm

appropriate and cost-effective practices, inadequate budgets, weak capacity, inadequate framework for cost sharing between the national and local governments, lack of political will, and weak enforcement of regulations.

Several other related factors have compelled many local governments to abandon or defer plans to establish composting plants, controlled dumps, and sanitary landfills: negative public sentiment over sanitary landfills due to faulty construction and poor operations, the "Not-In-My-Backyard" syndrome, and lack of acceptable landfill sites nationwide, particularly in Metro Manila. Even the Metro Manila Development Authority was forced to capitulate to strong public demand to close the two landfills it operated: Carmona in Cavite Province and San Mateo in Rizal Province. These were designed as sanitary landfills, but were not constructed nor operated properly, resulting in serious environmental and social hazards.[19]

Another legislation which affects local government units is the Philippine Clean Air Act or RA 8749, which took effect on July 1999. RA 8749 describes the requirements for a comprehensive air pollution control and management program for the Philippines. Its implementing rules and regulations contain specific requirements that prohibit vehicular and industrial sources from emitting pollutants in amounts that cause significant deterioration of air quality. However, there are no requirements nor standards imposed on any of the six greenhouses gases under the UNFCCC since they are not considered pollutants. There is also no requirements nor standards that apply to MSW dumpsites. Relevant excerpts are attached as Appendix 3.

Non-implementation and non-enforcement of existing legislations are persistent problems in the Philippines. According to the Integrated Bar of the Philippines, in addition to the Clean Air Act of 1999 and Solid Waste Management Act of 2001 there are 130 environment-related laws: "Our books overflow with environmental laws languishing in the sickbed of non-compliance."[20]

In addition to the above, there are city-specific issues with regards to establishment of a sanitary landfill that make full compliance with RA 9003 difficult. First of all, even if closure of the controlled dump does occur in 2007, there is physically no space within Payatas to accommodate a sanitary landfill. Second, no other site within the QC has been yet identified for a sanitary landfill. Scenario C becomes unlikely. Therefore, the establishment of an alternative sanitary landfill for Quezon City cannot be assumed on the basis of the existence of RA 9003 alone.

Nonetheless, whether or not QC establishes a sanitary landfill to accommodate its MSW, the closed Payatas dumpsite will still continue emitting LFG, although at a decreasing rate. While RA 9003 stipulates a deadline for the closure of controlled dumps and post-closure requirements of soil cover, drainage, and vegetation; there are no specific requirements for gas recovery and utilization.

Given these circumstances, Scenario C is not considered a plausible scenario.

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[19] Philippines Environment Monitor 2001, The World Bank Group, December 2001. http://www.worldbank.or.ph./monitor

[20] "Seeing Green," Doris Gaskell Nuyda, Philippine Daily Inquirer, 7 November 2003.

5. Thus, the list of alternatives is reduced to only two plausible scenarios: Scenario A, Business-as-Usual and Scenario B, the proposed Project.

6. A conservative IRR for the Project, excluding CER revenues, is calculated. The calculation uses the incremental investment, as well as costs of operation, maintenance, and all other costs of upgrading the BAU scenario to the proposed Project. It includes all revenues to be generated by the Project activity except carbon revenues.

   The potential financial returns from the Project will come from the sale of electricity generated using methane extracted from the Payatas dumpsite. The feasibility of the Project is affected by developments in the electric power industry in the Philippines and depends mainly on the price at which the electricity is to be sold. It is necessary to conduct a financial analysis to determine whether the Project is an economically attractive course of action.

   Financial Analysis

   PNOC EC conducted cash flow analyses for 3 investment scenarios:

   1) 100% equity (base case)
   2) 100% equity with 59% grant from a foreign or local aid institution
   3) 25% equity / 75% debt consisting of a soft loan with 2% interest.

   For all 3 investment scenarios, the key financial parameters are the company's hurdle rate of 20% for its commercial projects and 12% benchmark rate for Philippine 10-year bonds.

   A first order rate equation and the Scholl-Canyon Model were used to estimate the gas production and extraction rates of the dump.

   The key technical and economic assumptions and key assumptions on gas extraction for are summarized in Table 2 and Table 3, respectively.

Table 2 – Key Technical & Economic Assumptions

PNOC EC Power Plant	
Plant Size	1.0 MW
Total Plant Cost	USD 2,250,000 [21]
Electricity Price	PHP 2.40 /kWh [22]
Project Life	10 years
Plant Efficiency	25-30%
Heating Value of Gas	500 BTU/standard ft^3
Operating Hours	8,000 hours/year
Foreign Exchange Rate	PHP 55 / USD 1

Table 3 – Key Assumptions on Gas Production & Extraction

	Old Site	New Site	New Site
Potential Methane Generation Capacity of Refuse (m3/tonne)	80	80	80
Proportion of methane in landfill gas	50%	50%	50%
Average Annual Refuse Acceptance Rate (tonne/year)	105,000	38,300	127,700
Cell Opened in Year	1973	1984	2000
Cell Closed in Year	2000	2000	2007
Methane generation constant	0.30	0.30	0.30
Abstraction Efficiency	50%	50%	50%

[21] Includes installations costs for gas extraction and collection systems, and construction, operation, maintenance of the power plant.

[22] Electricity Regulatory Commission-approved NPC wholesale price for the Luzon grid is currently PHP 2.40/kwh or USD0.04/kWh.

The cash flow analyses show the following IRR for PNOC EC's investment scenarios:

1) 100% equity: negative 8.33% IRR
2) 100% equity with 59% grant a foreign or local aid institution: 12% IRR
3) 25% equity / 75% debt consisting of a soft loan with 2% interest: 12.09% IRR

In order for the Project to be as qualified under the Clean Development Mechanism, investment scenario 3 was not considered appropriate.

The 12% benchmark rate for Philippine 10-year bond is attainable in investment scenario 2, but only with a 59% grant. However, the company's hurdle rate of 20% for its commercial projects is not achieved.

Investment scenario 1, the base case with 100% equity, yields the worst IRR of negative 8.33%, far below the company's hurdle rate of 20% for its commercial projects and 12% benchmark rate for Philippine 10-year bonds

7. Since the base case yields an IRR that is far below the key financial parameters for PNOC EC, the Project is financially unattractive and not the baseline scenario.

   Thus, the remaining BAU scenario is deemed the most likely baseline scenario.

   The BAU scenario will most likely continue and be influenced by the following conditions:

   - Implementation of provisions of Ecological Solid Waste Management Act or RA 9003 applicable to the Payatas open dumpsite

   - Financial attractiveness of LFG utilization for electricity generation.

8. The baseline scenario for the Project can be described as follows:

   In compliance with RA 9003, Payatas is currently being converted from an open dumpsite to a controlled dump. Municipal solid waste generated by Quezon City will continue to be deposited in Payatas until 2007. To prevent spontaneous combustion and to physically stabilize the massive pile, the Quezon City LGU will install pipes throughout the site for passive venting of the gas. However since the law does not require collection, flaring, nor utilization of LFG for open nor controlled dumpsites,[23] the vented gas will not be collected for flaring nor will it be utilized for electricity generation. Thus, uncontrolled LFG emission into the atmosphere will continue and there will be no electricity generated.

B.4 Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM

[23] The Implementing Rules and Regulations of RA 9003 do not require any gas control system for open nor controlled dumps. Therefore, flaring is deemed not required. See Appendix 1.

project activity ***(i.e. explanation of how and why this project is additional and therefore not the baseline scenario)***

In the absence of the Project, the LFG produced in the Payatas open dumpsite will be vented passively. Since there is no law governing gas control in open nor controlled dumpsites, the vented gas will not be flared nor used for power production. Unmitigated LFG emissions into the atmosphere will continue. Furthermore, the displacement of fossil fuel-based electricity with renewable energy from landfill gas will not take place.

The Project is not the baseline scenario due to the following barriers:

Investment barrier

Electricity generation in the Philippines is dominated by imported fuels with oil accounting for 40.8 % and coal 9 %. While fossil fuel power plants are financially more viable than the Project, they also result in higher GHG emissions. In addition geothermal, the largest indigenous energy source, is located mainly in the Visayas region, not in Luzon where the Project is located.

The Project requires a capital investment of approximately USD 2.25 million. At the moment, PNOC EC plans to fund the Project through 100% equity. As the first independent power producer in the Philippines to utilize LFG for generating electricity to be sold to MERALCO, PNOC EC has employed much time, human and financial resources in this pioneering effort, particularly in planning and engineering design. The amount of work involved for the Project far exceeds plans and designs for a power plant using imported fossil fuels, the dominant fuels for power generation in the country. However, due to the relatively small size of the plant, the revenue base is too small to absorb planning and design costs. The high initial cost combined with a small revenue base results in negative 8.33 % IRR that is significantly lower than the company's commercial projects or other conventional IPP projects in the Philippines.

Technological barrier

As discussed in Section A.4.3, for the Project PNOC EC has designed a gas extraction and recovery system using horizontal lines and wells. Compared to the conventional vertical systems for LFG extraction used here and in other countries, this horizontal design and technology is more appropriate for the climactic conditions of the Philippines and also for the unique characteristics of MSW generated in the country's urban areas. The horizontal design and technology which will be fully utilized in Payatas for the first time can be applied to other solid waste disposal sites throughout the country.

The Project will also be the first to use the smaller-sized (250 kW) reciprocating internal combustion engines as modular energy generating units. The use of modular units to generate energy is deemed appropriate since the volume of Payatas LFG is expected to first increase while the site remains in use, then gradually decrease following its closure.

