CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)

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Apendixes

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Landfill Gas Extraction and Utilization at the Matuail landfill site Dhaka, Bangladesh

A.2. Description of the project activity:

>>
The project aims at the realisation of a landfill gas extraction and utilisation project at Matuail landfill site near the capital Dhaka in the Peoples Republic of Bangladesh. The extracted gas will be used on-site for electricity generation in co-generation units.
The project comprises the design and engineering of the extraction system according to modern standards, all equipment delivery (wells, piping, compressor(s), flare, CHP units, grid connection, etc.). Reshaping the landfill and introducing proper landfilling techniques are part of the project activity.

Based on investigations and calculations the project will realise 1,300,000 tonnes CO_2 equivalents over the 7-years period 2006 – 2012 (first crediting period). The investments will be realised mainly during the period 2005 till 2007. Delivery of CERs will start from mid 2006.

The project does not use any scare resources (like fuel, water); neither it produces any waste or emissions to water and soil. The gas engines do produces local combustion gases. The main environmental negative component can be NOx that is an acidifying gas. The engines however, will comply with US and Western European emission standards; therefore the amount emitted is very limited. It is noted here that elsewhere inefficient and polluting electricity production is prevented. This results overall in a net reduction of combustion gases including NOx.

Extracting the landfill gas has a local environmental impact, mainly reduction of several side effects like odour- and dust emission, fires, etc. No negative impact will occur. The compressor(s) and gas engines will be placed in enclosed acoustic housings (sound reducing containers), so no noise pollution will occur.

The project will be the first in the Bangladesh to extracts and utilizes LFG for electricity generation on a commercial basis. As a pioneering effort by the project proponent, the project will contribute significantly to the sustainable development of the Bangladesh. The following environmental, economic, and social benefits can be attributed directly to the project:

1 Environmental benefits - assist in mitigating uncontrolled GHG emission from the landfill, help to prevent on-site fires, control the release of volatile organic compounds, provide greater control of leachate drainage, and physically stabilize the Matuail landfill;
2 Economical benefits – LFG as a new indigenous fuel source for Bangladesh; foreign expertise and training to facilitate smooth technology transfer; foreign capital inflow for investment;
3 Social benefits – improved health conditions due to mitigation of gaseous emissions and greater control of leachate; improved safety around the site due to stabilizing the waste pile; jobs for locals and staff training to improve skills of locals.

It is thought that this project will become a test case in Bangladesh that will be closely monitored by other dumpsite/landfill owners.

A.3. Project participants:

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Project proponent/ Sponsor	**World Wide Recycling B.V.** (**WWR**) a Dutch private company and **Waste Concern** (**WC**) a Bangladeshi independent non-governmental organisation (NGO). They will form a Special Purpose Company (SPC).
DNA	Government of the People's Republic of Bangladesh Department of Environment
DNA	Government of the Netherlands – is expected to give authorisation to WWR.

Annex 1 provides more information on the project participants.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>
Matuail landfill site, Dhaka, Bangladesh

A.4.1.1. Host Party(ies):

>>
Peoples Republic of Bangladesh

A.4.1.2. Region/State/Province etc.:

>>
Dhaka greater area

A.4.1.3. City/Town/Community etc:

>>
Dhaka

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

>>
The LFG project will be erected at the landfill site of Matuail near Dhaka (see maps in figures A-1 & A-2 on next page).
Currently the Matuail landfill is operated by Dhaka City Corporation (DCC). In fact only uncontrolled dumping of collected waste, up to a height of some 6 meters, is performed. WWR and WC intend to take over the activities at Matuail landfill and will introduce proper landfilling techniques. The landfill will be reshaped according to Western standards in order to optimize it for a/o landfill gas extraction.

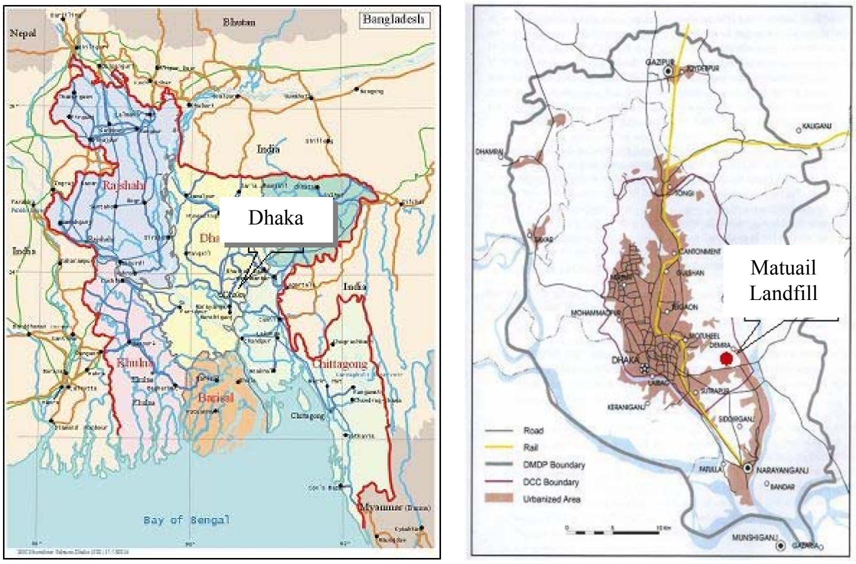

Figure A-1 & A-2: Map of Bangladesh and location of Matuail landfill near the capital Dhaka

Picture A-1: Access road to Matuail landfill

A.4.2. Category(ies) of project activity:

>>

Project activity: 13 - Waste handling and disposal

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

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The technology proposed for the extraction and utilisation of biogas can be regarded as standard, proven and sound technology, environmentally safe.

The extraction technology applied will basically consist of:

- vertical + wells;
- collectors + piping;
- condensate separator;
- compressors;
- leachate treatment installation and pond.

The landfill gas utilisation equipment consists of:

- flare;
- dedicated LFG gas engines connected to electric generators (3 x 1 MWe);
- hook-up to grid devices.

The landfill will be reshaped and will go up in height (from approx. 6m up to 25m) in order to make it more suitable for landfill gas extraction and to prolong the landfilling period up to 2011.

WWR has extensive knowledge of landfill gas extraction and utilisation techniques. Its mother company VAR operates a large recycle centre, including a landfill with landfill gas extraction in the Netherlands.

Royal Haskoning (www.royalhaskoning.com), the engineering consultant of the project proponents, has designed numerous landfill gas extraction and utilisation projects all over the world a/o for the World Bank Prototype Carbon Fund (PCF) Liepaja project in Latvia.

WC operates several small-scale composting plants that have been designed by Waste Concern and in use since 1995 in Bangladesh. It has extensive knowledge in managing waste projects in Bangladesh.

The know-how related to the applied technology and the know-how related to the operation of the plant will be transferred to the host party since, in the future by far, the majority of the employees will be residents of the host-country.

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 is based on two complementary activities:

- the collection and flaring (combustion) of landfill gas, thus converting its methane content into (non-fossil) CO_2, reducing its greenhouse gas effect,
- electricity generation and supply of electricity to the grid, thus replacing a certain amount of fossil fuel for electricity generation.

In Bangladesh there is no legislation enforcing landfill gas extraction with or without utilization or what-so-ever. Since it is not obligated to collect/combust LFG, the approach is to continue emitting LFG directly into the atmosphere. Commercial LFG extraction projects have not been implemented to date because they are not economically attractive and there are few to no incentives to justify the high risk involved in using this for Bangladesh new technology. The project will not be viable unless CDM assistance is acquired (see section B.2 for further details). The Project is additional in that emissions reductions would not occur in the absence of the proposed CDM activity.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

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1,300,000CER's over the period 2006 – 2012 (first crediting period).

A.4.5. Public funding of the project activity:

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There is no public funding in this project.

SECTION B. Application of a baseline methodology

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

>>
The baseline methodologies used are:

- the ACM0001: “Consolidated baseline methodology for landfill gas project activity”, which was approved on 3 September 2004;
- the ACM0002: ”Consolidated methodology for grid-connected electricity generation from renewable sources”, which was approved on 3 September 2004.

Both consolidated methodologies can be found on the UNFCC website:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

Project activity: 13 - Waste handling and disposal

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

>>
The project meets all the applicability criteria as set out in the methodologies.

ACM0001 is applicable to the following situations in regards to LFG activities where:

a) The captured gas is flared; or
b) The captured gas is used to produce energy (e.g. electricity/thermal energy), but no emission reductions are claimed for displacing or avoiding energy from other sources; or
c) The captured gas is used to produce energy (e.g. electricity/thermal energy), and emission reductions are claimed for displacing or avoiding energy from other sources.

The project activity corresponds to situation a) and c) above and is therefore applicable to ACM0001. Since there are no regulatory requirements in the Bangladesh at present, the baseline scenario is the total atmospheric release of LFG. The project activity will extract, collect and utilize LFG and result in additional GHG reductions.

ACM0001 says that in the case of c), the approved consolidated baseline methodology for grid-connected electricity generation from renewable sources can be applied (ACM0002).

ACM0002 is applicable to grid-connected renewable power generation project activities amongst others under the following conditions:

- Applies to grid connected electricity generation from landfill gas capture to the extent that it is combined with the approved “Consolidated baseline methodology for landfill gas project activities” (ACM0002)

The project activity corresponds to the situation described above and is therefore applicable to ACM0002.

Furthermore the project activity is not financially viable without CER revenue. LFG revenues (gas, electricity and/or heat) alone are insufficient to recover project investments and operational costs.

B.2. Description of how the methodology is applied in the context of the project activity:

>>
To apply the methodology to this CDM project activity, the below steps are followed.

Step 1: Application criteria
The project activity extracts landfill gas and combusts it in a flare or (preferred) in gas engines for electricity generation, where the baseline scenario is landfilling where the methane produced in the landfill is totally released into the atmosphere.

The following conditions apply:
- the waste would be landfilled in the baseline and landfill gas would be released into the atmosphere. No other alternatives besides landfilling and the project itself are available. Methane capture from the existing landfill is not financially viable without CER revenue. LFG revenues (gas, electricity and/or heat) alone are insufficient to recover project investments and operational costs. The methane emissions from the landfill would thus be emitted into the atmosphere in the baseline.

As stipulated by ACM0001, the “tool for the demonstration and assessment of additionality” is applied in a conservative and transparent manner to show that CDM assistance is required for the project activity to be successfully implemented. Following the preliminary screening process, a convincing justification is provided to demonstrate that there is no plausible baseline scenario except the project activity and the continuation of key present policies and practices. An investment analysis is then presented to demonstrate that the project activity is additional. Next, a common practice analysis will be conducted to double-check the credibility of the investment/barrier analysis. Lastly, an explanation is offered as to how the impact of CDM registration will enable the Project to be successfully implemented.

The following steps from the “tool for the demonstration and assessment of additionality” will be completed below in section B.3.

Step 0 – Preliminary screening based on the starting date of the project activity
Step 1 – Identification of alternatives to the project activity consistent with current laws and regulations
Step 2 – Investment Analysis
Step 4 – Common Practice Analysis
Step 5 – Impact of CDM Registration

B.3. 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 project activity:

>>
The determination of project scenario additionality is done using the CDM consolidated tool for demonstration of additionality, which follows the following steps:

Step 0. Preliminary screening based on the starting date of the project activity

The project is only expected to start operation after registration with the UNFCCC. In any case, as it will be demonstrated in the following steps, CDM revenue has been considered from the early stages of development of the project, and it is an integral part of the financial package of the project.

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

Sub-step 1a. Define alternatives to the project activity:

Table B.1 give a scenario analysis.

Table B.1: Scenario analysis

Scenarios without the Project	Is it probable?
Landfill gas recovery does not take place	*Most probable:* currently the technical, organisational, legal, economic and financial conditions for landfill gas recovery are not available in Bangladesh (see Section 4.1, Key factor 1).
A modified amount of LFG is extracted	*Not probable:* This option is economically unattractive given the high necessary investment costs for recovery of any landfill gas.
Air or O_2 injection in the landfill (= alternative technology)	*Not probable:* Given the absence of enabling conditions for landfill gas, this option is even less attractive. It is more expensive than landfill gas recovery and does not produce landfill gas and thus revenues from electricity generation.
Composition of disposed waste will significantly change or recycling will strongly increase	*Not probable:* Without carbon credits reduction in waste amount or change in composition is unlikely.
Different use of landfill gas on site	*Not probable:* alternative use could be, for example, upgrading to natural gas quality to be used on site. This process is extremely expensive for the landfill gas volumes produced at the landfills (not economically feasible).
Different use of landfill gas off site	*Not probable:* alternative use would be, for example, upgrading to natural gas quality and feed it into the national gas grid. This process is extremely expensive for the landfill gas volumes at the landfills (not economically feasible)
No electricity generation will occur (for example, because supply to the grid is not possible)	*Most probable:* without the recovery of landfill gas, electricity generation is not possible at all.
The project is deferred with seven years (delay)	*Not probable:* Lack of enabling conditions makes it not likely that LFG recovery will take place before 2012 without carbon revenues.

As the above analysis shows, there are no reasonable alternatives unless CERs could be generated in some of the alternatives. Hence the only likely alternative is continuation of the current practice.

Sub-step 1b. Enforcement of applicable laws and regulations:
As mentioned in paragraph A.4.4. there is no legislation enforcing landfill gas extraction with or without utilization or what-so-ever. Hence, all the alternatives comply with the laws and regulatory requirements for the project location. It is unlikely that regulations will change in a way that would render any of the scenarios non-compliant. However, as stipulated in the Monitoring Plan, laws and regulations in regards to LFG extraction/combustion will be monitored yearly and if there are changes that affect LFG treatment an adjustment factor will be incorporated to represent the portion of LFG that must be collected to be in compliances8.

Step 2. Investment Analysis

Sub-step 2a: Determine appropriate analysis method
According to the methodology for determination of additionality, if the alternative to the CDM project activity does not include investments of comparable scale to the project, then Option III (of the methodology tool) must be used. As this is the case for the project, Option III is applied here.

Sub-step 2b: Option III - Application of benchmark analysis
The likelihood of development of this project, as opposed to the continuation of its baseline will be determined by comparing its NPV with the benchmark of interest rates available to a local investor, i.e., those provided by local banks in the Host Country, which averages 12% (source: economic trends on www.bangladesh-bank.org)

Sub-step 2c: Calculation and comparison of financial indicators
The Table below shows the financial analysis for the project activity. As shown, the project NPV (without carbon) is very negative, i.e. the project is unattractive compared to the interest rates provided by local banks in the Host Country.

Table B.2: Financial results of the project (Alternative 1) without carbon finance. NPV uses 14.0% discount rate.

	without C
Net Present Value (US$)	-5,021,486
Discount rate	14.0%

Summary of results of project analysis. Details made available to validators.

Assumptions:

- Discount rate: related to historical commercial lending fees (source: economic trends on www.bangladesh-bank.org), assumed to be approx 12%. In addition a technology risk factor of 2% is taken into account, since Landfill gas extraction projects have not been executed in the Host country, hence the associated technology used is new to the country and to local operators. These two factors add up to a 14% discount rate.
- Inflation: based on historical data (Source: World Economic Outlook (WEO) -- September 2004 -- Statistical Appendix) an average inflation rate of 5% has been assumed. For foreign currency an average inflation rate of 2% has been assumed.
- Currency devaluation rate: Local currency to hard currency devaluation has been assumed to be 4.5% (source: International Monetary Fund – country report No. 04/27 February 2004).
- Project duration: 15 years.
- Revenue streams: Taken into account are the expected revenues: sale of electricity generated through combustion of methane.
- Investments: Taken into account are the expected investments required to manage the landfill and extract the Landfill gas.
- Costs: Taken into account are the associated operational expenses (mainly labour, energy costs/ fuel for on-site vehicles, etc.).

