CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

>>
Santa Fe Energy Wind Farm
Version: 1
06/09/2007

A.2. Description of the project activity:

>>
The Santa Fe Energy Wind Farm (hereafter, the Project) developed by Santa Fe Energy, S. A. (hereafter referred to as the Project Developer) will be located in Veraguas Province in Panama (hereafter referred to as the "Host Country"). Total installed capacity of the Project will be 81 MW, consisting of 27 turbines with a capacity of 3 MW, with an expected annual power generation of 261,751 MWh. The project developer plans to eventually increase the capacity to 120 - 150 MW. The proposed project will be implement the first commercial wind farm interconnected to the national electricity distribution network in Panama.

The purpose of the project is to utilise the wind resources of the area of Cerro Tute and Cerro Delgadito through a Wind Farm in order to generate zero emission energy to be supplied to the National Interconnected System (*Sistema Interconectado Nacional*, hereafter referred to as the 'Grid'). The electricity currently generated by the grid is moderately carbon intensive, with an operating margin emission factor of 0.723 tCO_2/MWh and a build margin emission factor of 0.625 tCO_2/MWh, and a combined carbon emission factor of 0.699 tCO_2/MWh. The project is therefore expected to reduce emissions of greenhouse gases by an estimated 182,854 tCO_2e per year during the first crediting period.

The project is contributing to sustainable development of Panama. Specifically, the project:

- Reduces the importation of fossil fuels, which will reduce the dependence on foreign sources thereby strengthening the nation's energy security and self sufficiency
- Increases employment opportunities in the area where the project is located (20 people will be permanently employed for the project operation and during the construction 150 people will be contracted)
- Enhances the local investment environment and therefore improves the local economy
- Diversifies the sources of electricity generation, important for meeting growing energy demands and the transition away from fossil fuel electricity generation
- Makes greater use of wind renewable energy generation resources for sustainable energy production
- Demonstrates replicable clean energy technology
- Reduces greenhouse gas emissions (GHG), especially CO_2, by displacing energy from thermal power plants

A.3. Project participants:

>>

Name of Party involved (*) (host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Panama (host)	Santa Fe Energy, S.A.	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Group PLC	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.

Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

Santa Fe, Veraguas Province, Panama.

A.4.1.1. Host Party(ies):

>>

Panama

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

>>

Veraguas Province

A.4.1.3. City/Town/Community etc:

>>

Santa Fe, near Panama city

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

>>

The project will be located in the area of Cerro Tute and Cerro Delgadito, geographical coordinates are Latitude: 08°29'03'' N, Longitude: 81°06'25'' W. The elevation of the project site is 1,079 m above sea level.

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

>>

According to Annex A of the Kyoto Protocol, this project fits into Sectoral Category 1, Energy Industries (renewable/non renewable).

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

>>

The Project will use state of the art wind power technology with 81MW installed capacity (consisting of 27 turbines, each with a capacity of 3 MW) and an estimated annual generation of 261,751 MWh. The specific project data are the following.

Project data

Total power	81 MW
Turbine	3.0 MW
Hub height	65 m
Rated output	3,000 kW
Operational data	50 Hz 1,000 V
Rotor diameter	80 m
Number of turbines	27
Annual production	261,751 MWh
Capacity factor	46%
Transmission line length	42 km
Transmission line voltage	115 kV

The Project will consist of the following main parts:

- Transmission line: 115 kV double circuit overhead transmission lines between the wind farm substation and 115 kV substation, approximately 45 km in length.
- Internal roads: between wind turbines, as part of the operation of the project.
- Internal cabling: Internal medium voltage cables need to be constructed interconnecting the wind turbines within the wind farm.
- Substation: Because the high installed capacity of the wind farm (81 MW), a high voltage connection to the grid is necessary. The substation will be built next to the wind farm.
- Wind turbines transformers: Each turbine needs to have a controller and CPU, switchgear and step-up transformer, as well as an adequate grounding and protection system.

For the erection of turbines, assembly areas and truck manoeuvring spaces will be constructed. The rotor assembly is going to be 50x50 m^2 approximately; the crane pad is going to be 10x20 m, considering a capacity for 600 t.

These turbines will have three blades and a rotor of 80 m diameter at a hub height of 65 m.

The Project construction aims to start in October 2007, and the total construction period is estimated to be 15 months. Hence the project would start operation in January 2009.

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

>>

Table A.4.4 Estimated amount of emission reductions over the chosen crediting period
(tCO_2 e/year)

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2009	182,854
2010	182,854
2011	182,854
2012	182,854
2013	182,854
2014	182,854
2015	182,854
Total estimated reductions (tonnes of CO_2 e)	1,279,975
Total number of crediting years	21
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	182,854

Refer to section B.6. for further details on the quantification of GHG emission reductions associated with the project.

A.4.5. Public funding of the project activity:

>>

The project will not receive any public funding from Parties included in Annex I of the UNFCCC.