Prevailing practice of using imported fuels

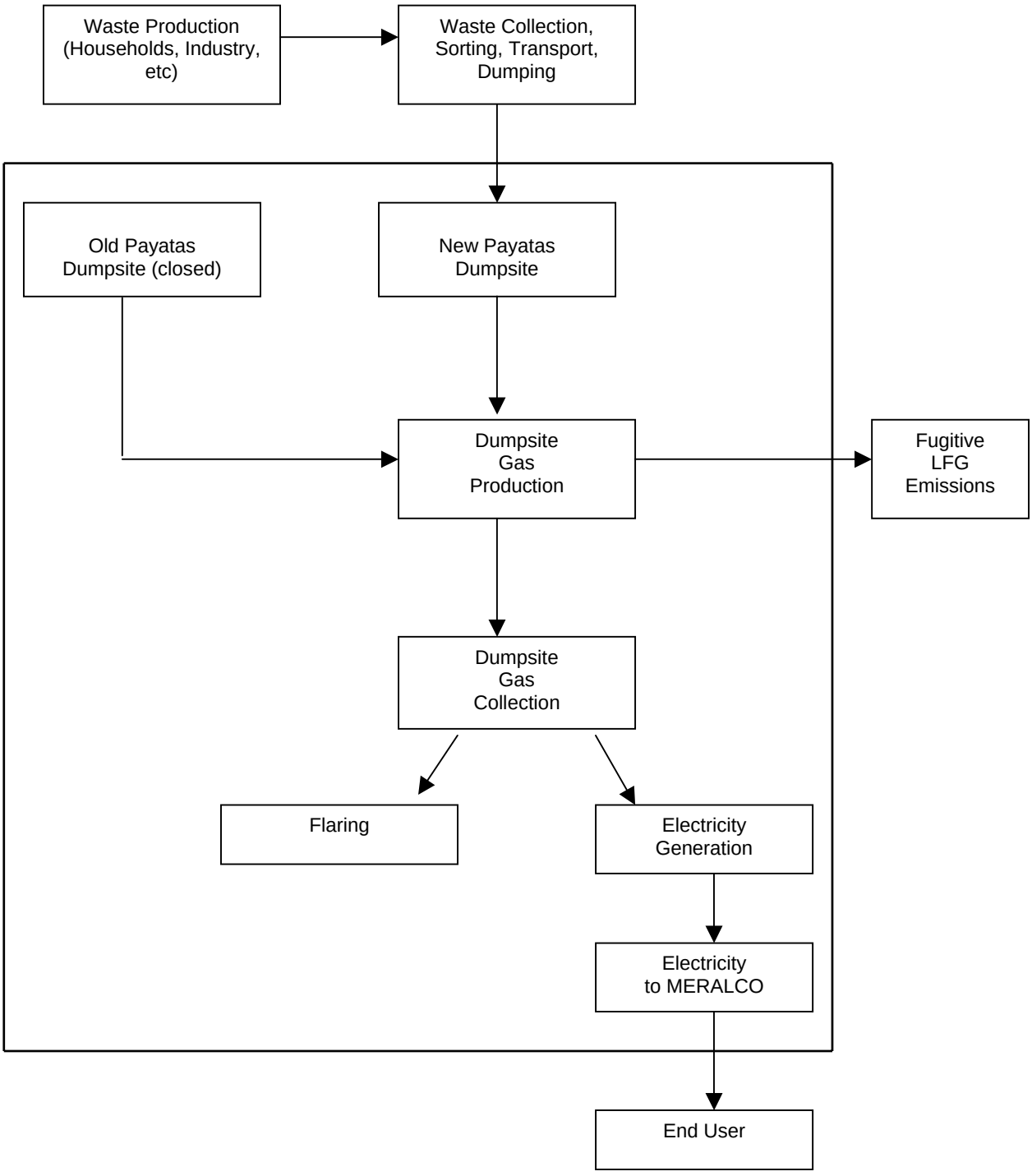
The Project will be the first in the Philippines to commercially utilize the vast potential of LFG as a renewable fuel for electricity generation, effectively displacing the prevailing practice of using more carbon intensive imported fossil fuels. Thus, it contributes to the national policy of diversification of energy sources away from imported oil and coal towards indigenous resources.

The Project is not the baseline scenario due to investment and technological barriers, and prevailing practice. Its expected GHG emissions reductions through 1) the active collection and use of LFG as fuel for electricity generation and for flaring, and 2) the displacement of fossil fuel-based electricity by renewable energy from landfill gas, are additional to the fulfilment of national policies on solid waste management and air pollution. Since these reductions would not take place in the absence of the CDM project activity, the Project is additional.

B.5 Description of how the definition of the project boundary related to the baseline methodology is applied to the project activity*:*

The physical boundary of the Project is the Payatas dumpsite. The systems boundary includes landfill gas collection, electricity generation, and transmission to MERALCO .

Figure 3 – Project and Systems Boundaries



B.6 Details of baseline development

B.6.1 Date of completing the final draft of this baseline section *(DD/MM/YYYY)*:

B.6.2 Name of person/entity determining the baseline:

Clean Energy Finance Committee
Mitsubishi Securities Company Ltd.
Tokyo, Japan
Tel: (81-3) 6213-6860
E-mail: hatano-junji@mitsubishi-sec.co.jp

Mitsubishi Securities is the CDM adviser to the Project. The firm is not a project participant.

C. DURATION OF THE PROJECT ACTIVITY / CREDITING PERIOD

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

Estimated DD/MM/2005

C.1.2. Expected operational lifetime of the project activity: ***(in years and months, e.g. two years and four months would be shown as: 2y-4m****)*

10 years

C.2 Choice of the crediting period and related information:

C.2.2. Fixed crediting period ***(at most ten (10) years)*****:**

C.2.2.1. Starting date:

Estimated DD/MM/2005

C.2.2.2. Length (max 10 years): ***(in years and months, e.g. two years and four months would be shown as: 2y-4m)***

10 years

D. MONITORING METHODOLOGY AND PLAN

D.1. Name and reference of approved methodology applied to the project activity:

Monitoring methodology for methane recovery from landfill gas used for electricity generation (NM0010)

D.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The methodology is applicable in the case of monitoring landfill gas recovered and fed into a power plant that sells electricity to the grid. The methodology can be applied to all landfill projects where the new project will be more costly to invest compared to current and future fossil based generation projects.

For a landfill gas capture project, it is most appropriate to accurately measure the methane combusted in flares and generators, and therefore, the emission reductions attributable to the project. LFG collection and utilization projects can directly monitor the emissions not released to the atmosphere. The emissions reductions achieved by the project do not have to be derived from a comparison between baseline and project emissions, because every ton of methane collected and combusted equals one ton of methane not released to the atmosphere, and thus one ton of methane emission reduced. A monitoring and emission reduction calculation method can be established that does not rely on information about baseline emissions. The proposed monitoring and calculation method can also be expected to be more accurate than an attempt to derive emission reductions as the difference between monitored or estimated baseline and project emissions.

The emission reductions achieved through displacement of grid electricity are estimated by multiplying the amount of electricity, measured in kWh, delivered to the grid in a year by the average grid emission factor for that year, measured as $kgCO_2/kWh$. The average grid emission rate, specifically the Luzon grid to which the power plant will be connected, is calculated utilizing data from the International Energy Agency, default factors from the IPCC Reference Manual and the current generation mix of the Luzon grid. This grid emission rate is determined in accordance with 29 (b) in Appendix B of the simplified M&P for small-scale CDM project activities. Please see Section E.5 and Appendix 6 for more details of the calculations.

D.3. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.6)*	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1	quantitative	Flow of landfill gas from project wells	m^3	m	Continuous	100%	Electronic	2 years and duration of the project crediting period in files	
2	quantitative	Flow of landfill gas to flares	m^3	m	Continuous	100%	Electronic	2 years and duration of the project crediting period in files	
3	quantitative	Flare efficiency	%	m & c	Semi-annual	n/a	Electronic	2 years and duration of the project crediting period in files	
4	quantitative	Methane content of landfill gas	%	m & c	Continuous	100%	Electronic	2 years and duration of the project crediting period in files	
5	quantitative	Generator heat rate	GJ/ MWh	m & c	Semi-annual	n/a	Electronic	2 years and duration of the project crediting period in files	
6	quantitative	Gross electricity produced	MWh	m	Continuous	100%	Electronic	2 years and duration of the project crediting period in files	
7	quantitative	Net electricity delivered to the grid	MWh	m	Continuous	100%	Electronic	2 years and duration of the project crediting period in files	
8	quantitative	Emission intensity of Luzon grid	$kgCO_2$ /kWh	c	Annually	100%	Electronic	2 years and duration of the project crediting period in files	

D.4. Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources.

Only the construction of the landfill gas collection and utilization system will lead to some CO_2 emissions that would not have occurred in the absence of the Project. These emissions are however considered insignificant and would likely occur if alternative power generation capacity were to be constructed at alternative sites. No increase in emissions is discernable other than those targeted and directly monitored by the project. Moreover, since the project employs direct monitoring of emission reductions, indirect emissions will not change the calculation.

D.5 Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHG within the project boundary and identification if and how such data will be collected and archived.

Baseline determination is not applicable, because the project directly monitors and calculates emission reductions. However, the baseline scenario is subject to monitoring in order to determine the effect of any changes to the current waste management regulations may have on the Project.

ID number *(Please use numbers to ease cross-referencing to table D.6)*	Data type	Data variable	Data unit	Will data be collected on this item? (If no, explain).	How is data archived? (electronic/paper)	For how long is data archived to be kept?	Comment
1	qualitative	Changes in waste management regulation		Yes	Electronic	Minimum of 2 years after last CER issuance.	

D.6 Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored. *(data items in tables contained in section D.3., D.4. and D.5 above, as applicable)*

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation why QA/QC procedures are or are not being planned.
D.3-1	Low	Yes	Flow meters will undergo maintenance subject to appropriate industry standards.
D.3-2	Low	Yes	Flow meters will undergo maintenance subject to appropriate industry standards.
D.3-3	Low	Yes	Regular maintenance will be done subject to appropriate industry standards. Flare efficiency will be calibrated semi-annually or more often if significant deviations from standard efficiency are observed.
D.3-4	Low	Yes	Gas analyzer will undergo maintenance subject to appropriate industry standards to ensure accuracy.
D.3-5	Low	Yes	Regular maintenance will be done subject to appropriate industry standards. Heat rate will be checked semi-annually or more often if significant deviations from standard heat rate are observed.
D.3-6	Low	Yes	Meters will undergo maintenance subject to appropriate industry standards. The meter readings will be checked against sales receipts and inventory data.
D.3-7	Low	Yes	Meters will undergo maintenance subject to appropriate industry standards. The meter readings will be checked against sales receipts and inventory data.
D.3-8	Medium/Low	No	Based on accuracy of annual reports of the Department of Energy
D.5-1	Low	Yes	Regulatory requirements will be reviewed each time at verification.