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted by altering the following parameters:

- Increase in project revenue;
- Reduction in project investments and running costs (Operational and Maintenance costs).

These parameters were selected as being the most likely to fluctuate over time. Financial analyses were performed altering each of these parameters by 10%, and assessing what the impact on the project NPV would be (see Table below). As it can be seen, the project NPV remains lower than its alternative even in the case where these parameters change in favour of the project.

Table B.3: Sensitivity analysis on revenue and costs.

Scenario	**NPV (€) (optional)**
Original	-5,021,486
Increase in project revenue	-4,718,403
Reduction in project costs	-3,896,292

Note: NPV uses 14% discount rate.

Step 3. Barrier Analysis

Hereafter the relevant key factors are discussed. Each of the factors described below indicates how it influences the baseline development for the Bangladesh landfill gas project and the GHG emissions at project activity level.

Legal framework

The most relevant parts of the legal framework for disposal of waste in Bangladesh are:

- Law on Reduction of the harmful impact of waste upon the environment. In this law, there are no requirements for landfill gas recovery nor for reduction of organic content in waste.
- Environmental Conservation Act 1995 (ECA '95) and the Environmental Conservation Rules 1997 (ECR '97) of the Government of Bangladesh. The ECA '95 and ECR '97 give definitions, instructions how to handle wastes, emission limits and guidelines regarding the (screening for the need of a detailed) Environment Impact Assessment.

In none of these documents landfill gas extraction or methane reduction techniques from landfills are mentioned.

Envisaged implementation framework

The implementation of the legal framework is determined by three factors: (1) availability of securing necessary financial resources, (2) the adoption and implementation legislation and (3) the resolving of existing market barriers for landfill gas extraction projects in Bangladesh.

(1) Availability of securing necessary financial resources.
The Bangladesh waste sector is fully municipality driven. There are no private entrepreneurs involved. Although the need for privatisation is recognised, it is not likely that this process will take place soon. Municipalities do not have sufficient knowledge and financial resources to provide the necessary investments into separate collection and subsequent processing and marketing. The main reasons for this are waste taxes that are still too low and do not generate sufficient income to the municipalities. (Besides, the Bangladesh Government will need additional financial resources for the set up of proper waste management systems and a/o remediation and/or closure of existing and partly illegal landfills).

It can therefore be concluded, that international organisation and/or private financial resources will probably play a dominant role in the implementation of landfill gas collection and utilisation during the next 15 years. Furthermore, international organisation and/or private sector investments will strongly contribute to the improvement of waste management in general and to the implementation of the legal framework in particular.

(2) Legislation
Although there is a general policy to simulate re-use of wastes in Bangladesh there is no legislation enforcing landfill gas extraction with or without utilization or what-so-ever.

(3) Market barriers.
Since this is the first landfill gas recovery project in Bangladesh, it faces a number of market barriers. Economic unattractiveness, lack of technical know-how and lack of availability of equipment are the most important. The implementation of this project will assist Bangladesh in demonstrating the practice of landfill gas recovery that could assist Bangladesh in meeting the objectives regarding electricity production and energy from renewable sources. Important elements are:

- Demonstrating the practice of landfill gas recovery in Bangladesh;
- Demonstrating how trading emission reductions via the Kyoto mechanisms could assist in making the practice of landfill gas recovery economically viable and promote sustainable development;
- Transferring the necessary technology and know-how to Bangladesh, including:
  - Making available the required equipment (at this moment there are no providers of landfill gas recovery equipment in Bangladesh);
  - Development of local know-how by means of the involvement of Bangladesh partners during the project implementation;
  - Providing feedback to the Government of Bangladesh through close co-operation with relevant departments.

Step 4. Common Practice Analysis

Sub-step 4a. Analyse other activities similar to the proposed activity

To date there has not been any implementation of LFG projects in the Host Country, neither there is any LFG project in development. The technical expertise and equipment is lacking in the Host Country.

Sub-step 4b Discuss any similar options that are occurring

There are no similar options occurring.

Step 5. Impact of CDM registration

As shown in Step 2 above, the project is unlikely to move forward without the additional financial support of the CDM. If the developer was able to sell emission reduction credits from the project activity at an assumed price of U$ 3.00 till 5.00 dollars per tonne of CO_2e, the additional revenue generated by carbon sales would be over U$ 5,000,000 (in case of 5.00 dollars per tonne of CO_2e). This demonstrates that CDM provides a considerable contribution to the profitability of the project and thus enable the project activity to be undertaken.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:

>>
The project boundary is the Matuail landfill site where waste is landfilled and treated. The project generates and uses electricity. The net electricity delivery to the grid is accounted for CO_2 reduction in accordance with ACM0002.

The flow chart in figure B-1 (next page) shows the main components and connections including system boundaries of the project. The flowchart excludes processes beyond control or influence of the project, but includes the relevant beyond control processes to generate secondary energy carriers.

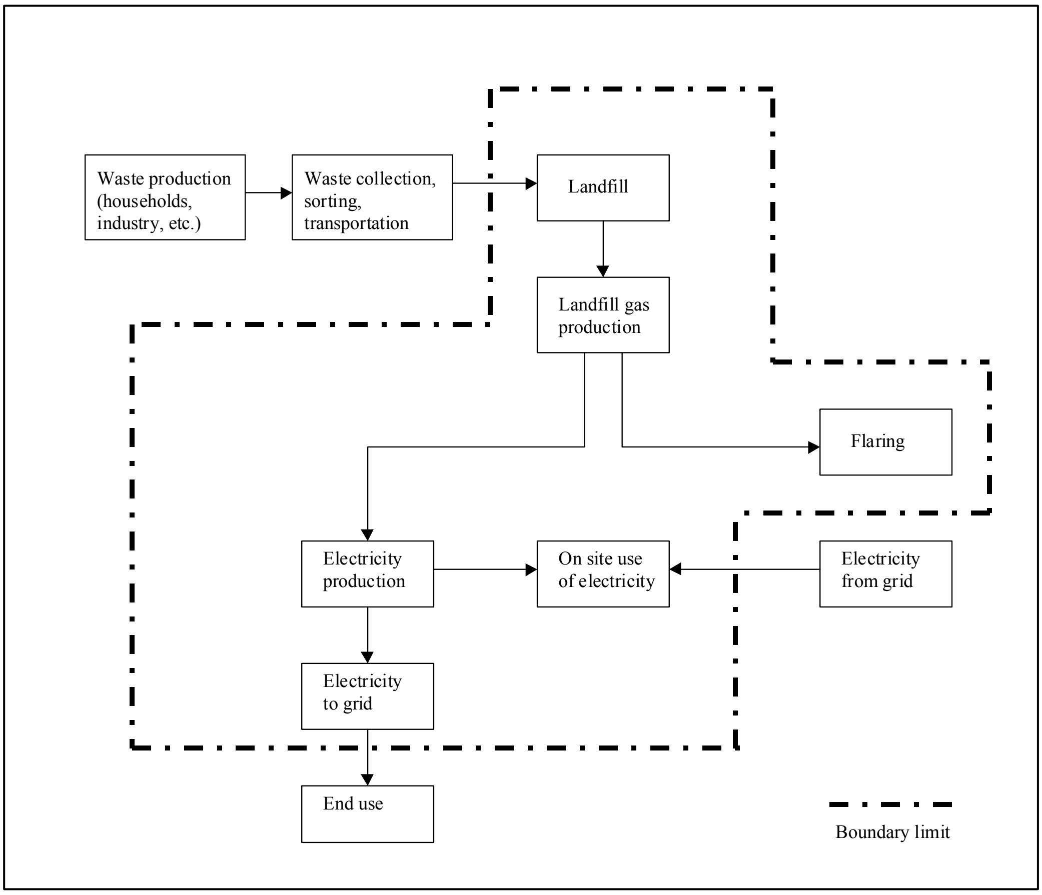

Figure B.1: System boundaries with landfill gas collection, flaring and electricity generation.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

>>

The baseline study was concluded on February 15, 2005 by Royal Haskoning, who is not a project participant. Royal Haskoning is consultant to the project participants.

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SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The time line of the project is as follows:

- Start operating of project-activity : August 1st 2006

C.1.2. Expected operational lifetime of the project activity:

>>
The LFG facility will continue to operate up to at least 2020.

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

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>
01/08/2006.

C.2.1.2. Length of the first crediting period:

>>
7 years.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
Fixed crediting period is not applicable, see paragraph C.2.1.1. for renewable crediting period

C.2.2.2. Length:

>>
Fixed crediting period is not applicable, see paragraph C.2.1.2. for renewable crediting period

SECTION D. Application of a monitoring methodology and plan

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

>>
Reference: ACM0001: "Consolidated monitoring methodology for landfill gas project activities".

and

reference: ACM0002: "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources".

Project activity: 13 - Waste handling and disposal.

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

>>

1) For landfill gas methane capture projects such as this one it is most appropriate to accurately measure the methane combusted in flares and gas engines, i.e. the emission reduction attributable to the project.

   Thus the methodology utilises direct monitoring of the emission reduction from the project activity. The emission reduction due to the project activity are monitored and calculated as differentials taking into account methane combustion in gas engines and methane combustion in a flare.

2) The emissions reduction from prevented electricity generation elsewhere in the grid is based on monitoring the net electricity delivery to the grid due to the project activity and calculated *ex-post* (average) Operating Margin (OM), Build Margin (BM) and baseline emission factors of the electricity park in Bangladesh, in accordance with ACM0002.

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

>>

Option 1 is not applicable for methodology ACM0001, hence table D.2.1.1. + D.2.1.2 + D.2.1.3 + D.2.1.4 are not filled in for ACM 0001
Option 1 is (partly) applicable for methodology ACM0002

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:
Not applicable for ACM0001 and not applicable for ACM0002

ID number *(Please use numbers to ease cross-referencing to D.3)*	Data variable	Source of data	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)	Comment

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)
Not applicable for ACM0001, only applicable for ACM0002

>>

The project activity generates electricity that will, after discounting own consumption, be delivered to the grid, thus mainly replacing fossil fuel consumption for electricity production in the grid.

The methodology ACM0002 "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources" is applied. It requires monitoring of the following:

- Electricity generation from the proposed project activity;
- Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with ACM0002;
- Data needed to recalculate the build margin emission factor, if needed, consistent with ACM0002.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

Not applicable for ACM0001, only applicable for ACM0002

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. EG_y	Electricity quantity	Electricity supplied to the grid by the project	MWh	Directly measured	Hourly measurement and monthly recording	100%	electronic	Electricity supplied by the project activity to the grid. Double check by receipt of sales.
2. EF_y	Emission factor	CO_2 emission factor of the grid	tCO_2/MWh	C	Yearly	100%	electronic	Calculated as a weighted sum of the OM and BM emission factors
3. $EF_{OM, y}$	Emission factor	CO_2 Operating Margin emission factor of the grid	tCO_2/MWh	C	yearly	100%	electronic	Calculated as indicated in the relevant OM baseline method above
4. $EF_{BM,y}$	Emission factor	CO_2 Build Margin emission factor of the grid	tCO_2/MWh	C	Yearly	100%	Electronic	Calculated as $[\sum_I F_{I,y}*COEF_i] / [\sum m\ GEN_{m,y}]$ over recently built power plants defined in the baseline methodology
5. $F_{i,y}$	Fuel quantity	Amount of each fossil fuel consumed by each power source/plant	Mass or volume	M	Yearly	100%	Electronic	Obtained from the power producers, dispatch centers of latest local statistics
6. $COEF_i$	Emission factor coefficient	CO_2 emission coefficient of each fuel type i	tCO_2/mass or volume unit	M	Yearly	100%	Electronic	Plant or country specific values to calculate COEF are preferred to IPPC default values.

7. $GEN_{j/k/n, y}$	Electricity quantity	Electricity generation of each power source/ plant j, k or n	MWh/y	M	Yearly	100%	Electronic	Obtained from the power producers, dispatch centers or latest local statistics.
8.	Plant name	Identification of power source/ plant for the OM	Text	E	Yearly	100% of set of plants	Electronic	Identification of plants (j, k, or n) to calculate Operating Margin emission factors
9.	Plant name	Identification of power source/plant for the BM	Text	E	Yearly	100% of set of plants	Electronic	Identification of plants (m) to calculate Build Margin emission factors
10. $GEN_{j/k/II, y}$ *IMPORTS*	Electricity quantity	Electricity imports to the project electricity system	kWh	C	Yearly	100%	Electronic	Obtained from the latest local statistics. If local statistics are not available, IEA statistics are used to determine imports.
10b. $COEF_{i,j\ y}$ *IMPORTS*	Emission factor coefficient	CO_2 emission coefficient of fuels used in connected electricity systems (if imports occur)	tCO_2/mass or volume unit	C	Yearly	100%	Electronic	Obtained from the latest local statistics. If local statistics are not available, IPCC default values are used to calculate.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

Not applicable.

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

The following figure shows the different monitoring variables. The explanation follows in the table below:

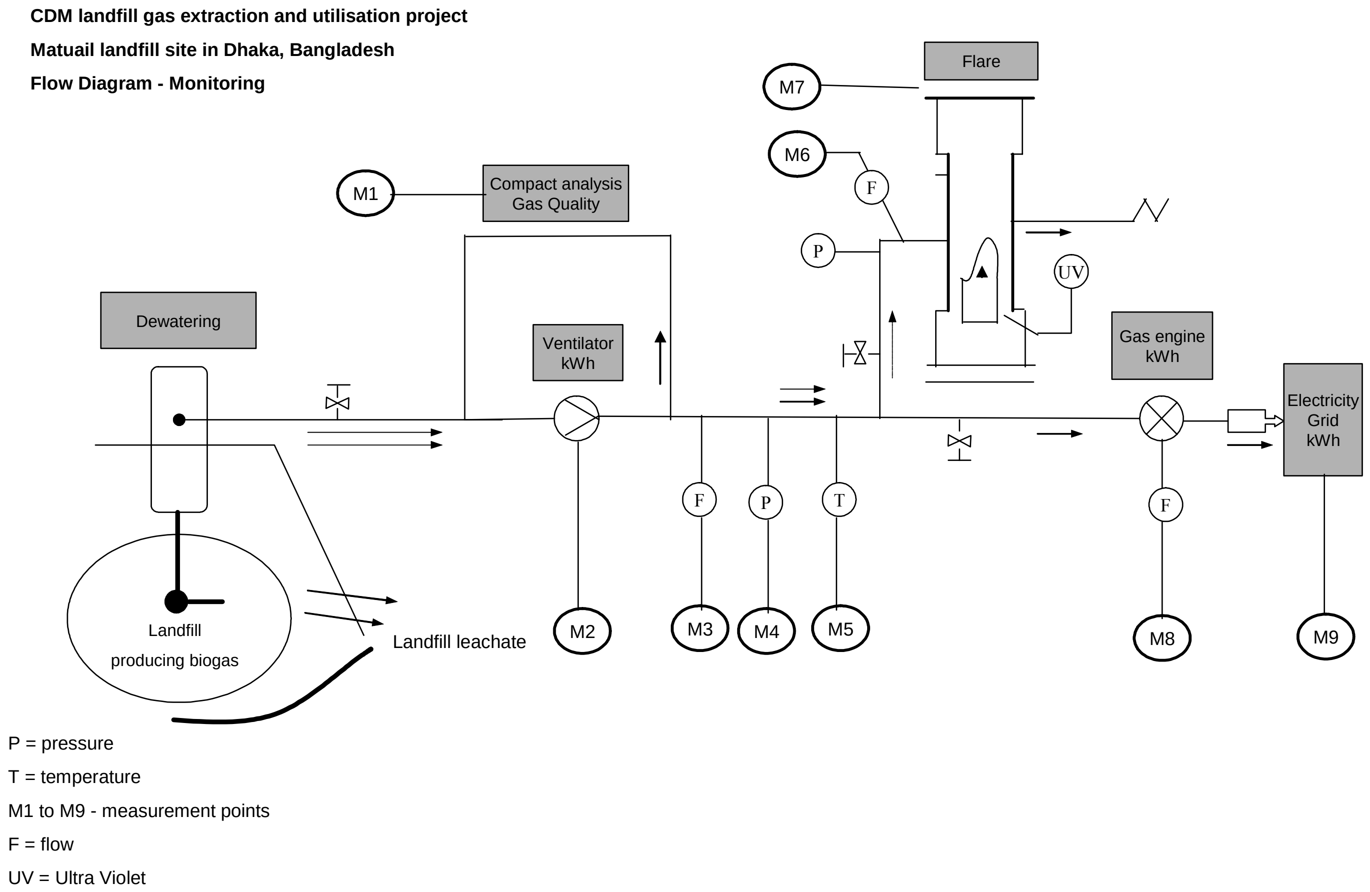


Figure D-1: Monitoring variables

D.2.2.1. 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 D.3)*	Data variable	Source of data	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)	Comment
1. $LFG_{total,y}$	Total amount of landfill gas captured	Volume	M^3	m	continuous	100%	electronic	Data will be aggregated monthly and yearly through measurement device M3 (see above)
2. $LFG_{flare,y}$	Amount of landfill gas flared	Volume	M^3	m	continuous	100%	electronic	Data will be aggregated monthly and yearly through measurement device M6 (see above)
3. $LFG_{electricity,y}$	Amount of landfill gas combusted in power plant	Volume	M^3	m	continuous	100%	electronic	Data will be aggregated monthly and yearly through measurement device M8 (see above)
4. LFG-$_{thermal,y}$	Not applicable							Not applicable (see paragraph E.4)
5. FE	Flare/combusting efficiency, determined by the operating hours (1) and the methane content in the exhaust gas (2)	Percentage	%	m	Discontinue, 4 times/year	100%	Paper	(1) Periodic measurement of methane content of flare exhaust gas and (2) Continuous measurement of operation time of flare (e.g. with temperature)
6. $W_{CH4,y}$	Methane fraction in the landfill gas	m^3 CH_4/ m^3 LFG	%	m	periodically	100%	electronic	Data will be measured monthly by gas quality analyser through measurement device M1 (see above)
7. T	Temperature of the landfill gas	temperature	^oC	m	periodically	100%	electronic	Data will be measured monthly through measurement device M5 with the purpose to determine the density of methane D_{CH4}
8. p	Pressure of landfill gas	Pressure	Bar	m	continuous	100%	electronic	Data will be measured monthly through measurement device M4 with the purpose to

								determine the density of methane D_{CH4}
9.	Total amount of electricity and/or other energy carriers used in the project for gas pumping (not derived from the gas)	electricity	MWh	m	continuous	100%	electronic	Data will be aggregated monthly and yearly through measurement device M2 Data will be used to determine CO_2 emissions from use of electricity or other energy carriers to operate the project activity.
10	CO_2 emission intensity o fthe electriity and /or other energy carriere in ID 9.							CO2-emission intensity is already covered by the table D.2.1.3, which makes this item not applicable in this table
11	Regulatory requirements relating to landfill gas projects		Test	n.a.	annually	100%	Electronic	Required for any changes to the adjustment factor (AF) or directly $MD_{reg,y.}$.

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

See sections E.1 and E.2, no project emissions are foreseen.

D.2.3. Treatment of leakage in the monitoring plan

Under ACM0001 no leakage effects need to be accounted for under this methodology.

D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	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)	Comment

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

No leakages are associated with the project activity, in line with ACM0001.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

See section E.4

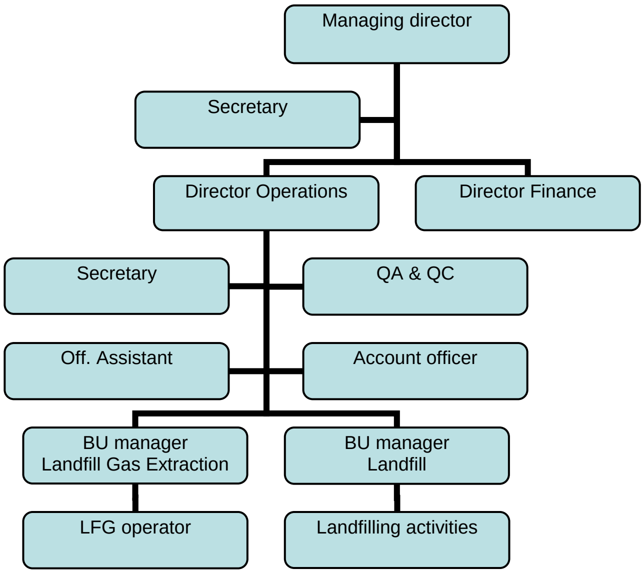
D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
D.2.2.1-1 $LFG_{total,y}$	Low	Flow meter (nr M3 indicated in figure D-1) will be subject to regular maintenance and testing to ensure accuracy.
D.2.2.1-2 $LFG_{flare,y}$	Low	Certified institute will do the analysing (instrument M6 indicated in figure D-1)
D.2.2.1-3 $LFG_{electricity,y}$	Low	Flow meter (nr M8 indicated in figure D-1) will be subject to regular maintenance and testing to ensure accuracy.
D.2.2.1-5 FE	Low	Meter (nr M7 indicated in figure D-1) will be subject to regular maintenance and testing to ensure accuracy.
D.2.2.1-6 $W_{CH4,y}$	Low	Landfill gas analyzers (instrument M6 indicated in figure D-1) will be subject to regular maintenance and testing to ensure accuracy.
D.2.2.1-7 T	Low	Meter (nr. M5 indicated in figure D-1) will be subject to regular maintenance and testing to ensure accuracy.
D.2.2.1-8 p	Low	Meter (nr. M4 indicated in figure D-1) will be subject to regular maintenance and testing to ensure accuracy.
D.2.2.1-9	Low	kWh meter (instrument nr. M2 indicated in figure D-1) will be subject to regular maintenance and testing to ensure accuracy. Their reading will be double checked by the electricity distribution company
D.2.2.1-11	Low	Public data source, national developments regarding landfill-guidelines will be used
D.2.1.3 - 1 to 8	Low	Public data source (Bangladesh Power Development Board (BPDB)) will be used.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

>>

The Project Proponents will erect a Special Purpose Company (SPC) for the project and will be shareholders of the company and will seat in the board of directors.

The SPC structure will be as follow:



The Business Unit Manager Landfill Gas Extraction is responsible for the activities related to implementation of the procedures as described in the monitoring plan (see annex 4). The QA & QC officer will report directly to the Director Operations. He will carry out the internal audits and the quality control and quality assures procedures as described in the monitoring plan.

D.5 Name of person/entity determining the monitoring methodology:

>>

Mr. H. Oosterdijk
Haskoning Nederland B.V. (Royal Haskoning)
P.O. Box 151
6500 AD Nijmegen
The Netherlands
Telephone: +31 24 32 84 671
Fax: +31 2432 36 146
email: h.oosterdijk@royalhaskoning.com
www.royalhaskoning.com

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>
The only emissions from the project is the combustion of landfill gas in which the methane is fully combusted into CO_2.

According the IPCC Good Practice Guidance[1] the CO_2 emissions from landfill gas combustion are of biogenic origin and are therefore are not considered as a GHG gas.

The project activity does not use any vehicles on-site. The dozers used on the landfill site are not attributable to the project activity.

Therefore the project activity emission is = 0.

E.2. Estimated leakage:

>>
No leakage effects need to be accounted under this methodology (ACM0001).

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

Sum of E1 (0) and E2 (0) is 0 tonnes of CO_2 per year.

Table E.1: Resulting project emissions and leakages in first crediting period

Year	E.3 CERs related to consumed electricity and fuel (on and off-site) Tonnes
2006	0
2007	0
2008	0
2009	0
2010	0
2011	0
2012	0
Total 2006-2012	**0**

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

Following the instructions outlined in the Baseline Methodology (ACM0001), *ex ante* emission reductions estimates for methane extraction/destruction are projected for reference purposes only. The project activity, once commissioned, will determine emission reductions on an *ex post* basis by measuring project data as

[1] IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, footnote 4 on page 95)

stipulated in the monitoring plan. This data will be used to calculate emission reductions for the project activity..

A. Calculation of GHG emission reduction associated with methane combustion

The landfill gas extraction and combustion is directly monitored and used to calculate the CER's. For predicting the amount of CER's the Approved Consolidated Methodology ACM0001 has been used. A description of the used model follows hereafter.

The greenhouse gas emission reduction achieved by the project activity during a given year "y" (ER_y) is calculated by using the formulas as given in method ACM0001:

$$ER_y = (MD_{project,y} – MD_{reg,y})*GWP_{CH4} + EG_y*CEF_{electricity,y} + ET_y*CEF_{thermal,y}$$

Where:

ER_y = Emission reduction in tonnes of CO_2 equivalent during year y
$MD_{project,yy}$ = the methane destroyed by the project activity in tonnes CH_4 in year y
$MD_{reg,y}$ = the methane that would be destroyed in the baseline in tonnes CH_4 in year y ; for this project = 0 (see "determination of $MD_{reg,y}$")
GWP_{CH4} = The approved Global Warming Potential of methane (21 tCO_2/tCH_4)
EG_y = The net quantity of electrical energy displaced during the year
$CEF_{electriicty,y}$ = CO_2 emissions intensity of the electrical energy displaced in the grid
ET_y = quantity of thermal energy displaced during the year, which for this project = 0
$CEF_{thermal,y}$ = CO_2 emissions intensity of the thermal energy displaced, which for this project is irrelevant since $ET_y = 0$

Determination of $MD_{reg,y}$
$MD_{reg,y} = MD_{project,y} * AF$

Where:
AF = Adjustment Factor

In cases where regulatory or contractual requirements do not specify $MD_{reg,y}$ an adjustment Factor (AF) shall be used and justified, taking into account the project context where "reg" stands for "regulatory and contractual requirements". Considering the actual situation on top of the regulatory and contractual requirements, one can observe the following:
1: In the Matuail landfill situation currently no measures are in place to capture or destroy methane produced.
2: In Bangladesh no policies or regulations or contractual requirements what so ever are in place that oblige landfill operators to capture or destroy methane (REF)

Hence the AF factor will be 0% for the first crediting period. In accordance with the Monitoring Methodology the $MD_{reg,y}$ and therefore the AF will be evaluated at the beginning of each crediting period.

Determination of $MD_{project,y}$
In accordance with ACM001, $MD_{project,y}$ will be determined ex post by metering the actual quantity of methane captured and destroyed once the project activity is operational.

The methane destroyed by the project activity ($MD_{project,y}$) during a year is determined by monitoring the quantity of methane actually flared and gas used to generate electricity. Within this project there are no intentions to produce thermal energy. The applicable ACM0001-formula therefore will be:

$MD_{project,y} = MD_{flare,y} + MD_{electricity,y} + 0$

$MD_{flared,y} = LFG_{flare,y} * W_{CH4,y} * D_{CH4} * FE$

Where:

$MD_{flared,y}$	=	quantity of methane destroyed by flaring
$LFG_{flare,y}$	=	quantity of landfill gas flared during the year measured in normal cubic meters
$W_{CH4,y}$	=	average methane fraction of the landfill gas as measured during the year
D_{CH4}	=	density of methane = $7,168*10^{-4}$ tonne/Nm^3
FE	=	Flare Efficiency (the fraction of methane destroyed) (by default: 100%)

$MD_{electricity,y} = LFG_{electricity,y} * W_{CH4,y} * D_{CH4}$

Where:

$MD_{electricity,y}$	=	quantity of methane destroyed by generation of electricity
$LFG_{electricity,y}$	=	the quantity of landfillgas fed into electricity generator
$W_{CH4,y}$	=	The average methane fraction of the landfill gas is measured during the year and expressed as a fraction (m^3/m^3)

Determination ex ante of emissions reductions

In accordance with ACM0001, project proponents provides an ex ante estimate of emissions reductions, by projecting the future GHG emissions of the landfill. To calculate ex ante the GHG-emissions of the landfill a model is used (LFG_{model}).

The methodology used for calculation of the captured and destroyed landfill gas is based on multi-phase modelling. In the multi-phase First Order Decay Model, a number of fractions are distinguished, for which landfill gas generation is described separately (see table E.5). There are distinguished three phases: slow, moderate and fast degradable materials, but other subdivisions are possible, including the introduction of an inert fraction. The advantage of the multi-phase model is that the typical waste composition will be taken into account, since all types of waste contain typical fractions of slow, moderate and fast degradables.

In general, landfill gas formation models are not based on microbiological or biochemical principles, but mainly on a practical description of formation, as observed in laboratory experiments or in full-scale recovery projects.

The amount of landfill gas ($LFG_{model:}$) that is generated is estimated with the following LFG generation model (multi-phase model):

$$LFG_{model} = \zeta \sum_{j=1}^{3} 1.87 * A_i * DOC_i * k_{1,i} * e^{-k_{1,i}t}$$

and

$LFG_{model} * EE_{LFG} = LFG_{flare} + LFG_{electricity}$

Description of the parameters in this model are given in table E.2

Table E.2: Parameters applied in ex ante calculation for emission reduction (see annex 3 how these are obtained):

Parameter	**Descripition**
LFG_{model}	Formation of landfill gas in m3/yr, 8760 hours/year
1.87	a maximum amount of 1.87 m^3 biogas is produced out of one kilogram degraded organic carbon
ζ	formation factor = $MCF * DOC_f$.
DOC	amount of (dry) organic carbon for each specific waste stream (kg/ton).
DOC_f	fraction *DOC* dissimilated to landfill gas. See sub section E.1 from New Baseline Methodology
MCF	Methane Correction Factor (fraction) see table E.1 from New Baseline Methodology
A	amount of waste (ton/year).
K	degradation velocity of each specific waste stream.
T	time elapsed since (prevented) depositing in years.
I	Category of waste
EE_{LFG}	Extraction efficiency = fraction of the generated landfill gas that is exctracted and thus available for combusting or electricity production

The methane generated in the landfill, extracted and used for energy-production is calculated using the following formula:

$$ME = LFG_{model} * W_{CH4,y} * D_{CH4} * EE_{LFG}$$

ME : Methane (CH_4) extracted (tones/yr) and to be combusted and/or used for electricity generation

$LFG_{model,y}$: is the amount of Landfillgas/y as calculated by the multiphase model in Nm^3 LFG/y (see below)

$W_{CH4,y}$: average methane fraction of the LFG (in m^3 CH_4/m^3 LFG);

D_{CH4} : density (tonne/Nm^3) of methane (CH_4)

EE_{LFG} : extraction-efficiency = fraction of the generated amount of landfillgas that is to be extracted

The amounts and composition of the wastes that were and are expected to be landfilled at Matuail, are given in annex 3. Annex 3 also gives the set-points of the parameters used in the model. In doing so, the method is verifiable, in accordance with ACM0001.