D.7 Name of person/entity determining the monitoring methodology:

Clean Energy Finance Committee
Mitsubishi Securities Company Ltd.
Tokyo, Japan
Tel: (81-3) 6213-6860
E-mail: hatano-junji@mitsubishi-sec.co.jp

Mitsubishi Securities is the CDM adviser to the Project. The firm is not a project participant.

E. CALCULATION OF GHG EMISSIONS BY SOURCES

E.1 Description of formulae used to estimate anthropogenic emissions by sources of greenhouse gases of the project activity within the project boundary:

This is not applicable, because the Project directly monitors and calculates emission reductions. Please see the comment under E.3 below, and description of the calculation procedure in E.5.

The combustion of methane in engines and flares will lead to a conversion of methane emissions to CO_2 emissions. According to the IPCC guidelines[24], "decomposition of organic material derived from the biomass sources (e.g., crops, forests) which are regrown on an annual basis is the primary source of CO_2 released from waste. Hence, these CO_2 emissions are not treated as net emissions from waste […unless…] biomass raw materials are not being sustainably produced". Consistent with the guidelines, carbon dioxide emissions from biomass – the food waste fraction of MSW – was deemed carbon neutral.

As to the emission reduction from grid electricity displacement, this is calculated by multiplying the amount of electricity delivered to the grid by the appropriate carbon emission rate.

E.2 Description of formulae used to estimate leakage, defined as: the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and that is measurable and attributable to the project activity:

Please see D.4

E.3 The sum of E.1 and E.2 representing the project activity emissions:

Not applicable, because the project directly monitors and calculate emission reductions. The only discernable difference between baseline and project emissions comes from the collection and combustion of the methane in LFG, which is monitored and calculated directly.

E.4 Description of formulae used to estimate the anthropogenic emissions by sources of greenhouse gases of the baseline:

Not applicable, because the project directly monitors and calculate emission reductions.

E.5 Difference between E.4 and E.3 representing the emission reductions of the project activity:

The monitoring plan provides for the calculation of emission reductions from avoided methane emissions and from displaced grid electricity. These are calculated in the following way:

[24] p 6.1, Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual

STEP 1 – Methane combustion in electricity generators

Gross Annual Electricity Produced by the Project (MWh)	X	Generator Heat Rate (GJ/MWh)	=	Total Energy Input (GJ)

Convert energy input (GJ) to equivalent tons of methane, using factors 0.037 GJ/m^3 CH4 and 0.000714 $tCH_4/m^3 CH_4$:

Total energy input (GJ)	/	Conversion Factor 0.037 GJ/m^3 CH_4	X	Conversion Factor 0.000714 $tCH_4/ m^3 CH_4$	=	Mass of methane utilized for generation (tCH_4)

Convert methane to its CO_2 equivalent:

Mass of methane utilized for generation (tCH_4)	X	Global Warming Potential of methane of 21	=	Annual CO_2 emissions reduced through electricity generation (tCO_2 equivalent)

To illustrate the above calculation, we use the data for 2005:

8,000,000 kWh	X	12,600 kJ/kWh	=	100,800,000,000 kJ
			=	100,800 GJ

Convert energy input (GJ) to equivalent tons of methane, using factors 0.037 GJ/m^3 CH4 and 0.000714 $tCH_4/m^3 CH_4$:

100,800 GJ	/	0.037 GJ/m^3 CH_4	X	0.000714 $tCH_4/ m^3 CH_4$	=	1,945 tCH_4

Convert tons of methane to its CO_2 equivalent:

1,945 tCH_4	X	21	=	40,849 tCO_2e

Please refer to Appendix 4 for a complete calculation of Step 1 over the crediting period.

The CO_2 emission reductions from methane combustion in flares will be calculated on an annual basis as shown below:

STEP 2 – Methane combustion in flares

Volume of LFG channelled to flares (m^3)	X	Methane content of LFG from gas analyzer (%)	X	Flare efficiency (%)	=	Net volume of methane combusted (m^3)

Convert net volume of methane combusted to equivalent tons of methane, using factors 0.000714 $tCH_4/m^3 CH_4$:

Net volume of methane combusted (m^3)	X	Conversion factor 0.000714 $tCH_4/ m^3 CH_4$	=	Mass of methane combusted in flares (tCH_4)

Convert tons of methane to its CO_2 equivalent:

Mass of methane combusted in flares (tCH_4)	X	Global Warming Potential of methane of 21	=	Annual CO_2 emissions reduced through flaring (tCO_2 equivalent)

To illustrate the above calculation, we use the data for 2005:

4,149,991 m^3	X	50%	X	97%	=	2,022,154 $m^3 CH_4$

Convert net volume of methane combusted to equivalent tons of methane, using factors 0.000714 $tCH_4/m^3 CH_4$:

2,022,154 $m^3 CH_4$	X	0.000714 $tCH_4/ m^3 CH_4$	=	1,444 tCH_4

Convert tons of methane to its CO_2 equivalent:

1,444 tCH_4	X	21	=	30,320 tCO_2 equivalent

Please refer to Appendix 4 for a complete calculation of Step 2 over the crediting period.

For quality assurance, a confirmation method will be utilized with a different set of monitored data. This method provides for the monthly collection of the following two metered variables: Volume of landfill gas flared and volume of gas extracted from production wells. It also provides the monthly laboratory values for the methane content in landfill gas. The following data provides for the calculation of emission reductions in the following way:

LFG volume channelled to flares (m^3)	X	Flare efficiency (%)	/	LFG volume collected (m^3)	=	Proportion of LFG combusted (%)

Calculate the volume of LFG combusted by multiplying the proportion of LFG combusted with the total LFG collected by the project.

LFG volume collected (m^3)	X	Proportion of LFG combusted (%)	=	Volume of combusted LFG (m^3)

Calculate the amount of methane utilized:

Volume of combusted LFG (m^3)	X	Methane content of LFG from gas analyser (%)	X	Conversion Factor 0.000714 $tCH_4/ m^3 CH_4$	=	Mass of methane combusted (tCH_4)

Convert tons of methane to its CO_2 equivalent:

Mass of methane combusted (tCH_4)	X	Global Warming Potential of methane of 21	=	Annual CO_2 emissions displaced (tCO_2 equivalent)

Electricity Displacement

Based on 29 (b) in Appendix B of the simplified M&P for small-scale CDM project activities, the Project Activity's baseline is calculated by multiplying the electricity (kWh) produced by the renewable generating unit by the weighted average emissions (in $kgCO_2$/kWh) of the current generation mix. Thus,

Baseline Emissions ($kgCO_2$/year)	=	Electricity Generated by the Project (kWh/year)	X	Weighted Average of the Grid ($kgCO_2$/kWh)

The Project will produce an average of 5,666,878 kWh/year, but it will utilize 69,456 kWh/year, primarily for its gas compressor. This will result in an average of 5,597,422 kWh/year supplied to the grid over a ten-year period. The amount of electricity sold to the grid is calculated as follows:

Gas utilization amount (m^3)	/	Maximum gas usage of 1 MW power plant (m^3)	=	Electricity Produced (MW)
For the year 2005: 5,423,298 m^3	/	5,423,298 m^3	=	1.00 MW or 1,000 kW
For the year 2010: 3,846,911 m^3	/	5,423,298 m^3	=	0.71 MW or 710 kW

Please see Appendix 5 for more details.

The power plant will be operating 8,000 hours per year, thus:

For the year 2005: 1,000 kW	X	8,000 hours/year	-	69,456 kWh/year	=	7,930,544 kWh/year
For the year 2010: 710 kW	X	8,000 hours/year	-	69,456 kWh/year	=	5,605,188 kWh/year

It was also established that the weighted average carbon emissions of the Luzon grid to which the Project supplies electricity is 0.655 $kgCO_2$/kWh. Please see Appendix 6 for the calculation. Thus, the Project's baseline emissions are calculated as follows:

Electricity Generated by Project (kWh/year)	X	Weighted Average Emissions of Luzon Grid ($kgCO_2$/KWh)	=	BASELINE EMISSIONS ($kgCO_2$/year)
5,597,422 kWh/year (average over 10-year period)	X	0.655	=	3,666,311 $kgCO_2$/year or 3,666 tons CO_2/year

E.6 Table providing values obtained when applying formulae above:

Table 3: Emission Reduction Estimates

(tons CO_2e)

No	Item	Year										Total
		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	
(1)	Methane combustion in electricity generation	40,849	40,849	40,849	40,849	39,095	28,975	21,445	15,903	11,807	8,735	289,354
(2)	Methane combustion in flares	30,320	29,853	29,502	11,622	0	0	0	0	0	0	101,297
(3)	Electricity baseline emissions	5,195	5,195	5,195	5,195	4,970	3,671	2,705	1,994	1,469	1,074	36,663
(4)	Total baseline emissions	76,363	75,896	75,545	57,665	44,065	32,646	24,151	17,898	13,276	9,810	427,314
(5)	Project activity emissions	0	0	0	0	0	0	0	0	0	0	0
(6)	Emission reductions	76,363	75,896	75,545	57,665	44,065	32,646	24,151	17,898	13,276	9,810	427,314

`F. ENVIRONMENTAL IMPACTS

F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts

A Memorandum of Agreement between the Department of Environment and Natural Resources (DENR) and the Department of Energy (DOE) excludes power plants with less than or equal to 1MW capacity, such as the Project, from the list of energy projects requiring an Environmental Impact Statement (EIS).[25] The Project is still required to comply with the relevant provisions of the Ecological Solid Waste Management Act of 2000 (RA 9003) and the Philippine Clean Air Act of 1999 (RA 8749), attached respectively as Appendices 1 and 2.