The application of the formulas described above in combination with the data given in annex 3 result in emission reductions given in the table below.

Table E.4: Emission reductions in first crediting period

	CER's from LFG recovery (and subsequent full combustion) from Matuail landfill

Year	Tonnes
2006	103,503
2007	206,973
2008	200,628
2009	186,000
2010	175,693
2011	168,522
2012	163,624
Total 2006 – 2012	**1,204,943**

B. Calculation of GHG emission reduction associated with renewable electricity delivery to the grid

PE_{elec} Project emissions of electricity production in the grid

The Approved Consolidated Methodology ACM0002: ”Consolidated methodology for grid-connected electricity generation from renewable sources”, which was approved on 3 September 2004, is applied for determination of the emission factor (EF) of the grid.

Step 1 of ACM0002 is calculation of the Operating Margin emission factor ($EF_{OM,y}$), based on one of the four following methods:

a. Simple OM, or
b. Simple adjusted OM, or
c. Dispatch data Analyses OM, or
d. Average OM.

The Bangladesh Power Development Board (BPDB) publishes annually about the electricity production in the grid. Relevant copies of the year 2003 (FY (2003-2004) are attached in annex 3.

Due to the fact that reliable information is neither available regarding low-cost/must run resources nor regarding the set of power plants in the top 10% of the grid system dispatch, the methods a, b and c are not usable. Only method d can be applied.

The average OM is calculated as the average emission factor rate of all power plants including low-cost/must run power plants.

The average OM, as the simple OM, can be calculated using either of the two following data vintages:

- a 3-years average, based on the most recent statistics available at the time of PDD submission;
- the year in which project generation occurs, if $EF_{OM,y}$ is updated based on *ex-post*.

Due to non-availability of reliable or complete date of the years 2001 and 2002 the second option is selected to be applicable.

Step 2: Calculate the Build Margin emission factor ($EF_{BM,y}$) as the generation-weighted average emission factor of a sample of power plants. The sample group consists of either:

- the five power plants that have been built most recently, or
- the power plants capacity additions in the electricity system that comprises 20% of the system generation (in MWh) and that have been built most recently.

The sample group that comprises the larger annual generation shall be used.

In line with Step 1, an *ex-post* calculation is proposed.

Step 3: Calculated the baseline emission factor EF_y as the weighted average of the OM emission factor ($EF_{OM,y}$) and the Build Margin factor ($EF_{BM,y}$):

$EF_y = w_{OM}. EF_{OM,y} + w_{BM}. EF_{BM,y}$

where the weights w_{OM} and w_{BM} by default are 50%.

For the most recent year (2003) the steps 1 to 3 have been applied, according ACM0002, in the table in annex 3 (table Annex 3.5).

In accordance with ACM0002 leakages (like related to construction activities) are not considered. This results in a baseline emission factor of the electricity park in Bangladesh for the year 2003 of 0.63271 tCO_2/MWh (see table Annex 3.5 in Annex 3, which also contains relevant copies of annual report of BPDB FY 2003-2004).

Hence the electricity delivered to the grid and the emission reduction thus calculated is given in the table below.

Table E.5: Emission reductions in first crediting period

Year	Net electricity delivered to grid by combusting extracted methane in gas engine/generators	CER's from LFG recovery (and consequent combusted) from Matuail landfill
	MWh	Tonnes
2006	21,065	13,382
2007	23,502	14,870
2008	23,504	14,871
2009	23,510	14,875
2010	23,513	14,877
2011	23,516	14,879
2012	23,518	14,880
Total 2006 – 2012	**162,127**	**102,580**

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

Table E.6: Resulting emission reductions in first crediting period

Year	CER's from LFG recovery (and consequent combusted) from Matuail landfill	CER's (net) related to prevented electricity generation in the grid (elsewhere)	Net total amount of CERs
	Tonnes	Tonnes	Tonnes
2006	103,503	13,382	116,831
2007	206,973	14,870	221,843
2008	200,628	14,871	215,499
2009	186,000	14,875	200,874
2010	175,693	14,877	190,571
2011	168,522	14,879	183,401
2012	163,624	14,880	178,501
Total 2006-2012	**1,204,943**	**102,580**	**1,307,522**

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

The tables in the appendix 2, summarised in table E-9, presents the calculation of the emission reduction

(CERs) that will be realised by the landfill-gas extraction project during the sequential crediting periods up to 2026.

Table E.7: Calculated CERs

Year	CER's from LFG recovery (and consequent combusted) from Matuail landfill	CER's (net) related to prevented electricity generation in the grid (elsewhere)	Net total amount of CERs
	Tonnes	**Tonnes**	**Tonnes**
2006	103,503	13,382	116,831
2007	206,973	14,870	221,843
2008	200,628	14,871	215,499
2009	186,000	14,875	200,874
2010	175,693	14,877	190,571
2011	168,522	14,879	183,401
2012	163,624	14,880	178,504
Total 2006-2012	**1,204,943**	**102,580**	**1,307,522**
2013	135,454	14,887	150,341
2014	113,811	14,655	128,466
2015	96,844	9,923	106,767
2016	83,411	9,926	93,338
2017	72,666	9,357	82,023
2018	63,977	8,238	72,215
2019	56,873	7,323	64,197
Total 2013 -2019	**623,037**	**74,310**	**697,347**
2020	51,001	6,567	57,568
2021	46,092	5,935	52,027
2022	41,944	-10	41,934
2023	38,402	-9	38,392
2024	35,346	-8	35,337
2025	32,684	-8	32,677
2026	30,346	-7	30,339
Total 2020 -2026	**275,815**	**12,460**	**288,275**
GRAND TOTAL CERS OVER 2006- 2026: 2,293,144			

SECTION F. Environmental impacts

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

The project involves the implementation and operation of a landfill gas extraction system with landfill gas utilisation in gas engines for power production. It does not use any scare resources (like fuel, water); neither it produces any waste or emissions to water and soil. The gas engines do produces local combustion gases. The main environmental negative component can be NOx that is an acidifying gas. The engines however, will comply with US and Western European emission standards; therefore the amount emitted is very limited. It is noted here that elsewhere inefficient and polluting electricity production is prevented. This results overall in a net reduction of combustion gases including NOx.

Extracting the landfill gas has a local environmental impact, mainly reduction of several side effects like odour- and dust emission, fires, etc. All other activities at the landfill site will not change; therefore no negative change in impact will occur.

The compressor(s) and gas engines (3 pcs. of 1.048 MWe each) will be placed in enclosed acoustic housings (sound reducing containers), so no noise pollution will occur.

F.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

Environmental impacts of the project

The project involves the implementation and operation of a landfill gas extraction system with landfill gas utilisation in gas engines for power production. It does not use any scare resources (like fuel, water); neither it produces any waste or emissions to water and soil. The gas engines do produce local combustion gases. the main environmental negative component can be NOx that is an acidifying gas. The engines however, will comply with us and Western European emission standards; therefore the amount emitted is very limited. It is noted here that elsewhere inefficient and polluting electricity production is prevented. This results overall in a net reduction of combustion gases including NOx.

Extracting the landfill gas has a local environmental impact, mainly reduction of several side effects like odour- and dust emission, fires, etc. All other activities at the landfill site will not change; therefore no negative change in impact will occur.

The compressor(s) and gas engines (3 pcs. of 1.048 MWe each) will be placed in enclosed acoustic housings (sound reducing containers), so no noise pollution will occur.

In brief, the project does not have any negative environmental impacts nor in the execution phase nor in the operation phase. The screening and the Initial Environment Examination reveals that no detailed Environmental Impact Assessment is required.

No impacts during the construction phase are expected

Environmental legislation

The legislation in force are the Environmental Conservation Act 1995 (ECA '95) and the Environmental Conservation Rules 1997 (ECR '97) of the Government of Bangladesh.

The Department of the Environment (DOE) of the Ministry of Environment and Forests (MOEF), headed by the Director General, is the Regulatory Body responsible for enforcing the ECA '95 and ECR '97.

There is a three-tier approach to be followed regarding the Environmental Impact Assessment (EIA).

1. *Screening*
   As per ECR '97, a normative screening procedure is to be followed according to which industries/activities/projects have been divided into four categories viz. Green, Orange A, Orange B and Red;
2. *Initial Environment Examination (IEE)*
   All industries/activities and projects in Orange B and Red categories have to conduct an IEE which helps in understanding the potential extent of environment changes and in finding ways to mitigate by considering the available information, or past experience or standard operating practices. The steps for conducting IEE are:
   - collection of baseline information in respect of the project and the environmental setting of the project and its site;
   - setting of boundaries of an IEE by identifying the significant issues;
   - impact assessment, suggestion of mitigation measures, Environment management plan (EMP) or alternative or other project modifications;
   - in the event that the IEE of the project reveals that further investigation is to be carried out then the developer will have to carry out a detailed EIA;
3. *Detailed EIA*
   The detailed EIA should be focused on addressing the issues, which remains unresolved in the IEE. The steps involved in conducting an EIA are as follows:
   a. Baseline studies – this is usually divided into two sections:
      1: studies related to the project (site selection, mass and energy balances, product storage and transport, list of machinery and equipment emission and ways of treatment etc.);
      2: impact identification (list of key sources on environment, detailed impacts, etc);
   b. Evaluation to determine whether mitigation of pollution or the proposed project will be required;
   c. Mitigating measures (changing of site, process, operation, disposal routes etc).

Screening

The screening of the landfill gas extraction and utilisation project reveals that this type of project is not mentioned in one of the lists. Mentioned are however, in the Red list, "gas distribution" and "power generation" two elements of the project. No specification is given about the size or whatsoever.

Initial Environment Examination (IEE)

In the baseline study the project boundaries, the environmental setting of the project and its site are given.

The environmental impact is analysed above. Apart from some local emission of NOx, that is more than compensated elsewhere, the impacts are all positive.

As mentioned, extracting the landfill gas has a local environmental impact, mainly reduction of several side effects like odour- and dust emission, fires, etc. All other activities at the landfill site will not change; therefore no negative change in impact will occur.

From the screening and the IEE it can be concluded that the proposed landfill gas extraction project with relatively small amount of power generation does not require a detailed EIA.

Stakeholder consultations have not resulted in any negative comment.

Environmental impact assessment

As mentioned before, for landfill gas extraction and utilisation in small-scale gas engines for power production, there is no requirement of a detailed EIA report. This is confirmed by the letter by the Ministry of Environment shown in figure on the next page.

02/10/2005 17:20 880-2-9884774 WASTE CONCERN PAGE 01

ATTN. JAN. EENHOORN

Government of the People's Republic of Bangladesh
Department of Environment
Paribesh Bhaban, E/16 Agargaon,
Sher-e-Bangla Nagar, Dhaka 1207.
Website:www.doe-bd.org

Ref.: Paribesh/Tech. (Int. Con.)/350/2003/298 **Date:** ...09 / 02 /2005.

Sub.: Endorsement of two projects (1) Landfill Gas Extraction and Utilization at Matuail Landfill Site in Dhaka" and (2) Composting of Organic Waste in Dhaka" of World Wide Recycling (WWR) BV of the Netherlands and Waste Concern of Bangladesh by Designated National Authority of Bangladesh.

Ref.: Paribesh/Tech. (Int. Con.)/350/2003/2632 dated.16/09/2004.

In continuation to our memo referred above, this is to further inform you that the IEE Report submitted by you along with Project Design Document (PDD) has been able to meet our requirements to make our evaluation. We don't require detail EIA report at this stage.

(Mohammad Reazuddin)
Director (Technical)
&
Member Secretary
National CDM Committee

Mr. Maarten (J.M.W.) Van Dijk
Managing Director
World Wide Recycling B.V.
Rijksstratweg 102, 7383 AV Voorst,
P.O. Box 90, 7390 AB, Twello,
The Netherlands.

Figure F.1: Letter form the Government of Bangladesh' Department of Environment**.**

The project is scheduled to start construction beginning 2006 and start operation mid 2006. For the operation of the power generation units a licence will be obtained according the procedures and regulations set in the Private Sector Power Generation Policy of Bangladesh from the Ministry of Energy and Mineral

Resources.

References

(1) Environmental Conservation ACT, Government of Bangladesh, 1995
(2) Environmental Conservation Rules, Government of Bangladesh,1997
(3) National Policy for Safe Water & Sanitation. Local Government Division, Ministry of Local Government Rural Development & Co-operatives, Dhaka, 1998
(4) Private Sector Power Generation Policy of Bangladesh, Ministry of Energy and Mineral Resources, Dhaka, 2000

SECTION G. Stakeholders' comments

>>

The project is planned at the Matuail landfill site in Dhaka. This is by far the largest landfill (dump) site in Dhaka and is situated some 7 km south from the city centre. In the project area the major stakeholders are:

a. Local population - they comprise of the local people in and around the project area. The role of the local people is as a beneficiary of the project. They will benefit from an improved environmental surrounding. In addition, the local population is also a consumer of electrical power that is supplied from the co-generation units at the end-users site. This is important because this improves the stability of the grid and might result in less power cuts;
b. Dhaka City Corporation (DCC) (a self government institution) - as they are the owner and operator of the landfill site;
c. Dhaka Electricity Supply Authority (DESA), responsible for distribution of electricity in the greater Dhaka area including the metropolitan city of Dhaka - as the buyer of produced electricity. DESA is a main stakeholder in the project. Their willingness to buy against an attractive price will determine the application of gas engines/generator sets for electricity production.

The situation in Bangladesh is in many respects comparable to many other Developing countries. Waste is usually dumped in the street where 'Tokais' (poor people, complete families with children) take out all valuable materials. Collection of waste is locally (municipality) organised, using simple collection systems. Waste from urban areas is transported to a local landfill and dumped without any sanitary measures and little or no control. Dhaka City Corporation is responsible for the waste management in Dhaka City.

It is not expected that landfill gas extraction will be realised at Matuail landfill. The result of this situation is that classic garbage disposal sites will continue to exist resulting in a series of adverse effect to citizens and the environment (waste falling down, incidental fires, smoke, smell burden, uncontrolled gas (methane) release, incidental gas explosions, uncontrolled filtrate, insects/rodents, etc.). Extracting the landfill gas has a local environmental impact, mainly reduction of several side effects like odour- and dust emission, fires, etc.). All other aspects at the landfill site will not be change.
People living around the landfill site will therefore not undergo negative effects of the proposed project.

Since landfill gas extraction projects with relatively small amount of power generation does not require a detailed environment impact assessment (EIA) as have been investigated. Stakeholder consultations have not been completed and documented so far. However, this is proposed to be carried out in parallel with design and engineering of the project.

The entire process of carrying out the local stakeholder consultation has been done in a participatory manner. The project developer used consultative techniques such as the Participatory Rural approach to assess the views and needs of the local stakeholders. The project, during its operation will try to adhere, as far as possible and relevant, to the requirements of the local stakeholders from the project.

The project is scheduled to start operation mid 2006. For the operation of the power generation units a licence will be obtained according the procedures and regulations set in the Private Sector Power Generation Policy of Bangladesh from the Ministry of Energy and Mineral Resources.

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

>>

Through advertisements (see Appendix 1) stakeholders were invited to come to an information meeting at the BRAC Center in Dhaka on February 12, 2005

45 participants from government offices, academics, non-governmental organizations, media groups, local residents, development partners and private sector were present in the meeting.

A Minutes of Meeting (MoM) was prepared in which all questions, remarks etc. were recorded. Appendix 1 contains the Minutes of Meeting.

G.2. Summary of the comments received:

>>

Questions were related to the technology applied, the role of DCC, the CDM procedures etc. No questions were raised on environmental topics.

The stakeholders suggested to form a group or forum who will actively involve to encourage this type investment and for initiation of more this type projects and also to look after on going projects and the progress work in this regard. Overall there was agreement that the proposed project was a beneficial project from sustainability view point.

Pictures G.1 to G.4: Photo's made during the Stakeholder assessment

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

>>

The project proponents will take the suggestion up and will inform the stakeholders regularly on the progress of the projects at Matuail landfill site.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	World Wide recycling BV
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First Name:	Maarten
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Represented by:	
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Salutation:	Mr
Last Name:	Reazuddin
Middle Name:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is required

Annex 3

BASELINE INFORMATION

The Matuail landfill was put into operation in 1994. It is the intension of the project developers to reshape the existing landfill in such a way that landfilling is possible up to 2021. In 2003 a daily amount of 1,760 tonnes of waste was landfilled leading to some 635,500 tonnes of waste to be landfilled in 2003. The growth rate (1994 – 2003) of the amount of waste landfilled was about 4.25% per year. For the future it is assumed that a constant amount of 1,760 tonnes per day is collected and transported to Matuail landfill site. From 2006 onwards it is presumed that a part of the offered waste is recycled somehow (160 t/d in 2006, 360 t/d in 2007 and 560 t/d from 2008 onwards). These amounts are diverted from the daily arrival of 1,760 tonnes (conservative approach).

The amounts and composition of wastes were and are expected to be landfilled taking into account above scenario (baseline scenario), are indicated in table Annex 3.2.

The degradation-velocity (k) and the amount of degradable organic carbon (DOC) are indicated per waste-category in table Annex 3.3.

It is calculated that by the end of 2011 the landfill will be closed (conservative approach).

$$LFG_{model} = \zeta \sum_{j=1}^{3} 1.87 * A_i * DOC_i * k_{1,i} * e^{-k_{1,i}t}$$

Description of the parameters in this model:

LFG_{model} : formation of landfill gas (m^3/year) (8760 hours/year),

1.87 : a maximum amount of 1.87 m^3 biogas is produced out of one kilogram degraded organic carbon (1 kg Carbon = 1 kg C = 1000 gr/12 mol C = 83.333 mol C * 22,4 ltr/mol = 1866.67 ltr/kg Carbon).

Table Annex 3.1: Set points for LFG_{model} calculation

Parameter	Descripition	Value
ζ	'Formation factor' or 'Gas Generation Rate' = *MCF* * DOC_f.	Minimum value: 0.5 Maximum value: 0.6
DOC	amount of (dry) organic carbon for each specific waste stream (kg/ton).	See table Annex 3.3.
DOC_f	fraction *DOC* dissimilated to landfill gas. See sub section E.1 from New Baseline Methodology	Minimum value: 0.6 Maximum value: 0.77 (references: 'revised 1996 IPCC guidelines for National Greenhouse Gas Inventories' and 'IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories')
MCF	Methane Correction Factor (fraction) see table E.1 from New Baseline Methodology	0.8 (unmanaged site, deeper than 5 meters, classified in accordance with the IPCC 1996 revised guidelines)
A	amount of waste (ton/year).	See table Annex 3.2 below.
k	degradation velocity of each specific waste stream.	$k_{j=1}$ 0.2890 (Fast) $k_{j=2}$ 0.0840 (Moderate) $k_{j=3}$ 0.0345 (Slow)

t	time elapsed since (prevented) depositing in years.	Elapsed years of project (maximum: 3 crediting periods).
i	Category of waste	See table Annex 3.2 below.

Table Annex 3.2: amounts of waste (A) and category of waste (i)

	Category of waste (i)	Food & Vegetables	Paper products	Garden, tree trimmings, straw	Textile	Inerts (incl. plastics)
Year	**Total waste in ton/yr**					
1994	429,900	52.7%	9.3%	5.4%	5.0%	27.6%
1995	449,000	52.7%	9.3%	5.4%	5.0%	27.6%
1996	468,900	52.7%	9.3%	5.4%	5.0%	27.6%
1997	489,700	52.7%	9.3%	5.4%	5.0%	27.6%
1998	511,500	52.7%	9.3%	5.4%	5.0%	27.6%
1999	534,200	52.7%	9.3%	5.4%	5.0%	27.6%
2000	557,900	52.7%	9.3%	5.4%	5.0%	27.6%
2001	582,600	52.7%	9.3%	5.4%	5.0%	27.6%
2002	608,500	52.7%	9.3%	5.4%	5.0%	27.6%
2003	635,500	52.7%	9.3%	5.4%	5.0%	27.6%
2004	635,500	52.7%	9.3%	5.4%	5.0%	27.6%
2005	635,500	52.7%	9.3%	5.4%	5.0%	27.6%
2006	577,100	48.9%	10.2%	4.9%	5.5%	30.5%
2007	518,700	44.3%	11.4%	4.3%	6.2%	33.8%
2008 onwards	431,100	35.0%	13.7%	3.2%	7.4%	40.7%

Table Annex 3.3: degradation velocity and degradable organic content (DOC) per category

	Food & Vegetables	**Paper products**	**Garden, tree trimmings, straw**	**Textile**	**Inerts (incl. plastics)**
DOC-content	9.5%	26.8%	9.5%	35.1%	0%
Degradation velocity	95% is fast 5% is slow	Moderate	slow	slow	N.A.

Table Annex 3.4 shows the setpoints for the parameters used in the formula used for ex ante caculation of emission reduction.

Table Annex 3.4: set points used for W_{CH4}, D_{CH4} *and* EE_{LFG}

parameter	**Applied set point**	**Reference**
W_{CH4}	50%	Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories
D_{CH4}	0.0007168 tonne/Nm3	ACM0001
E_{LFG}	50%	Conservative approach, no default data available, no locally available figures available.

Table Annex 3.5 contains the determination of EF (y = 2003) of the grid in Bangladesh (ref to ACM0002).

Table Annex 3.5: Calculated emission factor of the grid in most recent year (2003, FY 2003-2004) according ACM0002

FY	2003 -2004		Power plant data (source BPDB)														
No.	Name of Plant		Fuel source	Commissioning period	Installed capacity [in MW]	Derated capacity [in MW]	Type of plant	Heat rate [GJ/MWh]	CO_2 emissionfactor [t CO_2/GJ]	Oxidation factor	Emission factor [t CO_2/MWh]	Electricity generated [MWh]	Emission [t CO_2/year]	Average [t CO_2/MWh]	Electricity generated [MWh]	Emission [t CO_2/year]	Average [t CO_2/MWh]
1	Karnafuli	2 x 40 + 3 x 50 MW	hydro	1962 -1988	230	220			0		0	803.113	-				
2	Ashuganj	2 x 64 MW ST	Gas	1970	128	100	Steam turbine	11,64	0,0561	99,5%	0,6530	712.033	462.629				
	Ashuganj	3 x 150 MW ST	Gas	1986 -1988	450	450	Steam turbine	10,36	0,0561	99,5%	0,5813	2.313.792	1.338.284				
	Ashuganj	GT1	Gas	1982	56	45	Gas turbine	17,80	0,0561	99,5%	0,9988	80.440	79.939				
	Ashuganj	Combined cycle	Gas	1984	34			13,39	0,0561	99,5%	0,7510	69.958	52.277				
	Ashuganj	GT2	Gas	1986	56	67	Gas turbine	17,82	0,0561	99,5%	0,9997	211.134	210.016				
3	Shanhjibazar	7 x GT	Gas	1968 -1969	96	68	Gas turbine	30,61	0,0561	99,5%	1,7171	123.701	211.346				
	Shanhjibazar	70 MW GT	Gas	2000	70	70	Gas turbine	12,77	0,0561	99,5%	0,7165	84.770	60.431		84.770	60.431	
4	Sylhet	1 x 20 MW GT	Gas	1986	20	20	Gas turbine	16,58	0,0561	99,5%	0,9299	49.807	46.083				
5	Fenchuganj	ST/CC	Gas	1994 - 1995	90	90	Gas turbine	11,62	0,0561	99,5%	0,6521	450.050	291.989				
6	Ghorasal	2 x 55 MW ST	Gas	1974 -1976	110	80	Steam turbine	14,28	0,0561	99,5%	0,8008	211.861	168.820				
	Ghorasal	2 x 210 MW ST	Gas	1986 -1989	420	420	Steam turbine	10,82	0,0561	99,5%	0,6069	1.868.528	1.128.381				
	Ghorasal	2 x 210 MW ST	Gas	1994 -1999	210	210	Steam turbine	10,75	0,0561	99,5%	0,6032	1.699.654	1.020.040		1.699.654	1.020.040	
7	Siddhirghanj	1 x 50 ST	Gas	1970	50	46	Steam turbine	10,63	0,0561	99,5%	0,5963	171.476	101.748				
8	Haripur	2 x 33 MW GT	Gas	1987	99	96	Gas turbine	16,00	0,0561	99,5%	0,8977	446.039	398.403				
9	Chittagong	1 x 60 MW ST	Gas		60	50	Steam turbine	13,46	0,0561	99,5%	0,7552	213.035	160.089				
	Chittagong	2 x 28 MW GT	Gas		56	52	Gas turbine	12,05	0,0561	99,5%	0,6758	2.091	1.406				
10	Rauzan	1 x 210 MW ST	Gas	1993	210	180	Steam turbine	10,93	0,0561	99,5%	0,6130	1.050.800	640.955				
	Rauzan	1 x 210 MW ST	Gas	1997	210	180	Steam turbine	11,03	0,0561	99,5%	0,6187	739.500	455.223		739.500	455.223	
11	Khulna	1 x 100 MW ST	FO	1984	110	35	Steam turbine	11,52	0,0741	99,0%	0,8535	668.788	565.107				
	Khulna	1 x 60 MW ST	FO	1973	60	55	Steam turbine	12,90	0,0741	99,0%	0,9560	49.196	46.559				
	Khulna	2 x 28 MW ST	SKO	1980	56	21	Steam turbine	14,33	0,0774	99,0%	1,1091	32.562	35.754				
12	Baghabari	GT	Gas	1991	71	71	Gas turbine	12,74	0,0561	99,5%	0,7146	407.323	289.609				
	Baghabari	GT	Gas	2001	100	100	Gas turbine	12,57	0,0561	99,5%	0,7052	642.310	450.677		642.310	450.677	
	Bherramara	3 x 20 MW GT	HSD	1976 - 1980	60	54	Gas turbine	15,73	0,0774	99,0%	1,2178	101.455	122.313				
13	Thakurgaon	7 x 1.5 MW Diesel	LDO	1966	4,5	2,5	Diesel engine	9,70	0,0741	99,0%	0,7191	1.666	1.186				
14	Saidpur	3 x 3.75 MW Diesel	LDO		3,75	0	Diesel engine		0,0741	99,0%	0,0000	-	-				
	Saidpur	1 x 20 MW GT	HSD	1987	20	18	Gas turbine	15,78	0,0774	99,0%	1,2210	31.033	37.513				
16	Barisal	2 x 20 MW GT	HSD	1984 - 1987	40	36	Gas turbine	16,07	0,0774	99,0%	1,2440	64.601	79.562				
	Barisal	9 x Diesel units	HSD	1975 1980	2,6	1,5	Diesel engine	33,62	0,0774	99,0%	2,6022	5.607	14.445				
17	Rangpur	1 x 20 MW GT	HSD	1988	20	18	Gas turbine	16,53	0,0774	99,0%	1,2791	27.574	34.916				
18	Bhola	Diesel unit	HSD	1988	1,5	4	Diesel engine	12,20	0,0774	99,0%	0,9441	2.702	2.525				
	Bhola	Diesel unit	FO	1975 -1980	6		Diesel engine	15,01	0,0741	99,0%	1,1124	2.692	2.965				
		Total (grid)			2312	2045						13.339.291	8.511.191	0,63805	3.166.234	1.986.370	0,62736
														$EF_{OM,03}$	24%		$EF_{BM'03}$
															of total power generation		
														$EF_{OM,03}$	$EF_{BM'03}$		
													2003 - 2004	0,63805	0,62736		
													Average	0,63271			

Table with baseline data of Electricity Park in Bangladesh (below follow relevant copies from Bangladesh Power Development Board (BPDB) annual report FY 2003-2004):

BPDB Net generation 12583.3270 MKWh
Total Private Net Generation 7478.1746 "
Total Net generation 20061.5016 "
Total Private Net generation + BPDB Gross Generation 20820.5713 "

POWER PLANT WISE YEARLY SUMMARY STATISTICS (Provisional) FY2003-2004 **Page No. - 3**

Total generation (System) :	Energy:		Per Unit Fuel Cost :		Total Cost :		Fuel Consumption :		Per Unit Fuel Consumption		Heat Rate :		Efficiency (%)
Steam Turbine (N.Gas/FO)	9698.6645	Gwh	0.891	Taka/kwh	8640.2406	Million Taka					2619.396	Kcal/kwh	32.83
Steam Turbine (N.Gas)	8980.6803	"	0.762	"	6841.7712	"	97806.859	Million cuft.	10.891	cu.ft/kwh	2607.259	"	32.99
Steam Turbine (F.Oil)	717.9842	"	2.505	"	1798.4694	"	208.157	Million lit.	0.290	litre/kwh	2771.202	"	31.04
Gas Turbine (N.Gas/HSD/SKO)	2093.7091	"	1.923	"	4025.9409	"					3601.940	"	23.88
Gas Turbine (N.Gas)	1836.4844	"	1.046	"	1921.3784	"	27467.154	Million cuft.	14.956	cu.ft/kwh	3580.557	"	24.02
Gas Turbine (HSD/SKO)	257.2247	"	8.182	"	2104.5625	"	107.8546	Million lit.	0.419	litre/kwh	3754.612	"	22.91
Gas Turbine (HSD)	224.6625	"	8.428	"	1893.4090	"	95.3542	"	0.424	"	3803.039	"	22.62
Gas Turbine (SKO)	32.5622	"	6.485	"	211.1535	"	12.5004	"	0.384	"	3420.487	"	25.14
Diesel (HSD/LDO/FO)	15.7681	"	6.068	"	95.6890	"	7.3374	"	0.465	"	4208.598	"	20.44
Diesel (HSD)	11.4102	"	6.809	"	77.6964	"	5.8991	"	0.517	"	4632.475	"	18.57
Diesel (LDO)	1.6659	"	5.138	"	8.5599	"	0.4292	"	0.258	"	2315.847	"	37.14
Diesel (FO)	2.6920	"	3.504	"	9.4327	"	1.0092	"	0.375	"	3583.258	"	24.00
Combined Cycle (Gas)	731.1417	"	0.858	"	627.2251	"	8966.526	Million cuft.	12.264	cu.ft/kwh	2935.937	"	29.29
Hydro	803.1133	"											
							134240.538	Million cuft.					
Total (Excluding Hydro)	12539.2835	"	1.068	"	13389.10	" (Total)	323.3492	Million lit.			2803.909	"	30.67