It should be noted that none of the greenhouse gases under the UNFCCC are considered pollutants and therefore not included in the Philippine national air quality standards which are attached as Appendix 3.

F.2. If impacts are considered significant by the project participants or the host Party

No significant negative environmental impacts are expected to result from the Project. On the other hand, by collecting and combusting landfill gas, the Project will contribute greatly to reducing uncontrolled LFG emissions into the atmosphere, preventing on-site fires, controlling leachate drainage, as well as physically stabilizing the Payatas dumpsite.

[25] Memorandum of Agreement on Streamlining of Environmental Impact Statement (EIS) Process for Energy Projects, the Department of Environment and Natural Resources (DENR) and the Department of Energy (DOE), August 1999.

G. STAKEHOLDERS COMMENTS

G.1. Brief description of the process on how comments by local stakeholders have been invited and compiled:

As part of the process to gather stakeholders' comments for the Project, PNOC EC consulted with the Department of Energy, Department of Environment and Natural Resources on the national level and with the Quezon City local government unit on numerous occasions.

In coordination with the Payatas Operations Group (POG), PNOC EC invited members of the Payatas dumpsite community to a public consultation for the Project. The event took place on Friday, 5 December 2003 at the POG office at the dumpsite. Twenty-five community leaders attended the forum, representing the various sectors, associations, and cooperatives – urban poor, scavengers, recyclers, junk shops, transport, parish/missionary, school, and the QC LGU. The session was conducted in English and Filipino. The list of participants and minutes are attached as Appendix 7.

PNOC EC gave a slide presentation on the Project. During the meeting, participants were invited to express their opinions through an open question and answer session.

G.2. Summary of the comments received:

In general, the participants were knowledgeable and involved in the on-going conversion of Payatas from an open to a controlled dumpsite, and aware of the 100kW test plant. They were supportive of the Project. Community members were particularly interested in the Project's environmental, health, and safety impacts, participation of dumpsite workers (scavengers), employment opportunities, and other benefits.

There were no negative comments on the Project.

G.3. Report on how due account was taken of any comments received:

The questions asked and answers provided are included in the minutes of the consultation, attached as Appendix 7. PNOC EC expressed willingness to keep the community informed and involved in the Project through the Payatas Operations Group of the Office of the Mayor of Quezon City.

ANNEX 1

Contact Information on Participants in the Project Participants in the Project Activity

(Please copy and paste table as needed)

Organization:	PNOC Exploration Corporation
Street/P.O.Box:	Merritt Road, Fort Bonifacio
Building:	Building 1, Energy Center
City:	Taguig, Metro Manila
State/Region:	
Postfix/ZIP:	
Country:	Philippines
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	President and Chief Executive Officer
Salutation:	Mr.
Last Name:	Bomasang
Middle Name:	
First Name:	Rufino
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Organization:	Mitsubishi Securities Co., Ltd. (CDM Advisor)
Street/P.O.Box:	2-5-2 Marunouchi, Chiyoda-ku
Building:	Mitsubishi Building, 10th Floor
City:	Tokyo
State/Region:	
Postfix/ZIP:	
Country:	Japan
Telephone:	(81-3) 6213-6860
FAX:	
E-Mail:	hatano-junji@mitsubishi-sec.co.jp
URL:	http://www.mitsubishi-sec.jp/english_fs.html
Represented by:	
Title:	Chairman
Salutation:	Mr.
Last Name:	Hatano
Middle Name:	
First Name:	Junji
Department:	Clean Energy Finance Committee
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

ANNEX 2

Information Regarding Public Funding

The financial plans for the Project will not involve public funding from Annex I countries.

ANNEX 3

New Baseline Methodology

Not applicable

ANNEX 4

New Monitoring Methodology

Not applicable

ANNEX 5

Table: Baseline Data

(Please provide a table containing the key elements used to determine the baseline (variables, parameters, data sources etc.). For approved methodologies you may find a draft table on the UNFCCC CDM web site. For new methodologies, no predefined table structure is provided.)

APPENDIX 1

Ecological Solid Waste Management Act of 2000 or Republic Act 9003

The Ecological Solid Management Act, otherwise known as Republic Act, signed in January 2001, emphasizes the necessity for adopting an integrated environmentally-friendly national framework for solid waste management. It gives provisions for institutional mechanisms, comprehensive and sustainable waste management targets for the local government units, and also penal measures. Under this Act:

- waste segregation at the source into compostable, non-recyclable, recyclable, special and other waste becomes mandatory.

- no open dumps are to be established, and all open dumps are to be converted to controlled dumps within three (3) years from effectivity.

- as an alternative to open dumps, and eventually controlled open dumps, sanitary landfills with gas control measures are to be established.[26]

Relevant excerpts on Open Dumpsites, Controlled Dumpsites, Sanitary Landfills from Implementing Rules and Regulations of RA 9003[27]

RULE XIII OPERATIONS OF CONTROLLED DUMPSITES

Section 1. Controlling the Operation of Open Dumpsites

No open dumpsites shall be established and operated by any person or entities, including the LGUs, will be allowed. Within three (3) years following the effectivity of the Act, all open dumpsites shall be converted to controlled dumpsites to operate only within five (5) years and beyond the said period shall consider these facilities as deemed closed and phased out. The Commission through the Department shall issue subsequent guidelines that will classify controlled dumpsites according to the following considerations:

a) Volume of wastes received;
b) Types and character of wastes received; and
c) Cost requirements for operating the facilities.

Section 2. Minimum Requirements for Operation of Controlled Dumpsites

The following minimum requirements shall be applied in siting, designing and operation of controlled dumpsites:

[26] http://www.emb.gov.ph/nswmc/ra9003/RA9003new.htm

[27] http://www.emb.gov.ph/nswmc/IRR/irrnew.htm

a) Daily cover consisting of inert materials or soil of at least 6 inches in thickness shall be applied at the end of the working day; where there is a lack of onsite soil material, other alternative materials may be used subject to the prior written approval of the enforcement authority and the Department;

b) Drainage and runoff control shall be designed and managed such that storm water does not come in contact with waste and that discharge of sediments into the receiving body of water is minimized. Appropriate erosion protection shall be installed at storm discharge outfalls;

c) Provision for aerobic and anaerobic decomposition shall be instituted to control odor;

d) Working areas shall be minimized and kept at no more than a ratio of 1.5 square meter (sqm) or less per ton/day (tpd) of waste received on a daily basis, e.g. 30 sqm working area for a 20 tpd facility;

e) Security fencing shall be provided to prevent illegal entries, trespassing and large animal entries. Large animals shall include but not limited to adult domesticated or feral animals such as dogs, cats, cattle, pigs, carabaos and horses. Provisions for litter control including the use of litter fences and daily picking of litter shall be included;

f) Basic record keeping including volume of waste received daily, special occurrences such as fires, accidents, spills, unauthorized loads (maintain record of unauthorized and rejected loads, name and address of hauler and generator of such unauthorized waste), and daily waste inspection logs;

g) Provision of maintained all-weather access roads;

h) Controlled waste picking and trading, if allowed by owner/operator, in order to facilitate daily covering and compliance to Subsections (a) through (e) above;

i) Provision of at least 0.60 m final soil cover at closure, and post-closure maintenance of cover, drainage and vegetation; Post-closure maintenance shall be for a period of ten (10) years;

j) Site shall not be located in flood plains and areas subject to periodic flooding and it shall be hydro-geologically suitable, i.e., adequate separation or clearance between waste and underlying groundwater and any surface body of water shall be provided. Engineering controls shall be provided otherwise.

k) Open dumpsites that do not comply with siting requirements of this Section shall be closed immediately. A replacement facility shall be, at a minimum, a controlled dump and shall meet the requirements of Rule XIII, and other applicable provisions of the IRR.

RULE XIV OPERATIONS OF SANITARY LANDFILLS

Section 1. Minimum Considerations for Siting and Designing Sanitary Landfills

The following guidelines, standards and criteria shall be applied in siting and designing sanitary landfills:

a) The location of the facility shall be consistent with the overall land use plan of the LGU.

b) The site shall be accessible from major roadways and thoroughfares, provided that if it is not accessible, the project design shall include means of access.

c) The site shall have an adequate quantity of earth cover material that is easily handled and compacted; as an alternative, an offsite guaranteed source of cover material shall be identified.

d) If the site is located within two (2) kilometers of an airport runway, it shall not pose a bird hazard to aircraft. The Owner/Operator shall institute a bird control program so as to prevent hazards to aircraft if bird population becomes significant due to the operation of the landfill. The site shall comply with other requirements for safety of flying aircraft in terms of height of structures, such as provisions for obstruction lights, if required.

e) Locations of public water supply intakes located within one (1) kilometer from the facility, including active public drinking water supply wells, shall be shown on a facility map.

f) The facility shall not be constructed within 75 meters from a Holocene fault or known recent active fault.

g) If significant archaeological and cultural resources are present at the site, such resources shall be protected and preserved.

h) If the site is a habitat of listed endangered species, mitigation measures for protection of the species as required by applicable laws shall be included in the project proposal.

i) The site shall be chosen with regard to the sensitivities of the community's residents. The Sangguniang Bayan/Lungsod of the host LGU shall adopt a resolution confirming compliance with the pertinent siting, design criteria and standards. The resolution shall be deemed as having fully satisfied the public sensitivity requirement of this section.