Total Generation (System) : By type of Fuel :	Energy:		Per Unit Cost :		Total Cost :		Fuel Consumption :		Per Unit Fuel Consumption		Heat Rate :		Efficiency (%)
Gas =	11548.3064	Gwh	0.813	Taka/kwh	9390.37	Million Taka	134240.538	Million cuft.	11.624	cu.ft/kwh	2782.848	Kcal/kwh	30.91
FO =	720.6762	"	2.509	"	1807.9021	"	209.166	Million lit.	0.290	litre/kwh	2774.235	"	31.00
HSD =	236.0727	"	8.350	"	1971.1054	"	101.253	"	0.429	"	3843.129	"	22.38
SKO =	32.5622	"	6.485	"	211.1535	"	12.500	"	0.384	"	3420.487	"	25.14
LDO =	1.6659	"	5.138	"	8.5599	"	0.429	"	0.258	"	2315.847	"	37.14
Hydro =	803.1133	"											
Total (Excluding Hydro)	12539.2835	"	1.068	"	13389.10	"					2803.909	"	30.67
Gas = (86.6)	11548.3064	Gwh	0.813	Taka/kwh	9390.3747	Million Taka	134240.54	Million cuft.	11.624	cu.ft/kwh	2782.848	Kcal/kwh	30.91
Liquid Fuel = (7.4)	990.9770	"	4.035	"	3998.7209	"	323.3492	Million lit.	0.326	lit./kwh	3049.334	"	28.21
Hydro = (6.0)	803.1133	"											

POWER PLANT WISE YEARLY SUMMARY STATISTICS (Provisional)

FY2003-2004

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Date : 27-07-04

Sl. No.	Name of power plant	Type of fuel	Installed Capacity (MW)	Generation Derated Capacity (MW)	Gross Energy Generation (GWH)	Fuel consumed (Mill.Cft./ Mill.Litre)	Fuel Cost (Million Taka)	Station use (GWH)	Station use % of gross Generation	Annual Plant factor (%)	Fuel consumed per unit generation. (cu.ft./kwhr litre/kwh)	Per unit Fuel Cost Taka/kwh	Average Heat rate Kcal/kwh	Efficiency (%)
1	Karnafuli Hydro(2x40 MW+3x50 MW)	Hydro	230	220	803.1133			2.7298	0.34	39.86				
2	Ashuganj 2x64 MW Steam Turbine	Gas	128	100	712.0331	8262.8578	578.0022	47.3212	6.65	63.50	11.60	0.81	2778	30.96
	Ashuganj 3x150 MW Steam Turbine	Gas	450	450	2313.7921	23902.1619	1672.0006	166.2137	7.18	58.70	10.33	0.72	2473	34.78
	Ashuganj GT 1	Gas	56	45	80.4440	1427.7836	99.8761	0.2040	0.25	16.40	17.75	1.24	4249	20.24
	Ashuganj Combined Cycle	Gas	34	} CC	69.9580			4.6216	1.64	35.65	13.34	0.93	3195	26.92
	Ashuganj GT 2 *	Gas	56	67	211.1337	3751.0910	262.3958	0.2228	0.11	43.04	17.77	1.24	4253	20.22
3	Shahjibazar Gas Turbine(7 units)	Gas	96	68	123.7009	3774.5286	264.0353	1.9788	1.60	14.71	30.51	2.13	7305	11.77
	Shahjibazar 60 MW Gas Turbine	Gas	70	70	84.7700	1079.1468	75.4883	0.4258	0.50	13.82	12.73	0.89	3048	28.22
4	Sylhet 1x20 MW Gas Turbine	Gas	20	20	49.8065	823.0144	57.5714	0.1668	0.33	28.43	16.52	1.16	3956	21.74
5	Fenchuganj C.C.	Gas	90	90	450.0500	5215.4347	364.8293	3.9043	0.87	57.08	11.59	0.81	2774	31.00
6	Ghorasal 2x55 MW Steam Turbine	Gas	110	80	211.8614	3014.8642	210.8953	28.2730	13.35	21.99	14.23	1.00	3407	25.25
	Ghorasal 2x210 MW Steam Turbine	Gas	420	420	1868.5284	20155.3102	1409.9013	144.7575	7.75	50.79	10.79	0.75	2582	33.31
	Ghorasal 2x 210 MW S/T (5+6 th Unit)	Gas	210	210	1699.6540	18218.8121	1274.4397	109.2947	6.43	92.39	10.72	0.75	2566	33.52
7	Siddhirganj 1x50 MW Steam Turbine	Gas	50	46	171.4760	1816.8511	127.0921	7.0016	4.08	39.15	10.60	0.74	2537	33.91
8	Haripur 3x33 MW Gas Turbine	Gas	99	96	446.0393	7116.2562	497.7953	1.8503	0.41	51.43	15.95	1.12	3819	22.52
9	Chittagong 1x60 MW Steam Turbine	Gas	60	50	213.0352	2859.1676	200.0041	21.7880	10.23	40.53	13.42	0.94	3213	26.77
	Chittagong 2x28 MW Barge Mounted GT	Gas	56	52	2.0912	25.1165	1.7569	0.3099	14.82	0.43	12.01	0.84	2875	29.91
10	Rauzan 210 MW S\T (1st)	Gas	210	180	1050.8000	11447.8069	800.7953	81.9071	7.79	57.12	10.89	0.76	2608	32.98
	Rauzan 210 MW S\T (2nd)	Gas	210	180	739.5000	8129.0269	568.6405	73.8158	9.98	40.20	10.99	0.77	2632	32.68
11	Khulna 1x110 MW Steam Turbine	F.oil	110	35	668.7882	192.3102	1645.6706	51.7082	7.73	69.41	0.29	2.46	2749	31.29
	Khulna 1x60 MW Steam Turbine	F.oil	60	55	49.1960	15.8471	152.7988	3.1139	6.33	9.36	0.32	3.11	3079	27.93
	Khulna 2x28 MW BMPP	SKO	56	21	32.5622	12.5004	211.1535	0.3184	0.98	6.64	0.38	6.48	3420	25.14
12	Baghabari 71 MW Gas Turbine	Gas	71	71	407.3230	5171.8353	361.7795	2.3275	0.57	65.49	12.70	0.89	3040	28.29
	Baghabari 100 MW Gas Turbine	Gas	100	100	642.3095	8049.4727	563.0755	1.6340		73.32	12.53	0.88	3000	28.67
13	Bheramara 3x20 MW Gas Turbine	HSD	60	54	101.4547	42.5218	829.8747	0.4508	0.44	19.30	0.42	8.18	3755	22.90
14	Thakurgaon 7x1.5 MW Diesel	LDO	4.5	2.5	1.6659	0.4292	8.5599	0.1520	9.12	4.23	0.26	5.14	2316	37.14

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Date: 6.07.2004

Bangladesh Power Development Board
Directorate of System Planning
STATEMENT OF GENERATING PLANTS
Month : June, 2004

(A) EAST ZONE (Existing)

SL No.	Power Station	Number of Unit(s)	Unit Type	Commissioning date (DD/MM/YY)	Type of Fuel	Installed Capacity (MW)	Derated Capacity (MW)	Generation (MW) on Max. Gen. Day	Generation (MW) on Min. Gen. Day
1	2	3	4	5	6	7	8	9	10
1	KARNAFULI HYDRO	2	Hydro	26-02-1962	Hydro	40	40	38	0
			Hydro	08-01-1962	Hydro	40	40	0	30
		3	Hydro	08-01-1982	Hydro	50	40	0	0
			Hydro	11-01-1988	Hydro	50	50	0	0
			Hydro	11-02-1988	Hydro	50	50	38	35
2	ASHUGANJ	2	ST	17-07-1970	Gas	64	64	64	0
			ST	08-07-1970	Gas	64	64	64	0
		3	ST	17-12-1986	Gas	150	150	150	0
			ST	04-05-1987	Gas	150	150	100	0
			ST	21-03-1988	Gas	150	150	110	110
		1	CT } CC	15-11-1982	Gas	56	40	0	
		1	ST }	28-03-1984	Gas	34	20	0	0
		1	CT } CC	23-03-1986	Gas	56	40	35	40
3	SIDDHIRGANJ	1	ST	29-04-1970	Gas	50	30	30	32
4	HARIPUR	3	CT	31-10-1987	Gas	33	32		
			CT	15-11-1987	Gas	33	32	31	31
			CT	02-12-1987	Gas	33	32	30	30
5	GHORASAL	2	ST	16-06-1974	Gas	55	40	0	
			ST	13-02-1976	Gas	55	40	0	
		4	ST	14-09-1986	Gas	210	200	100	100
			ST	18-03-1989	Gas	210	210	170	170
			ST	15-09-1994	Gas	210	210	190	170
			ST	31-01-1999	Gas	210	210	170	170
6	SHAHJIBAZAR	7	CT	1968-69	Gas	96	68	32	32
		2	CT	28-03-2000	Gas	35	35	33	32
			CT	25-10-2000	Gas	35	35	0	0
7	FENCHUGANJ CC	1	CT }	24-12-1994	Gas	30	30	30	26
		1	CT } CC	31-01-1995	Gas	30	30	30	29
		1	ST }	08-06-1995	Gas	30	30	30	0
8	SYLHET	1	CT	13-12-1986	Gas	20	20	20	20
9	RAOZAN	2	ST	28.03.1993	Gas	210	180	180	180
			ST	21.09.1997	Gas	210	180	190	200
10	SIKALBAHA	1	ST	24-04-1984	Gas	60	50	48	0
		2	CT	13-10-1986	Gas	28		0	0
			CT	23-10-1986	Gas	28		0	0
Private									
1	NEPC (Haripur BMPP)	8	D	30-06-1999	Gas	110	110	95	110
2	RPC (Mymenshing)	4	CT	20/11/99, Jan 00	Gas	140	140	108	141
			CT	Oct. 00,Dec.00	Gas				
3	CDC, Haripur	1	CT } CC	23-05-2001	Gas	360	360	350	347
		1	ST }	01-12-2001					
4	CDC,Meghnaghat	2	CT } CC	26-11-2002	Gas	450	450	420	330
		1	ST }						
SUB TOTAL(A) :						**3925**	**3652**	**2886**	**2365.0**

(B) WEST ZONE (Existing)

SL No	Power Station	Number of Unit(s)	Unit Type	Commissioning date (DD/MM/YY)	Type of Fuel	Installed Capacity (MW)	Derated Capacity (MW)	Generation (MW) on	
								Max. Gen. Day	Min. Gen. Day
1	2	3	4	5	6	7	8	9	10
1	KHULNA	1	ST	25-05-1973	F.Oil	60	55	48	0
		1	ST	07-07-1984	F.Oil	110	95	85	92
		2	CT	07-06-1980	SKO	28	21	16	16
			CT	03-06-1980	SKO	28	21	16	16
2	BHERAMARA	3	CT	28-07-1976	HSD	20	20	0	19
			CT	27-04-1976	HSD	20	20	18	19
			CT	19-01-1980	HSD	20	20	18	19
3	SAIDPUR	1	CT	17-09-1987	HSD	20	20	19	20
4	THAKURGAON	3	D	06-06-1966	LDO	4.5	4	4	2.8
5	BARISAL	2	D	1975-1980	HSD	5.85	3.2	3	2.5
		2	CT	05-08-1984	HSD	20	18	16	16
			CT	04-10-1987	HSD	20	18	15	15
6	RANGPUR	1	CT	16-08-1988	HSD	20	20	18	18
7	BHOLA	2	D	08-10-1988	F.Oil/HSD	6	2.5	2	1.5
		3	D	1975-1980	HSD	1.50	1.2	1	1
8	BAGHABARI	1	CT	04-06-1991	Gas	71	71	70	70
		1	CT	25-11-2001	Gas	100	100	102	0

Private

1	KPCL BMPP	18	D	12-10-1998	F.Oil	110	110	113	113
2	BAGHABARI BMPP	2	CT	26-06-1999	Gas	90	90	87	87
SUB TOTAL(B) :						**755**	**710**	**650**	**527.3**
TOTAL(A+B);						**4680**	**4362**	**3536**	**2892.3**

SUMMARY

						Installed Capacity (MW)	Derated Capacity (MW)	Generation (MW) on Max. Gen. Day	Generation (MW) on Min. Gen. Day
1	2	3	4	5	6	7	8	9	10
	Hydro					230	220	76	65
East	ST (Steam Turbine)					2058	1928	1566	1132
Zone	CC (Combined Cycle)					180	150	90	55
Total	CT (Combustion Turbine)					397	294	181	185
	D (Diesel)					0	0	0	0
	Private					1060	1060	973	928
	ALL					**3925**	**3652**	**2886**	**2365**
West	ST (Steam Turbine)					170	150	133	92
Zone	CT (Combustion Turbine)					367	349	308	228
Total	D (Diesel)					18	11	10	8
	Private					200	200	200	200
	ALL					**755**	**710**	**650**	**527.3**
	Hydro					230	220	76	65
System	ST (Steam Turbine)					2228	2078	1699	1224
Total	CC (Combined Cycle)					180	150	90	55
	CT (Combustion Turbine)					764	643	488	413
	D (Diesel)					18	11	10	8
	Private					1260	1260	1173	1128
	ALL					**4680**	**4362**	**3536**	**2892.3**

Notes :

System Maximum Generation was on 14-06-2004 during peak hours at 19:30 hrs.

System Minimum Generation was on 03-06-2004 during peak hours at 20:00 hrs.

Relevant copies from used multi-phase model (see paragraph E.4)

ROYAL HASKONING

GENERAL INFORMATION

General information

Filename:	LFG Estimate version 17 July 2003, update February 2005
LFG estimates based on:	Information from DCC / reshaping landfill
Projectnumber:	9R1533/Royal Haskoning/H. Oosterdijk
Municipality:	Dhaka
Name of landfill:	Matuail, Dhaka, Bangladesh

Compsition of waste

Municipal waste:		Note:	Input based on fraction present in the different types of waste
Industrial waste:			Source: "Refuse quality assessment of DCC for
Inerts:		+	waste to electrical energy project", July 1998
		%	IPCC deafault values used

Typical dates

Start year landfilling	1994	
Start year LFG extraction	2006	July

Gas generation rate

Minimum	50,0%	NOTE: The average of 55% has been used in the calculations
Maximum	60,0%	

Page 1

Gas properties

Methane concentration	50%	(by default, conservative approach)
Energy content in kW/m3	4,98	kW/m3 LFG
Energy content in MJ/m3	17,94	MJ/m3 LFG
CO2 eq. Avoided CO2	0,63271	ton CO2/MWh generated in Electricity Park Bangladesh (2003)
CO2 eq. Emission reduction	7.533	g/m3 LFG

Engine properties

Amount of gas engines	3	pcs.	
Efficiency gas engine	36%		
Efficiency extraction installation	80%		
Cap. extraction installation	3.000	m3/hr.	
Cap. per gas engine	1.048	kWe	Jenbacher JGS 320 GS-LL
Gas rate per gas engine	584	m3/hr.	

Annual operational hours

Extraction installation	8.760	hr/yr.
Gas engine	7.500	hr/yr.

Maximum gas production

Fast degradable	2,0	years
Average degradable	7,0	years
Slow degradable	15,0	years

Minimum gas production

Fast degradable	3,0	years
Average degradable	10,0	years
Slow degradable	30,0	years

ROYAL HASKONING

RECOVERY RATES

Filename: LFG Estimate version 17 July 2003, update February 2005
LFG estimates based on: Information from DCC / reshaping landfill
Projectnumber: 9R1533/Royal Haskoning/H. Oosterdijk
Municipality: Dhaka
Name of landfill: Matuail, Dhaka, Bangladesh

Period	1994	2006
Year	2005	2021
1994	50%	50%
1995	50%	50%
1996	50%	50%
1997	50%	50%
1998	50%	50%
1999	50%	50%
2000	50%	50%
2001	50%	50%
2002	50%	50%
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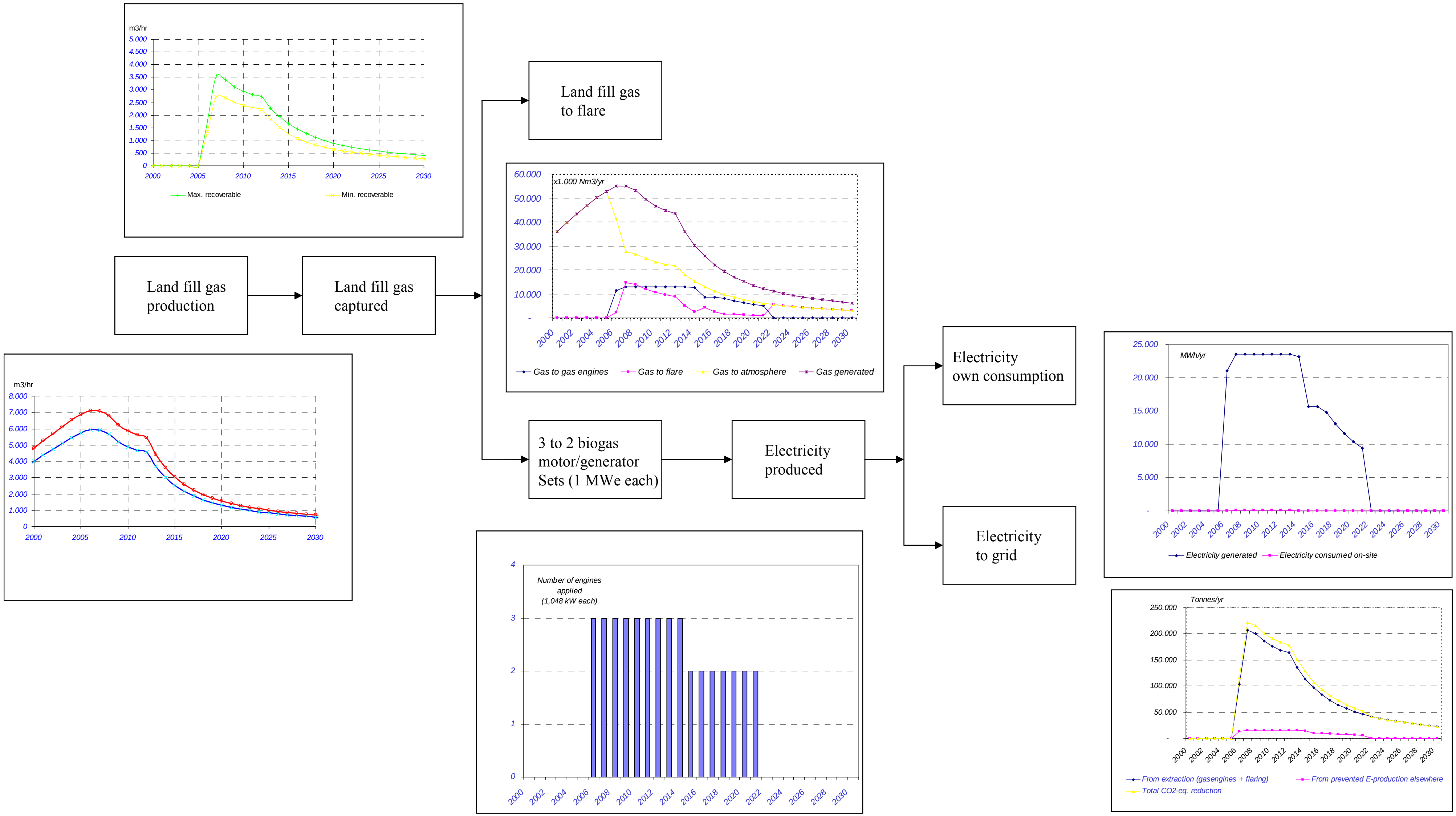
2026	50%	50%
2027	50%	50%
2028	50%	50%
2029	50%	50%
2030	50%	50%
2031	50%	50%
2032	50%	50%
2033	50%	50%
2034	50%	50%
2035	50%	50%
2036	50%	50%
2037	50%	50%

Projectnumber: 9R1533/Royal Haskoning/H. Oosterdijk
Municipality: Dhaka
Name of landfill: Matuail, Dhaka, Bangladesh

584 max flow to 1 gas engine
7.500 hr/yr availability per engine

Year	LFG Generation Nm3/hr min	LFG Generation Nm3/hr max	LFG Generation Nm3/hr average	LFG Recoverable Nm3/hr min	LFG Recoverable Nm3/hr max	LFG Recoverable Nm3/hr average	Energy content of recovered LFG MWh/yr min	Energy content of recovered LFG MWh/yr max	Energy content of recovered LFG MWh/yr average	Electricity consumption of compressor(s) MWh/yr min	Electricity consumption of compressor(s) MWh/yr max	Electricity consumption of compressor(s) MWh/yr average	Max. no. of gas engines Based on average flow	Gas flow to gas Nm3/hr average	Energy to gas e MWh/yr average	Electricity generation by gas engine MWh/yr average	Electricity consumption compresso(s) MWh/yr average	Net electricity generation MWh/yr average	CO2 equivalents of extracted LFG Tonnes CO2/yr average	Net avoided CO2 equivalents of electricity generation by gas engines Tonnes CO2/yr average	Total CO2 equivalents reduction Tonnes CO2/yr average	Gas to flare flow Nm3/hr
1994	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1995	777	1.270	1.023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1996	1.443	2.264	1.853	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1997	2.022	3.065	2.543	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1998	2.535	3.730	3.132	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1999	2.995	4.301	3.648	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2000	3.417	4.808	4.112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	3.809	5.272	4.540	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	4.180	5.708	4.944	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2003	4.537	6.128	5.332	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2004	4.884	6.539	5.712	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2005	5.174	6.865	6.020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2006	5.420	7.128	6.274	1.355	1.782	1.568	59.148	77.792	68.470	34	45	39	3	1.568	58.622	21.104	39	21.065	103.503	13.328	116.831	-
2007	5.465	7.081	6.273	2.733	3.540	3.136	119.291	154.547	136.919	68	89	78	3	1.753	65.500	23.580	78	23.502	206.973	14.870	221.843	1.384
2008	5.351	6.810	6.081	2.676	3.405	3.040	116.798	148.644	132.721	67	85	76	3	1.753	65.500	23.580	76	23.504	200.628	14.871	215.499	1.288
2009	5.027	6.247	5.637	2.514	3.124	2.819	109.734	136.355	123.044	63	78	70	3	1.753	65.500	23.580	70	23.510	186.000	14.875	200.874	1.066
2010	4.781	5.869	5.325	2.391	2.934	2.662	104.357	128.095	116.226	60	73	67	3	1.753	65.500	23.580	67	23.513	175.693	14.877	190.571	910
2011	4.596	5.619	5.108	2.298	2.810	2.554	100.310	122.655	111.482	57	70	64	3	1.753	65.500	23.580	64	23.516	168.522	14.879	183.401	801
2012	4.458	5.460	4.959	2.229	2.730	2.480	97.305	119.178	108.242	56	68	62	3	1.753	65.500	23.580	62	23.518	163.624	14.880	178.504	727
2013	3.673	4.537	4.105	1.837	2.269	2.053	80.178	99.036	89.607	46	57	51	3	1.753	65.500	23.580	51	23.529	135.454	14.887	150.341	300
2014	3.021	3.878	3.449	1.510	1.939	1.725	65.933	84.646	75.289	38	48	43	3	1.725	64.460	23.206	43	23.163	113.811	14.655	128.466	-
2015	2.529	3.341	2.935	1.265	1.671	1.468	55.204	72.927	64.065	32	42	37	2	1.168	43.667	15.720	37	15.683	96.844	9.923	106.767	299
2016	2.154	2.902	2.528	1.077	1.451	1.264	47.013	63.345	55.179	27	36	32	2	1.168	43.667	15.720	32	15.688	83.411	9.926	93.338	96
2017	1.863	2.542	2.202	932	1.271	1.101	40.665	55.476	48.071	23	32	28	2	1.101	41.156	14.816	28	14.789	72.666	9.357	82.023	-
2018	1.634	2.244	1.939	817	1.122	970	35.664	48.981	42.323	20	28	24	2	970	36.235	13.045	24	13.020	63.977	8.238	72.215	-
2019	1.450	1.997	1.724	725	999	862	31.654	43.592	37.623	18	25	22	2	862	32.212	11.596	22	11.575	56.873	7.323	64.197	-
2020	1.300	1.791	1.546	650	896	773	28.383	39.094	33.739	16	22	19	2	773	28.886	10.399	19	10.380	51.001	6.567	57.568	-
2021	1.176	1.618	1.397	588	809	698	25.667	35.316	30.491	15	20	17	2	698	26.106	9.398	17	9.381	46.092	5.935	52.027	-

Next page: Detailed flow of landfill gas, electricity production/consumption, CO_2 reductions etc.


m3/hr
Max. recoverable
Min. recoverable
Land fill gas production
Land fill gas captured
Land fill gas to flare
x1.000 Nm3/yr
Gas to gas engines
Gas to flare
Gas to atmosphere
Gas generated
m3/hr
3 to 2 biogas motor/generator Sets (1 MWe each)
Electricity produced
Number of engines applied (1,048 kW each)
Electricity own consumption
Electricity to grid
MWh/yr
Electricity generated
Electricity consumed on-site
Tonnes/yr
From extraction (gasengines + flaring)
From prevented E-production elsewhere
Total CO2-eq. reduction

Annex 4

MONITORING PLAN

The project developers and operators (SPC formed by World Wide Recycling and Waste Concern) will oversee the development of the project and will periodically carry out internal audits, when required with external assistance, to assure that project activities are in compliance with monitoring and operational requirements.

The SPC formed by WWR/WC will adopt the instructions given in the MP and accomplish all activities related to the implementation of the procedures given in the Operational Manual. The main responsibilities of the operator are related to:

- *Data handling*: maintaining an adequate system for collecting, recording and storing data according to the protocols determined in the Monitoring Plan, checking data quality, collection and record keeping procedures regularly;
- *Reporting*: preparing periodic reports that include emission reductions generated, observations regarding Monitoring plan procedures;
- *Training:* assuring personnel training regarding the performance of the project activities and the Monitoring plan;
- *Quality control and quality assurance*: complying with quality control and quality assurance procedures to facilitate periodical audits and verification.

An Operational Manual to be produced by the developer of the project will include procedures for training, capacity building, proper handling and maintenance of equipment, emergency plans, and work conditions and security.

The Monitoring plan and Operational Manual will be validated by the DOE.

Quality control and quality assurance procedures

Regarding quality control and assurance procedures to be undertaken for the monitored data, the practices to be implemented in the context of the Matuail landfill gas project are as follows:

Monitoring

The approved consolidated monitoring methodology ACM0001 "Consolidated monitoring methodology for landfill gas project activities" will be applied as is worked out in section D.2.

Monitoring records:

Daily readings of all field meters will be registered in either electronic form or on paper worksheets. Data collected will be entered in electronic worksheets and stored. Periodic controls of the field monitoring records will be carried out to check any deviation from the estimated CERs and according the Operational Manual for correction or future references.

Recommendations on system and procedures improvements will be presented. Periodic reports to evaluate performance and assist with performance management will be elaborated.

Equipment calibration and maintenance:

All meters and other sensors will be subject to regular maintenance and testing regime according to the technical specifications from the manufacturers to ensure accuracy and good performance.

Calibration of equipment will be performed periodically according to technical specifications and in agreement with recommendations given by suppliers and/or institutes.

Corrective actions:
Actions to handle and correct deviations from the Monitoring Plan and Operational Manual procedures will be implemented as these deviations are observed either by the operator or during internal audits. If necessary, technical meetings between the operator, the developer and the sponsor of the project will be held in order to define the corrective actions to be undertaken.

Site audits:
The authorities will make regular site audits to ensure that monitoring and operational procedures are being observed in accordance with the Monitoring Plan and the Operational Manual.

Training:
The operator personnel will be trained in equipment operation, data recording, reports writing, and operation, maintenance and emergency procedures in compliance with the Operational Manual.

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Appendix 1

Minutes of Meeting Stakeholders Assessment

STAKEHOLDERS' MEETING
ON
LANDFILL GAS RECOVERY AND UTILIZATION AT MATUAIL, DHAKA AND COMPOSTING OF ORGANIC WASTE IN DHAKA

Local stakeholders' consultation meeting to discuss stakeholder concerns on proposed Clean Development Mechanism (CDM) projects – 1) Landfill Gas Recovery and 2) Utilization at Matuail, Dhaka of capacity 3-6 MW electricity production and Composting of Organic Waste in Dhaka of capacity 700 tons / day.

Date and Venue: 12.02.2005, 10.00 AM at BRAC Center, Mohakhali, Dhaka, Bangladesh.

Dr. Mujibur Rahman, Professor, Environmental Engineering Division, Bangladesh University of Engineering and Technology (BUET) and Director International Training Network (ITN) chaired the meeting introducing himself and requested all the participants to introduce themselves accordingly. 45 participants from government offices, academics, non-governmental organizations, media groups, local residents, development partners and private sector were present in the meeting After that Dr. Mujibur Rahman conducted the meeting as Chairman. Then he requested the project proponents to give a brief description of the project.

Mr. Maqsood Sinha, Executive Director of Waste Concern (WC), in his presentation focused on aim of this project, the roles of two project proponents Waste Concern and World Wide recycling, Kyoto Protocol – Clean Development Mechanism (CDM), waste generation and management situation in Dhaka city and impact of this project. He also mentioned about the CDM project approval process in Bangladesh and informed that the aforesaid projects.

Mr. Maarten Van Dijk, Managing Director, World Wide Recycling (WWR), Netherlands, represented Word Wide Recycling in this stakeholders meeting and shared his project and experiences which will be replicated at Matuail, Dhaka after some modification. He explained the technology they use in their project for recycling and reuse of their wastes and also explained the scope of applying this technology in Bangladesh.

Mr. Iftekhar Enayetullah, Director, Waste Concern (WC), in his presentation focused on waste generation scenario of Dhaka City Corporation (DCC) Area , waste quality and its prospect for composting and bio-gas generation and also the scope of the project. He also gave a brief description of different units of the proposed CDM projects, project cost and financial viability, global and local benefits and finally the current status of both of the projects.

Dr. Mujibur Rahman, conducted the open discussion where the stakeholders raise questions, express their concerns and comments. Mr. Sinha, Mr. Iftekhar, Mr. Maarten and Dr. Ijaz answered the queries of the participants. Specific concerns and questions and the answers are delineated in the table below.