j) Except as provided in Section 1 (m) of Rule XIV, for landfills located in sensitive resources areas, landfills shall be provided with a base liner system consisting of clay and/or geosynthetic membranes (geomembrane). If clay is used, it shall have a minimum thickness of 0.75m and permeability of $1x10^{-6}$ cm/sec or less. Geomembranes shall be at least 1.5 mm thick with a permeability of $1x10^{-14}$ cm/sec or less; Geosynthetic Clay Liners (GCL) shall have a thickness of at least 6.4 mm and a permeability of $1x10^{-9}$ cm/sec or less. If composite liner is used (clay under geo-membrane), the thickness of the clay liner may be reduced to 0.60 m. The overlying geomembrane shall have the same properties as stated above. In the design of geosynthetic liners, international standards (e.g. Geosynthetic Research Institute, or applicable ASTM standards) shall be

used for its design and specifications in terms of properties, manufacturing and construction quality assurance and testing procedures.

k) Leachate collection and removal system shall be provided and designed such that leachate buildup in the landfill will be minimized. For design purposes, an allowable leachate level of not more than 0.60 meter over the liner system shall be maintained. If leachate is discharged to a receiving body of water, the discharge shall meet effluent discharge and water quality criteria prescribed by DENR.

l) Leachate storage facilities shall be designed with containment systems to prevent leachate from spillage and its migration into underlying groundwater or nearby surface body of water. For leachate impoundment ponds, the design shall include a geomembrane liner system, underlain by a low permeability soil layer of at least 0.30 m thick. The geomembrane liner shall be at least 1.5 mm thick with a permeability of $1x10^{-14}$ cm/sec or less; Liner specifications, CQA and engineering certification requirements shall be per provisions of Section 1 (m) of Rule XIV. Adequate freeboard including allowance for rainfall volume and other safeguards shall be provided to prevent pond overflowing.

m) The site shall be located in an area where the landfill's operation will not detrimentally affect environmentally sensitive resources such as aquifers, groundwater reservoir or watershed area, by provision of the following special mitigation measures and additional criteria:

1. The facility shall be a minimum 50 meters away from any perennial stream, lake or river.
2. The site shall be evaluated for presence of geologic hazards, faults, unstable soils, its foundation stability, and its hydrogeologic character. The site shall not be located in a floodplain.
3. It shall be provided with a composite base liner system consisting of a minimum 1.5 millimeter (mm) thick high density polyethylene liner (HDPE) underlain by a soil liner with a minimum thickness to 0.60 meter (m) and maximum permeability of $1x10^{-6}$ centimeter/second (cm/sec).
4. A Geosynthetic Clay Liner (GCL) with a minimum thickness of 6.4 mm and permeability of $1x10^{-9}$ cm/sec or less, may be substituted for the soil liner. Likewise, the design of the final cap shall be equivalent to its liner system in terms of permeability. The thickness of the final cover system shall be at least 1.5 m including a minimum 0.60 m thick soil foundation layer, its final cap, a drainage layer, and a vegetative layer of at least 0.30 m thick. If the thickness of the equivalent final cap makes the entire cover system less than 1.5 m thick, the deficiency shall be made up by increasing the thickness of the foundation layer.
5. Strict liner and final cap construction quality assurance (CQA) and testing shall be performed by a third party experienced in earthwork, clay and geosynthetic liner installation, quality assurance supervision, testing and inspection. The lead CQA person, as a minimum qualification or experience, must have supervised the installation of at least 100,0000 square meters each of clay and geosynthetic liner system; the CQA person or firm shall submit a construction completion report within 60 days of liner or final cap construction completion to the Department,

certifying that construction of each liner system was performed and completed in accordance with its plans and specifications. The CQA report shall be certified by a registered Civil or Geotechnical Engineer or other registered Engineer, provided that the certifying Engineer shall have at least designed or supervised the installation of soil and geosynthetic liners of quantities similar to those of the lead CQA person.

n) The design of the landfill shall be statically stable and shall be able to withstand the effects of a ground acceleration generated by an earthquake of 100-year or more recurrence interval.

o) A separation of at least two (2.0) meters shall be maintained between the top of the liner system and underlying groundwater.

p) A temporary impoundment for drainage runoff shall be provided with a detention time sufficient for sediment removal and/or reduction, prior to its discharge.

q) The site shall be large enough to accommodate the community's waste for a period of five (5) years or more during which people must internalize the value of environmentally sound and sustainable waste disposal.

r) The site chosen shall facilitate developing a landfill that will satisfy budgetary constraints, including site development, operation for many years, closure and post-closure care and possible remediation costs.

s) Operating plans shall include provisions for coordinating with recycling and resource recovery projects.

t) Designation of a separate containment area for household hazardous wastes.

u) A gas control system shall be provided when the volume of waste in the landfill has reached 0.5 million metric tons. The owner/operator shall consider recovery and conversion of methane gas into usable energy if economically viable. Prior to installation of gas control facilities, perimeter boundary gas monitoring shall be performed in accordance with Section 2(b) of Rule XIV.

v) Groundwater monitoring wells shall be placed at appropriate locations and depth for taking water samples that are representative of groundwater quality and for predicting groundwater flow.

w) Cover shall consist of a daily soil cover at least 6 inches in thickness applied at the end of each workday. Alternative Daily Cover (ADC), maybe used provided that the owner/operator can demonstrate to the Department in writing, the equivalency of the proposs4ed ADC in controlling infiltration, vector, odor and litter based on technical research or studies. In areas within the landfill that will not be used for at least 180 days, an additional interim soil cover of 6 inches thick shall be placed over the existing daily cover. The final cover shall consist of, from bottom to top, the foundation layer (consisting of 0.60m thick soil layer including interim cover), a final cap with an

equivalent permeability as that of its liner system. A drainage layer and a vegetative layer. Installation of final cover shall be completed within sic (6) months from the last receipt of waste.

x) Closure of the landfill shall be completed within one year of cessation of landfill operation.

y) Post-closure care shall be for a period of fifteen (15) years. DENR shall establish post-closure guidelines and requirements for financial assurance mechanisms within one year.

z) Small facility exemption from specific standards of this Section. The DENR will establish criteria for exemption within one (1) year from approval of the IRR.

aa) All technical reports, technical documents, plans and specifications pertaining to the engineering of the facility shall be certified and sealed by a licensed Engineer with relevant experience and expertise.

Section 2. Minimum Considerations for Operating Sanitary Landfills

In the operation of sanitary landfills, each site operator shall maintain the following minimum operating requirements:

a) Disposal site records of, but not limited to:

1. Records of weights or volumes accepted in a form and manner approved by the Department. Such records shall be submitted to the Department upon request, accurate to within ten percent (10%) and adequate for overall planning purposes and forecasting the rate of site filling;
2. Records of excavations which may affect the safe and proper operation of the site or cause damage to adjoining properties;
3. Daily logbook or file of the following information: fire, landslides, earthquake damage, unusual and sudden settlement, injury and property damage, accidents, explosions, receipt or rejection of non-permitted wastes, flooding and other unusual occurrences;
4. Record of personnel training; and
5. Copy of written notification to the Department, local health agency, and fire authority of names, addresses and telephone numbers of the operator or responsible party of the site.

b) Water quality monitoring of surface and ground waters and effluent, and gas emissions shall be performed in frequencies prescribed by the Department on a project by project basis; Parameters for groundwater, effluent and surface waters shall be as prescribed by the Department in the facility's permit. For landfills sited under Section 1m of Rule XIV of this IRR, groundwater, perimeter gas monitoring and receiving surface water monitoring shall be on a quarterly basis and treated leachate effluent discharge shall be monitored for pH, 5-day Biochemical Oxygen Demand (BOD5) and Total Suspended Solids (TSS) concentrations on a weekly basis or when discharged if discharge is not on a

daily basis, and shall not exceed limits prescribed by the Department according to the classification of the receiving body of water. Other parameters to be monitored and their respective frequencies shall be in accordance with the facility's permit. Owners/Operators of Section 1m of Rule XIV facilities shall submit monitoring and inspection reports on a quarterly basis to the designated enforcement authority with a copy furnished to the Department and other relevant agencies. The report shall be certified as to its correctness and accuracy by the owner/operator or his designated (in writing) representative. For other facilities, reporting frequencies shall be specified by the Department but in no case will it be more frequent than quarterly basis unless the facility is in a state of verification/assessment monitoring.

c) Groundwater Sampling Protocol – The DENR shall establish requirements and guidelines within one year from approval of this IRR.

d) Background Groundwater quality Monitoring Statistical Data Evaluation and Establishment of Concentration Limits for contaminant Indicators – The DENR shall establish requirements and guidelines within one year from approval of IRR.

e) Detection Groundwater Monitoring Data Statistical Analysis, Verification Monitoring – The DENR shall establish requirements and guidelines within one year from approval of IRR.

f) Assessment Monitoring and Corrective Action – The DENR shall establish requirements and guidelines within one year from approval of IRR.

i) Documentation of approvals, all reports, certification, plans and specifications, as built drawings, determinations and other requirements by the Department and other pertinent and relevant documents shall be kept in the facility's operating record.

j) Signs:

1. Each point of access from a public road shall be posted with an easily visible sign indicating the facility name and other pertinent information as required by the Department;
2. If the site is open to the public, there shall be an easily visible sign at the primary entrance of the site indicating the name of the site operator, the operator's telephone number and hours of operation; and easily visible sign at an appropriate point shall indicate the schedule of charges and the general types of materials which will be accepted or not;
3. If the site is open to the public, there shall be an easily visible road sign and/or traffic control measures which direct traffic to the active face and other areas where wastes or recyclable materials will be deposited; and
4. Additional signs and/or measures may be required at a disposal site by the Department to protect personnel and public health and safety.

i) The site shall be designed to discourage unauthorized access by persons and vehicles by using a perimeter barrier or topographic constraints. Areas within the site where open storage or ponding of hazardous materials occurs shall be separately fenced or otherwise

secured as determined by the Department. The Department may also require that other areas of the site to be fenced to create an appropriate level of security.

j) Roads within the permitted facility boundary shall be designed to minimize the generation of dust and the tracking of materials onto adjacent public roads. Such roads shall be kept in safe condition and maintained such that vehicle access and unloading can be conducted during inclement weather.

k) Sanitary facilities consisting of adequate number of toilets and handwashing facilities shall be available to personnel at or in the immediate vicinity of the site.