Stakeholder Concern / question / comment	Answer / outcome
How will the technology of the pilot project developed in Netherlands be adopted in different climatic condition of Bangladesh? [Mr. Shahjahan, BEMP, DoE, GoB]	The pilot project in Netherlands is developed for segregation of mixed wastes (both organic and inorganic), since Bangladesh doesn't has any source separate collection system. However, the waste management and treatment technology used in Netherlands will be implemented in Bangladesh with some modifications,

	making it suitable for the local circumstances.
Is there any plan for management of the remaining wastes, not collected by DCC? [Dr. Engr. Khurshed-ul-islam UNDP, SEU]	Presently DCC collects 1200 tons of waste/ day out of total generated waste 3200 tons / day. The project will manage only the wastes collected by DCC. However, the savings made by the project for DCC can help them to improve their collection efficiency.
How will the project manage the excess wastes, if the collection efficiency of DCC increases? [Md. Anisul Kabir Research Officer IPSU]	With the current collection efficiency (1200 tons / day) the project will sustain up to 2020. If the collection efficiency increases the wastes can be managed up to a certain time limit, but the lifetime of the land fill site will be reduced.
How long it will take to implement the project?	After completion of all types of official formalities, it will take only six (6) months to bring the project in full operation.
How will this project work to reduce the amount of landfill disposals from 35 % to 20%? [Taslima Islam, Senior Staff Lawyer, BELA]	Source segregation of wastes will help to achieve the target of landfill wastes reduction from 35% to 20%.
Does any developing country practice the technology used in this project? [Taslima Islam, Senior Staff Lawyer, BELA]	Yes. For example, in Lakhnow India there is a similar type project.
Who is the owner of this project? And how will the income from the project are distributed? [Shafiul Azam Ahmed, World Bank)	The land for this project belongs to DCC and WC and WWR works in partnership, where WWR is the investor and technology provider. Both WWR and DCC will be benefited from this project. A percent of royalty will go to DCC and DCC has no fixed cost anymore.
What is the Carbon Trading Concept and How does it work? [Dr. Abdus Satta Syed, ACE Data Products]	It's the concept of financing a developing country to reduce GHG emission by any developed country, which will give them the credit of reducing GHG emission for their country.
Are these two projects bundled or separate projects? Mr. Mozaharul Alam, MOEF]	These projects are separate CDM projects and not bundled.
What is the status of validation process of the project technologies? [Mr. Mozaharul Alam, MOEF]]	
Is there any scope for other projects like poultry litter treatment and composting to be included in CDM project? [Gias Uddin Ahmed, Chairman Center for Agro Technology Division]	A research is being carried out to include the poultry litter treatment and composting under CDM projects.

RECOMMENDATIONS OF STAKEHOLDERS' MEETING

The stakeholders thanked WWR and WC for initiating the first CDM project in Bangladesh and suggested to replicate this idea all over the country in different types of projects. Participants insisted to install the same type projects in the dumping sites of other city corporations also on the basis of response from the government authorities.

They also expressed their concern about the immediate implementation of the project with the active participation of all the concerned authorities. The stakeholders suggested to form a group or forum who will actively involve to encourage this type investment and for initiation of more this type projects and also to look after on going projects and the progress work in this regard.

Overall there was agreement that the proposed project was a beneficial project from sustainability view point.

Dr. Mujibur Rahman, concluded the meeting with a short speech mentioning the importance of immediate implementation of the project for the country's interest. And he also emphasized the role of media to highlight the importance of this type of project and to increase public awareness and involvement.

LIST OF PARTICIPANTS STAKEHOLDERS MEETING FEB. 12, 2005

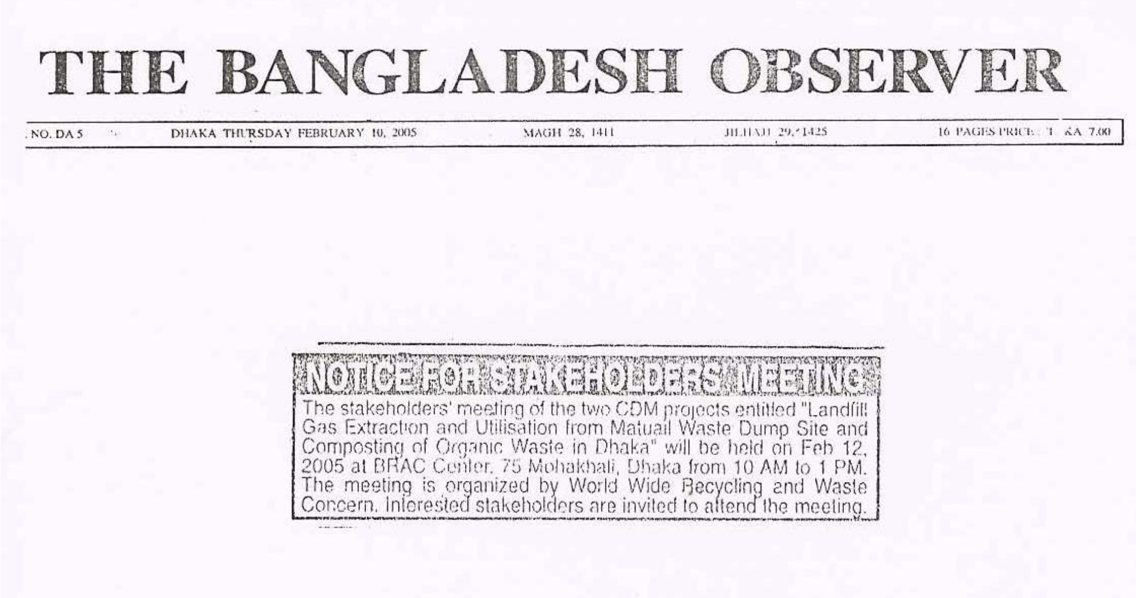
	Name & Designation	Telephone	Fax	Email
1	Mr. Md. Obaidur Rahman Managing Director MAP Agro Industries House-40, Road-18, Sector-14 Uttara Model Town Dhaka.	8952342 8921351	8952342	
2	**Krishibid MD. Rafiqul Islam** R&D Manager Alpha Agro Limited Jatiya Scout Bhaban (11th Floor) 70/1 Purana Paltan Line, Kakrail Dhaka 1000	9847967 0171-539008	8315335	
3	**Dr. Mujibur Rahman** Professor, Civil Engg. ITN-Bangladesh Civil Engineering Building(3rd Floor) Bangladesh University of Engineering & Technology (BUET) Dhaka-1000			
4	**Dr. Ijaz Hossain** Professor & Head Department of Chemical Engineering BUET Dhaka-1000	9665609 8617523 8110189 (R) 011052028		
5	**Engr. Anjan Shaha** Manager Engineering Business Resources Ltd.			
6	**Mr. Titu** Matuail High School Demra, Konapara Matuail, Dhaka			
7	**Saju** Momen Sai Demra, Matuail Dhaka			

8	**Ms. Rina** Momen Sai Demra, Matuail Dhaka			
9	**Ms. Helena Akter** Rose Bird Kindergarten Demra, Matuail Dhaka			
10	**Mr. Harun-ur-Rashid** Rose Bird Kindergarten Demra, Matuail Dhaka			
11	**Mr. A.H.Md. Maqsood Sinha** Executive Director WASTE CONCERN House 21(Side B), Road-7 Block-G, Banani, Dhaka-1213	9884774 9873002		
12	**Mr. Iftekhar Enayetullah** Director WASTE CONCERN House 21(Side B), Road-7 Block-G, Banani, Dhaka-1213	9884774 9873002		
13	**Mr. Maarten Van Dijk** Managing Director World Wide Recycling Netherlands			
14	**Mr. Shah Monirul Kabir** Research Officer WASTE CONCERN House 21(Side B), Road-7 Block-G, Banani, Dhaka-1213	9884774 9873002		
15	**Ms. Laila Arjuman Banu** WASTE CONCERN House 21(Side B), Road-7 Block-G, Banani, Dhaka-1213	9884774 9873002		
16	**Ms. Syeda Shaila Akter Khan** WASTE CONCERN House 21(Side B), Road-7 Block-G, Banani, Dhaka-1213	9884774 9873002		
17	**Mr. Abdur Razzak** WASTE CONCERN House 21(Side B), Road-7 Block-G, Banani, Dhaka-1213	9884774 9873002		
18	**Mr. Wasim Kha** WASTE CONCERN House 21(Side B), Road-7 Block-G, Banani, Dhaka-1213	9884774 9873002		
19	**Dr. M S Islam** **Exicitive Director** **BARI**	0176585137		
20	**Mr. Suranjit Debnath** Reporter	8124944-6	8125155	

	The Daily Star 19 Kawranbazar Dhaka			
21	**Mr. Shafiul Azam Ahmed** Water & Sanitation Specialist Water & Sanitation Program The World Bank Flat 03-04, Building-A, Priyo Prangan 2, Paribag Dhaka	8159015 extn.-4148	8159029	
22	**Mr. Murad Husain** Manager -COO Affairs Rahimafrooz Batteries Ltd. 705, West Nakhalpara Tejgaon, Dhaka.	9113696 0171-606707	8115305	
23	**Mr. Mozaharul Alam** Research Fellow BCAS House - 10, Road - 16/A Gulshan - 1 , Dhaka – 1212	8851237 8851986 9113682	8851417	
24	**Taslima Islam** Senior Staff Lawyer BELA House 15A, Road 3 Dhanmondi, Dhaka			
25	**Novera Hossain** Unnayan Samannay 2/F/1 Mymensingh Road , Shahbagh Dhaka	8610332 8622320	8622320	shamannay@sdnbd. org
26	**Begum Ummay Hasan** **Deputy Drector Technical** Department of Environment E-16, Agargaon Dhaka – 1207			
27	**Md. Shahjahan** LPC,BEMP Department of Environment Dhaka – 1207	0189258177		
28	**MD. Shah Alam** National Consultant on Energy, UNDP, SEU UNDP IDB Bhaban E/8-A, Begum Rokeya Sharani Sher-e-Bangla Nagar Dhaka	0171840354		
29	**Dr. Engr. Khurshed-ul-Islam** National Consultant on Energy, UNDP, SEU House 43/A, Road 116, Gulshan, Dhaka-1212			
30	**Dr. Zainal Abedin** Minstry of Agriculture Dhaka			

31	**Gias Uddin Ahmed** Chairman Center for Agro Technology Division			
32	**Md. Anisul Kabir** Research Officer IPSU			
33	**Anisur rahman** **BSS**			
34	**Zakir Hossain** Asst Engineer MSP LGED, Dhaka			
35	**Yasmin Akhter** BILIA Dhanmondi, Dhaka			
36	**Dr. Abdus Satta Syed** Proprietor ACE Data Products BIRS Bhaban Karwan Bazar Dhaka			
37	**Mohosinul Karim** Staff Correspondent BD News 24 10, Jahangir tower 6th Floor, Karwan Bazar Dhaka			
38	**S K Amzad Hossain** Project Director LGED, Dhaka	8119437		
39	**Latiful Alam Khan** Managing Director Center for Environment Studies HEDA, Bangladesh	0176193246		
40	**Masum Ahmed** Bangladesh Betar (Radio Bangladesh) Dhaka	0172981906		
41	**Abul Kalam Azad** S B, Dhaka			
42	**Salahudin Bablu** Senior Reporter Daily Inqilub Dhaka			
43	**Md Shariful Alam Mondal** **(**Environment Monitoring Officer) Dhanmondi r/A House 49, Road R/A Dhaka			
44	**Fiaz Ullah Bhueyan** Daily Naya Diganto Dhaka			
45	**Shafiul Goni Numan** Daily Sangram			

Figure Appendix 1.1: Advertisement for invitation to participate in the Stakeholders Assessment



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NOTICE FOR STAKEHOLDERS' MEETING

The stakeholders' meeting of the two CDM projects entitled "Landfill Gas Extraction and Utilisation from Matuail Waste Dump Site and Composting of Organic Waste in Dhaka" will be held on Feb 12, 2005 at BRAC Center, 75 Mohakhali, Dhaka from 10 AM to 1 PM. The meeting is organized by World Wide Recycling and Waste Concern. Interested stakeholders are invited to attend the meeting.

Appendix 2

Letter of Approval

WASTE CONCERN PAGE 01

Government of the People's Republic of Bangladesh
Department of Environment
Paribesh Bhaban, E/16 Agargaon,
Sher-e-Bangla Nagar, Dhaka 1207.

Ref.: Paribesh/Tech. (Int. Con.)/350/2003/2632 **Date:** ..16.. / 09 /2004.

Sub.: Endorsement of two projects **(1)** Landfill Gas Extraction and Utilization at Matuail Landfill Site in Dhaka" and **(2)** Composting of Organic Waste in Dhaka" of World Wide Recycling (WWR) BV of the Netherlands and Waste Concern of Bangladesh by Designated National Authority of Bangladesh.

The undersigned is pleased to convey that the two tier Designated National Authority (DNA) of Bangladesh formed under United Nations Framework Convention on Climate Change has endorsed the above mentioned projects subject to the following terms and conditions.

1. The proponent of the projects WWR BV of the Netherlands and Waste Concern of Bangladesh will make necessary arrangement for an early validation of the projects by a validator accredited to the CDM Executive Board of the UNFCCC.
2. The proponents of the projects will sign a memorandum of Understanding (MOU) with Dhaka City Corporation (DCC) before implementing the project.
3. The proponents of the projects will make the projects operational within 6 to 7 months after signing MOU with DCC and taking possession of the existing Matuail landfill site.
4. The proponents of the projects would be the implementing agency of the project.
5. Dhaka City Corporation would be the controlling authority of the project.
6. National CDM Committee will monitor the progress of the project.
7. The proponents of the projects would submit a quarterly monitoring and performance report to the National CDM Committee.
8. Power Development Board (PDB) and/or Dhaka Electricity Supply Authority (DESA) would buy the produced electricity at a negotiated price inconformity with the market price and in that respect the proponents of the projects would enter into an agreements with the respective agencies.

(Mohammad Reazuddin)
Director (Technical)
&
Member Secretary
National CDM Committee

Mr. Maarten (J.M.W.) Van Dijk
Managing Director
World Wide Recycling B.V.
Rijksstratweg 102, 7383 AV Voorst,
P.O. Box 90, 7390 AB, Twello,
The Netherlands.

Copy to:

1. Secretary, Ministry of Environment and Forest, Bangladesh Secretariat, Dhaka.
2. Secretary, Energy & Mineral Resources Division, Bangladesh Secretariat, Dhaka.
3. Secretary. Local Government Division, Bangladesh Secretariat, Dhaka.
4. Chief Executive Officer, Dhaka City Corporation, Nagar Bhaban, Dhaka.
5. Chief Conservancy Officer, Dhaka City Corporation, Nagar Bhaban, Dhaka.
6. Director General, Project Management Unit, Power Division, Ministry of Power, Energy & Mineral Resources, BTMC Bhaban (8th level), 7-9 Kawran Bazaar, Dhaka- 1215
7. PS to Principal Secretary, Prime Minister's Office, Old Airport Road, Dhaka.
8. Mr. A. H. Md. Maqsood Sinha, Executive Director, Waste Concern, House # 21 (Side B), Road # 7, Block - G, Banani Model Town, Dhaka 1213.
9. Executive Secretary, UNFCCC (He is requested to take necessary steps to place it in the official website of the CDM).