l) Safe and adequate drinking water supply for the site personnel shall be available.

m) The site shall have communication facilities available to site personnel to allow quick response to emergencies.

n) Where operations are conducted during hours of darkness, the site and/or equipment shall be equipped with adequate lighting as approved by the Department to ensure safety and to monitor the effectiveness of operations.

o) Operating and maintenance personnel shall wear and use appropriate safety equipment as required by the Department.

p) Personnel assigned to operate the site shall be adequately trained in subject pertinent to the site operation and maintenance, hazardous materials recognition and screening and heavy equipment operations, with emphasis on safety, health, environmental controls and emergency procedures. A record of such training shall be placed in the operating record.

q) The site operator shall provide adequate supervision of a sufficient number of qualified personnel to ensure proper operation of the site in compliance with all applicable laws, regulations, permit conditions and other requirements. The operator shall notify the Department and local health agency in writing of the names, addresses, and telephone number of the operator or responsible party. A copy of the written notification shall be placed in the operating record.

r) Any disposal site open to the public shall have an attendant present during public operating hours or the site shall be inspected by the operator on a regularly scheduled basis, as determined by the Department.

s) Unloading of solid wastes shall be confined to a small area as possible to accommodate the number of vehicles using the area without resulting in traffic, personnel, or public safety hazards. Waste materials shall normally be deposited at the toe of the fill, or as otherwise approved by the Department. For practical purposes, a working area shall be limited to 1.5 square meter or less per ton/day (tpd) of waste received on a daily basis, e.g. 30 sqm working area for a 20 tpd facility.

t) Solid waste shall be spread and compacted in layers with repeated passages of the landfill equipment to minimize voids within the cell and maximize compaction. The loose layer

shall not exceed a depth approximately 0.60 m or two feet before compaction. Spreading and compacting shall be accomplished as rapidly as practicable, unless otherwise approved by the Department.

u) Covered surfaces of the disposal area shall be graded to promote lateral runoff of precipitation and to prevent ponding. Grades shall be established of sufficient slopes to accost for future settlement of the fill surface. Other effective maintenance methods may be allowed by the Department.

v) Cover material or native material unsuitable for cover, stockpiled on the site for use or removal, shall be placed so as not to cause problems or interfere with unloading, spreading, compacting, access, safety, drainage or other operations.

APPENDIX 2

Philippine Clean Air Act of 1999 or Republic Act 8749[28]

The Philippine Clean Air Act or R.A. 8749, which took effect on July 1999, describes the requirements for a comprehensive air pollution control and management program for the Philippines. Its implementing rules and regulations contain specific requirements that prohibit vehicular and industrial sources from emitting pollutants in amounts that cause significant deterioration of air quality. The Environmental Management Bureau of DENR is mainly responsible for its implementation and enforcement.

Relevant excerpts on Alternative Fuels, Ecological Waste Management, and Greenhouse Gases from RA 8749

Section 11. ***Air Quality Control Techniques*** **-** Simultaneous with the issuance of the guideline values and standards, the Department, through the research and development program contained in this Act and upon consultation with the appropriate advisory committees, government agencies and LGUs, shall issue, and from time to time, revise information on air pollution control techniques. Such information shall include:

a) Best available technology and alternative methods of prevention, management and control of air pollution

b) Best available technology economically achievable which shall refer to the technological basis/standards for emission limits applicable to existing, direct industrial emitters of non-conventional and toxic pollutants; and

c) Alternative fuels, processes and operating methods which will result in the elimination or significant reduction of emissions.

Such information may also include data relating to the cost of installation and operation, energy requirements, emission reduction benefits, and environmental impact or the emission control technology.

The issuance of air quality guideline values, standards and information on air quality control techniques shall be made available to the general public: *Provided,* That the issuance of information on air quality control techniques shall not be construed as requiring the purchase of certain pollution control devices by the public.

Section 20. ***Ban on Incineration.*** **-** Incineration, hereby defined as the burning of municipal, bio-medical and hazardous wastes, which process emits poisonous and toxic fumes, is hereby prohibited: *Provided, however,* That the prohibition shall not apply to traditional small-scale method of community/neighborhood sanitation "siga", traditional, agricultural, cultural, health, and food preparation and crematoria: *Provided, further,* That existing incinerators dealing with bio-medical wastes shall be phased out within three (3) years after the effectivity of this Act: *Provided, finally,* That in the interim, such units shall be limited to the burning of pathological and infectious wastes, and subject to close monitoring by the Department.

Local government units are hereby mandated to promote, encourage and implement in their

[28] http://www.emb.gov.ph/Frameset_Download.htm

respective jurisdiction a comprehensive ecological waste management that includes waste segregation, recycling and composting.

With due concern on the effects of climate change, the Department shall promote the use of state-of-the-art, environmentally-sound and safe non-burn technologies for the handling, treatment, thermal destruction, utilization, and disposal of sorted, unrecycled, uncomposted municipal, bio-medical and hazardous wastes.

Section 31. ***Greenhouse Gases.*** -The Philippine Atmospheric, Geophysical and Astronomical Service Administration (PAGASA) shall regularly monitor meteorological factors affecting environmental conditions including ozone depletion and greenhouse gases and coordinate with the Department in order to effectively guide air pollution monitoring and standard-setting activities.

The Department, together with concerned agencies and local government units, shall prepare and fully implement a national plan consistent with the United Nations Framework Convention on Climate Change and other international agreements, conventions and protocols on the reduction of greenhouse gas emissions in the country.

APPENDIX 3

Philippine National Air Standards, Excerpt from Implementing Rules and Regulations of Philippine Clean Air Act of 1999 (RA 8749)[29]

PART II NATIONAL AMBIENT AIR QUALITY GUIDELINES

Rule VII. National air quality

Section I Nationall Ambient Air Quality Guideline Values

(a) Pursuant to Section 12 of Republic Act 8749, the initial set of National Ambient Air Quality Guideline Values necessary to protect public health and safety and general welfare shall be as follows:

Table 1
National Ambient Air Quality Guideline Values

Pollutants	Short Term[a]			Long Term[b]		
	μg/NCM	ppm	Averaging Time	μg/NCM	ppm	Averaging Time
Suspended Particulate Matter[c] –						
TSP	230[d]		24 hours	90		1 year[e]
PM-10	150[f]		24 hours	60		1 year[e]
Sulfur Dioxide[c]	180	0.07	24 hours	80	0.03	1 year
Nitrogen Dioxide	150	0.08	24 hours			
Photochemical Oxidants as Ozone	140	0.07	1 hour			
	60	0.03	8 hours			
Carbon Monoxide	35 mg/NCM	30	1 hour			
	10 mg/NCM	9	8 hours			
Lead[g]	1.5		3 months[g]	1.0		1 year

[a] Maximum limits represented by ninety-eight percentile (98%) values not to exceed more than once a year.
[b] Arithmetic mean.
[c] SO_2 and Suspended Particulate matter are sampled once every six days when using the manual methods. A minimum of twelve sampling days per quarter or forty-eight sampling days each year is required for these methods. Daily sampling may be done in the future once continuous analyzers are procured and become available.
[d] Limits for Total Suspended Particulate Matter with mass median diameter less than 25-50 μm.
[e] Annual Geometric Mean.
[f] Provisional limits for Suspended Particulate Matter with mass median diameter less than 10 μm and below until sufficient monitoring data are gathered to base a proper guideline.
[g] Evaluation of this guideline is carried out for 24-hour averaging time and averaged over three moving calendar months. The monitored average value for any three months shall not exceed the guideline value.

[29] Ibid.

Part VII POLLUTION FROM STATIONARY SOURCES

RULE XXV Stationary Sources - General

Section 1 National Emission Standards for Source Specific Air Pollutants

For any trade, industry, process, fuel-burning equipment or industrial plant emitting air pollutants, the concentration at the point of emission shall not exceed the limits set in Table 2.

Table 2
National Emission Standards for Source Specific Air Pollutants (NESSAP)

POLLUTANT	STANDARD APPLICABLE TO SOURCE	MAXIMUM PERMISSIBLE LIMITS (mg/NCM)	METHOD OF SAMPLING[a]	METHOD OF ANALYSIS[a]
Antimony and its Cmpds.	Any source	10 as Sb	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method
Arsenic and its Cmpds.	Any source	10 as As	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method
Cadmium and its Cmpds.	Any source	10 as Cd	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method
Carbon Monoxide	Any industrial source	500 as CO	USEPA Method 3 or 10	Orsat Analysis or NDIR
Copper and its Cmpds.	Any industrial source	100 as Cu	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method
Hydrofluoric Acid and Fluoride Compounds	Any source other than manufacture of Aluminum from Alumina	50 as HF	USEPA Method 13 or 14 as appropriate	As per sampling method
Hydrogen Sulfide	i) Geothermal power plants ii) Geothermal Exploration And Well Testing iii) Any source other than (i) and (ii)	[c], [d] [e] 7 as H_2S	USEPA Method 11, 15 or 16 as appropriate	Cadmium Sulfide Method or per sampling method
Lead	Any trade, industry or process	10 as Pb	USEPA Methods 1 through 5or 12 or 29	AAS[b] or per sampling method
Mercury	Any source	5 as elemental Hg	USEPA Methods 1 through 5 or 29 or 101	AAS[b]/ Cold-Vapor Technique or Hg Analyzer

POLLUTANT	STANDARD APPLICABLE TO SOURCE	MAXIMUM PERMISSIBLE LIMITS (mg/NCM)	METHOD OF SAMPLING[a]	METHOD OF ANALYSIS[a]
Nickel and its Cmpds. Except Nickel Carbonyl[f]	Any source	20 as Ni	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method
NO_x	1) Manufacture of Nitric Acid 2) Fuel burning steam generators a) Existing Source b) New Source i) Coal-fired ii) Oil-fired 3) Diesel-powered electricity generators 4) Any source other than (1), (2) and (3) a) Existing Source b) New Source	2,000 as acid & NO_2 calculated as NO_2 1,500 as NO_2 1,000 as NO_2 500 as NO_2 2,000 as NO_2 1,000 as NO_2 500 as NO_2	USEPA Methods 1 through 4 and Method 7	Phenol-disulfonic acid Method or per sampling method
Particulates	1) Fuel Burning Equipment a) Urban[g] and Industrial Area[h] b) Other Area[i] 2) Cement Plants (kilns, etc.) 3) Smelting Furnaces 4) Other Stationary Sources[j]	 150 200 150 150 200	USEPA Methods 1 through 5	Gravimetric per sampling method
Phosphorus Pentoxide[k]	Any source	200 as P_2O_5	USEPA Methods 1 through 5 or 29	Spectrophotometry or per sampling method
Sulfur Oxides	1) Existing Sources a) Manufacture of Sulfuric Acid and Sulf(on)ation Process b) Fuel Burning Equipment c) Other Stationary Sources[l] 2) New Sources a) Manufacture of Sulfuric Acid and Sulf(on)ation Process b) Fuel Burning Equipment c) Other Stationary Sources[l]	 2,000 as SO_3 1,500 as SO_2 1,000 as SO_3 1,500 as SO_3 700 as SO_2 200 as SO_3	USEPA Methods 1 through 4 and 6 or 8 as appropriate	As per sampling method
Zinc and its Compounds	Any source	100 as Zn	USEPA Methods 1 through 5 or 29	AAS[b] or per sampling method

[a] Other equivalent methods approved by the Department may be used.
[b] Atomic Absorption Spectrophotometry.
[c] All new geothermal power plants starting construction by 01 January 1995 shall control H2S emissions to not more than 150 g/GMW-Hr.
[d] All existing geothermal power plants shall control H_2S emissions to not more than 200 g/GMW-Hr.
[e] Best available control technology for air emissions and liquid discharges. Compliance with air and water quality standards is required.
[f] Emission limit of Nickel Carbonyl shall not exceed 0.5 mg/NCM.

[g] Urban Area means a poblacion or central district of cities or municipalities having at least 50,000 population, or twin political subdivisions with contiguous boundary which essentially form one community whose population is more than 50,000 inhabitants. Inside these centers or population are some scattered industrial establishments.
[h] Industrial Area means a well-defined, exclusive land use area in various stages of development that are primarily established for industrial subdivisions, manufacturing and other industry mixes with provisions for common support infrastructures, facilities and services such as roads, water supply, power supply, communication systems, housing, storm drainage, sanitary sewerage systems, industrial wastewater treatment facilities, etc. These areas which are usually from 200 to 500 hectares in size as registered with the (Housing and Land Use Regulatory Board (HLURB) or any other duly authorized government entities as industrial estates, parks or area. Export processing zones also fall under this category of land use.
[i] Other Areas means all areas other than an urban or industrial area.
[j] Other Stationary Sources (particulates) means a trade, process, industrial plant, or fuel burning equipment other than thermal power plant, industrial boilers, cement plants, incinerators, smelting furnaces.
[k] Provisional guideline.
[l] Other Stationary Sources (sulfur oxides) refers to existing and new stationary sources other than those caused by the manufacture of sulfuric acid and sulfonation process, fuel burning equipment and incineration.

RULE XXVI Source Specific Ambient Air Quality Standards

Section I National Ambient Air Quality Standards

For any industrial establishment or operation, the discharge of air pollutants that result in airborne concentrations in excess of the National Ambient Air Quality Standards shown in Table 3 shall not be permitted. Sampling shall be done at the location of highest expected concentration. Location shall be determined using dispersion modeling. Bureau-approved techniques shall be followed in developing sampling plans. For example, the Bureau's Air Quality Monitoring Manual specifies that sampling shall be done at an elevation of at least two (2) meters above the ground level, and shall be conducted either at the property line or at a downwind distance of five (5) to twenty (20) times the stack height, whichever is more stringent. However, the Bureau may approve the adoption of a different procedure in the choice of the location of the monitoring equipment depending upon the physical surrounding and other relevant factors in the area where the sampling is to be conducted.

Table 3
National Ambient Air Quality Standards for Source Specific Air Pollutants from Industrial Sources/Operations

Pollutants	Concentration [a]		Averaging Time (min)	Method of Analysis/Measurement [c]
	μg/NCM	Ppm		
Ammonia	200	.028	30	Nesselerization / Indo Phenol
Carbon Disulfide	30	0.01	30	Tischer Method
Chlorine and Chlorine cmpds expressed as CL_2	100	0.03	5	Methyl Orange
Formaldehyde	50	0.04	30	Chromotropic Acid method or MBTH Colorimetric method
Hydrogen Chloride	200	0.13	30	Volhard Titration with Iodine solution
Hydrogen Sulfide	100	0.07	30	Methylene Blue
Lead	20		30	AAS[b]
Nitrogen Dioxide	375 260	0.20 0.14	30 60	Griess-Saltzman
Phenol	100	0.03	30	4-Aminoantipyrine
Sulfur Dioxide	470 340	0.18 0.13	30 60	Colorimeteric-Pararosaline
Suspended Particulate Matter – TSP PM-10	300 200	-- --	60 60	Gravimetric Gravimetric
Antimony	0.02 mg/NCM	--	30	AAS[b]
Arsenic	0.02 mg/NCM	--	30	AAS[b]
Cadmium	0.01 mg/NCM	--	30	AAS[b]

Pollutants	Concentration [a]		Averaging Time (min)	Method of Analysis/Measurement [c]
	μg/NCM	Ppm		
Asbestos	2×10^6 Particulates/NCM (over 5 micrometer in size)	--	30	Light Microscopy
Sulfuric Acid	0.3 mg/NCM	--	30	Titration
Nitric Acid	0.4 mg/NCM	--	30	Titration

[a] Ninety-eight percentile (98%) values of 30-min. sampling measured at 25°C and one atmosphere pressure.
[b] Atomic Absorption Spectrophotometry.
[c] Other equivalent methods approved by the Department through the Bureau may be used.

APPENDIX 4

Calculation for Methane Used for Electricity Generation and Flaring

Methane Combustion in Electricity Generation

Year	Capacity Used	Power Plant Operation	Gross Electricty Produced	Generator heat rate (based on Durban)	Energy Input	Conversion of GJ to m^3 CH_4	Conversion of m^3 to tons CH_4	Conversion to CO_2 equivalent
	MW	hours/year 8,000	kWh	 12,600	GJ	m^3 0.037	tons 0.000714	tons 21
2005	1.00	8,000	8,000,000	12,600	100,800	2,724,324	1,945	40,849
2006	1.00	8,000	8,000,000	12,600	100,800	2,724,324	1,945	40,849
2007	1.00	8,000	8,000,000	12,600	100,800	2,724,324	1,945	40,849
2008	1.00	8,000	8,000,000	12,600	100,800	2,724,324	1,945	40,849
2009	0.96	8,000	7,656,640	12,600	96,474	2,607,396	1,862	39,095
2010	0.71	8,000	5,674,644	12,600	71,501	1,932,446	1,380	28,975
2011	0.52	8,000	4,199,944	12,600	52,919	1,430,251	1,021	21,445
2012	0.39	8,000	3,114,566	12,600	39,244	1,060,636	757	15,903
2013	0.29	8,000	2,312,329	12,600	29,135	787,442	562	11,807
2014	0.21	8,000	1,710,652	12,600	21,554	582,546	416	8,735
Total			56,668,775					289,354

Methane Combustion in Flaring

Year	Surplus Gas (flared)	Methane Fraction in LFG	Volume of CH_4 combusted in flares	Flare Efficiency	Net volume of CH_4 combusted in flares	Conversion of m^3 to tons CH_4	Conversion to CO_2 equivalent
	m^3		m^3		m^3	tons	tons
2005	4,149,991	0.50	2,084,695	0.97	2,022,154	1,444	30,320
2006	4,086,009	0.50	2,052,554	0.97	1,990,978	1,422	29,853
2007	4,038,023	0.50	2,028,449	0.97	1,967,596	1,405	29,502
2008	1,590,716	0.50	799,076	0.97	775,103	553	11,622
2009	-	0.50	-	0.97	-	-	-
2010	-	0.50	-	0.97	-	-	-
2011	-	0.50	-	0.97	-	-	-
2012	-	0.50	-	0.97	-	-	-
2013	-	0.50	-	0.97	-	-	-
2014	-	0.50	-	0.97	-	-	-
Total							101,297

APPENDIX 5

Methane Used for Electricity Generation

	Gas Extraction	Maximum Gas Usage of 1 MW Power Plant	Gas Utilization	Surplus Gas (flared)	Capacity Used
Year	scf	scf	scf	scf	MW
2005	338,128,560	191,550,877	191,550,877	146,577,683	
2006	335,868,720	191,550,877	191,550,877	144,317,843	
2007	334,173,840	191,550,877	191,550,877	142,622,963	
2008	247,734,960	191,550,877	191,550,877	56,184,083	
2009	183,329,520	191,550,877	183,329,520	-	
2010	135,872,880	191,550,877	135,872,880	-	
2011	100,562,880	191,550,877	100,562,880	-	
2012	74,574,720	191,550,877	74,574,720	-	
2013	55,366,080	191,550,877	55,366,080	-	
2014	40,959,600	191,550,877	40,959,600	-	
Total	1,846,571,760	1,915,508,772	1,356,869,189	489,702,571	

Convert standard cubic feet into cubic meters:

Year	m^3	m^3	m^3	m^3	MW
2005	9,573,289	5,423,298	5,423,298	4,149,991	1.00
2006	9,509,307	5,423,298	5,423,298	4,086,009	1.00
2007	9,461,320	5,423,298	5,423,298	4,038,023	1.00
2008	7,014,014	5,423,298	5,423,298	1,590,716	1.00
2009	5,190,530	5,423,298	5,190,530	-	0.96
2010	3,846,911	5,423,298	3,846,911	-	0.71
2011	2,847,194	5,423,298	2,847,194	-	0.52
2012	2,111,402	5,423,298	2,111,402	-	0.39
2013	1,567,556	5,423,298	1,567,556	-	0.29
2014	1,159,672	5,423,298	1,159,672	-	0.21
Total	52,281,194	54,232,978	38,416,455	13,864,739	

APPENDIX 6

Details of the electricity baseline and its development:

In accordance with 29 (b) in Appendix B of the simplified M&P for small-scale CDM project activities, the baseline for the Project is defined as the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in $kgCO_2/kWh$) calculated as the weighted average emissions (in $kgCO_2/kWh$) of the current generation mix.

Electricity Generation

Three grids account for the 48,467 GWh total electricity generated in the Philippines in January to November 2003: Luzon - 72%, Visayas - 15%, and Mindanao - 13%.[30] The government-owned National Power Corporation dominates power generation.

Grid fuel composition

The fuel mix of electricity generation for the Luzon grid is shown in Table 1 provided by the DOE.

Table 1: Fuel Mix of Electricity Generation for Luzon Grid in January – November 2003[31]

Type	Weight (%)
Oil-based	8%
Hydropower	11%
Geothermal	7%
Coal	38%
Natural Gas	36%
Total	100%

No data is publicly available for the grid carbon emission factor or actual fuel consumption specific to the Luzon grid. DOE publishes only the grid composition.[32]

[30] 2004-2013 Philippine Power Development Plan, Department of Energy www.doe.gov.ph

[31] Ibid

[32] Ibid

Carbon Emission Factors (CEFs) by Generation Type

The PDD estimates the CEFs using data from the International Energy Agency detailing fuel consumption for each generation type, and carbon emission factors provided by IPCC guidelines. For example, the CEF for coal is calculated as follows:

CO_2 emission = [fuel consumption (IEA)] x [net calorific value (IPCC)] x [carbon emission factor (IPCC)] x [oxidation factor (IPCC)] x [44/12]

= [3,989 x 10^3 toe] x [41.868 TJ/10^3 toe] x [26.8 tC/TJ] x [0.98] x [44 tCO2/12 tC]

= 16,083,426 tCO_2

The individual CEF (tCO_2/MWh) will then calculated with the CO_2 emission (tCO_2) divided by the electricity generated (MWh) by that fuel type.

CEF = 16,083,426 tCO_2 / 18,789,000 MWh

= 0.856 (tCO_2/MWh)

Similar calculations are carried out for other types of fossil fuel-based power generation, while a CEF of zero is assigned to hydro and geothermal.

The relevant figures are reproduced in Table 2.

Table 2: Carbon Emission Factors for Electricity Generation

	Fuel Consumption ('000 toe) [33]	Electricity Generated (MWh) [34]	Energy Content (TJ) [35]	CEF (tC/TJ)[36]	Oxidation factor[37]	CO2 emission (tCO2)	Assumption	Individual CEF (tCO2/MWh)
Petroleum	2,504	9,866,000	104,837	21.1	0.99	8,029,816	residual fuel oil	0.814
Hydro	611	7,104,000	25,581	0	0	0		0
Geothermal	8,977	10,442,000	375,849	0	0	0		0
Coal	3,989	18,789,000	167,011	26.8	0.98	16,083,426	anthracite	0.856
Gas	11	35,000	461	15.3	0.995	25,708	natural gas (dry)	0.735
Total		46,236,000				24,138,950		

[33] "Energy Balances of Non-OECD Countries, 2000-2001", International Energy Agency

[34] Ibid

[35] Table 1-1 IPCC Workbook

[36] Table 1-1 IPCC Reference Manual

[37] Table 1-6 IPCC Reference Manual

Weighted Average Emissions for electricity generation in Luzon Grid

The weighted average emissions for the current generation mix of the Luzon grid as of January to November 2003 is estimated to be 0.655 $kgCO_2/kWh$ which is the sum of the products of the weight of each fuel type in the grid and the CEF for each fuel type as shown in the Table 3.

Table 3: Weighted Average Emissions for Electricity Generation of Luzon Grid (January – November 2003)

Fuel Type	**(1) Weight in Grid (%)**	**(2) CEF (kgCO2/kWh)**	**(1) X (2) Weighted CEF (kgCO2/kWh)**
Oil-based	8%	0.814	0.065
Hydropower	11%	0	0
Geothermal	7%	0	0
Coal	38%	0.856	0.325
Natural Gas	36%	0.735	0.264
Total	100%		**0.655**

Thus, the Project's electricity baseline emissions, based on the formula stated in E.5, are calculated as follows:

Table 4: Grid Electricity Displacement

	Capacity Used	Power Plant Operation	Gross Electricty Produced	Electricity Utilized by Project	Net Electricity Delivered to Grid	Weighted Average Emissions of Luzon Grid	Electricity Baseline Emissions
Year	MW	hours/year 8,000	kWh	kWh	Kwh	$kgCO_2/KWh$	kg of CO2/yr
2005	1.00	8,000	8,000,000	69,456	7,930,544	0.655	5,194,507
2006	1.00	8,000	8,000,000	69,456	7,930,544	0.655	5,194,507
2007	1.00	8,000	8,000,000	69,456	7,930,544	0.655	5,194,507
2008	1.00	8,000	8,000,000	69,456	7,930,544	0.655	5,194,507
2009	0.96	8,000	7,656,640	69,456	7,587,185	0.655	4,969,606
2010	0.71	8,000	5,674,644	69,456	5,605,188	0.655	3,671,398
2011	0.52	8,000	4,199,944	69,456	4,130,489	0.655	2,705,470
2012	0.39	8,000	3,114,566	69,456	3,045,110	0.655	1,994,547
2013	0.29	8,000	2,312,329	69,456	2,242,873	0.655	1,469,082
2014	0.21	8,000	1,710,652	69,456	1,641,196	0.655	1,074,983
Total			56,668,775		55,974,218		36,663,113

APPENDIX 7

Public Consultation

Payatas Operations Group Office
Payatas, Quezon City
5 December 2003

A. Participants

	Organization/Association	Number of Representatives
1	Payatas Operations Group (POG), Office of the Mayor, Quezon City	2
2	Baranggay[38] Payatas	1
3	Payatas Scavenger Association Group (PSAG)	3
4	Alyansa ng Maralitang sa Payatas Estate (AMPAT - Scavengers Sector)	1
5	Payatas Recycling Movement (PRM) /Payatas Scavengers Association Inc. (PSAI)	1
6	Payatas Recycling Exchange (PARE) / Payatas Scavengers Association Inc. (PSAI)	1
7	Payatas Alliance Recycling	2
8	Payatas Recycling Movement (PRM)	1
9	Payatas Junkshop Scavenger Association (PAJOSA) 1	1
10	Payatas Junkshop Scavenger Association (PAJOSA) 2	1
11	Junk Shop	2
12	REN Transport Corp.	1
13	Food Court	1
14	Paaralang Pangtao (School)	1
15	Payatas Parent Association for Children Rehabilitation Inc. (PPACRI) / Vencentian Missionaries Social Development Foundation Inc. (VMSDFI)	4
16	Vencentian Missionaries Social Development Foundation Inc. (VMSDFI) / ILPP	1
17	Homeless People Federation of the Philippines (HPFP)	1
	Total	**25**

[38] The baranggay is the smallest political unit in the Philippines, equivalent to a village.

APPENDIX 7

Public Consultation (continued)

C. Minutes of the Public Consultation

Meeting started 10 AM.

1. Introduction by Col. Jaymalin, Payatas Operations Group
2. Consultation objectives by E. S. Garcia, PNOC EC
3. Presentation: PNOC EC background information and project objectives by S.E. Chua, PNOC EC

Questions raised during the open forum:

4. **Question:** What will be the effect of the project to the residents in the community and the people working in the dumpsite?

   Answer: The project will have positive effects to the environment and safety of the dumpsite. It will mitigate the adverse environmental impact of the gas emitting from the dump as this will be collected and used for generating electricity. It will also eliminate fires in the dumpsite especially during the dry season and as the leachate will be drained properly, it would stabilize the dump or prevent landslides as what happened before. This could even extend the usable life of the dump.

5. **Question:** What will be the role or participation of the workers in the dumpsite to the project?

   Answer: The project needs the support and cooperation of the whole community. For those people working directly in the dumpsite, they could, among others, oversee the equipment that will be brought in and the project facility to prevent pilferage, assist in policing the dumpsite and support the preparations, construction and plant operations.

6. **Question:** What is the capacity of the plant during rainy and dry seasons?

   Answer: Based on the preliminary studies and testing conducted, the plant can maintain the proposed 1mW capacity for 10 years provided dumping will continue until 2007 and is irregardless of the weather conditions.

7. **Question:** What sicknesses that could emerge or breakout as a result of the gas that is continuously emitting from the dumpsite?

   Answer: The gas or gasses being generated from the dumpsite are basically non-toxic and does not cause harm or diseases. In addition, the project, as mentioned earlier, will lessen the negative environmental impact of the gas generated as this will be collected and used for power.

APPENDIX 7

Public Consultation (continued)

8. **Question:** Will the safety of the children or the educational center nearby the dumpsite be compromised by the project?

   Answer: The safety of the children as well as the center will not be compromised as its location is distant from the project site.

9. **Question:** Who will benefit or the beneficiaries of the project?

   Answer: Everybody in the community will benefit from the project as mentioned earlier. As far as the electricity that will be generated, this might result in cheaper and more reliable electricity in the area. However, it is important to note that the PNOC EC project is just a part of a bigger project which is the conversion of the existing dumpsite to a controlled one. PNOC EC will coordinate with the POG on what other benefits that await the community and workers in the dumpsite.

10. **Question:** When is the start of the project?

    Answer: The project is a continuation of the gas production testing conducted in 2001.

Meeting adjourned at 11:30 AM.
Prepared by: R. V. Oliquino (sgd), PNOC EC

Approved by:
E. S. Garcia (sgd), PNOC EC