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

>>

1. The baseline and monitoring methodology ACM0002 is used: "Consolidated baseline methodology for grid connected electricity generation from renewable sources" version 06, in effect as of 19 May 2006;
2. The tool for demonstration and assessment of additionality used is: "the tool for demonstration and assessment of additionality", Version 03, in effect as of 16 February 2007.

More information about the methodology can be obtained at:
http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

>>

The Methodology of ACM0002 (Version 6) is chosen and applicable to the proposed project due to the following reasons:

- The project is a renewable electricity generation plant (wind farm);
- The proposed project is going to be connected to a national power grid, the National Interconnected System (*Sistema Interconectado Nacional*);

- The power grid (National Interconnected System) is clearly identified and information on the characteristics of this grid is publicly available, and; the proposed project is not an activity that involves switching from fossil fuels to renewable energy at the site of the project activity.

On the basis of the above reasons, the applicability criteria of the Methodology stated in ACM0002 (Version 6) are met.

B.3. Description of the sources and gases included in the project boundary

>>

	Source	Gas	Included?	Justification / Explanation
Baseline	Grid electricity production	CO_2	Included	According to ACM0002 only CO_2 emissions from the grid electricity generation should be accounted for.
		CH_4	Excluded	According to ACM0002
		N_2O	Excluded	According to ACM0002
Project Activity	Wind electricity production	CO_2	Excluded	As the project is a wind farm no greenhouse gas emissions from the project have to be considered according to ACM0002.
		CH_4	Excluded	
		N_2O	Excluded	

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

>>

As the project does not modify or retrofit existing electricity generation facilities, the baseline scenario is based on the grid electricity displacement.

Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations shown in B.6.1 and emission reduction calculation in B.6.3.

Table B.4: Key Information and Data Used to Determine the Baseline Scenario

Variable	Value / Unit	Source
Operating Margin Emissions factor	0.723 tCO2/MWh	Calculated with data from Panama National Dispatch Center (*Centro Nacional de Despacho, CND*)
Build Margin Emissions Factor	0.625 tCO2/MWh	Calculated with data from Panama National Dispatch Center (*Centro Nacional de*

Variable	Value / Unit	Source
		Despacho, CND)
Combined Margin Emissions Factor	0.699 tCO2/MWh	Calculated as the weighted average between BM and OM
Generation of the project in year y	261,751 MWh	Barlovento study

The baseline scenario was determined by analysing three alternatives to the project scenario, as follows:

Alternative 1: The proposed project activity without CDM: construction of a wind farm with an installed capacity of 81 MW connected to the national grid, implemented without considering CDM revenues.

This alternative would face investment and technological barriers (see section B.5 below), because the wind energy has not been tested in the host country, and no wind farms are commercially operated in Panama, therefore it is not considered as common practice, and is unlikely to be implemented in the absence of the CDM. For those reasons this alternative faces the largest number of barriers, therefore is not considered to be viable, and is not the baseline scenario.

Alternative 2: Construction of a thermal power plant with the same installed capacity or the same annual power output.

This alternative would face fewer barriers to its implementation, since construction of fossil fuel fired plants, together with large-scale hydroelectric plants, is the prevailing practice in the grid. However, this alternative would require additional investments to be made (thus facing more barriers than when compared with alternative 3) and in addition, the project developer has no experience in constructing fossil fuel fired power plants, therefore this alternative is not considered further.

Alternative 3: Continuation of the current situation. Electricity will continue to be provided by the existing Panama Interconnected Grid.

Continuation of the current situation would require no investments on the part of the project developer, and would not face any technological or other barriers. Electricity would continue to be provided by the existing mix of (predominantly fossil fuel and large-scale hydro) power plants in the grid. Hence, this alternative would face the least barriers, and is therefore identified as the baseline scenario.

To summarise, the most realistic and credible alternative is alternative 3: Continuation of the current situation.

B.5. 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 (assessment and demonstration of additionality):

The following steps are used to demonstrate the additionality of the project according to the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the Executive Board (Version 3, 16 February 2007, EB 29) (for the assessments of alternatives please refer to B.4):

The start of the crediting period of this project activity is not prior to the date of registration, however for the assessment of additionality it is important to note that the CDM was taken into account for the

investment decision and in the planning stage of the project. The Project Idea Note is dated as submitted on February 1st 2006[1], and the Feasibility Study of the "Santa Fe Energy Wind Farm" as a CDM project is dated in April 2007. The project has also received a Letter of No Objection dated on 26th March 2007 from the Designated National Authority of Panama. Construction of the project began in October 2007.

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

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

To provide the same services comparable with the proposed CDM project activity; three alternatives were analyzed, as follows:

Alternative 1: The proposed project activity without CDM: construction of a wind farm with an installed capacity of 81 MW connected to the national grid, implemented without considering CDM revenues.

Alternative 2: Construction of a thermal power plant with the same installed capacity or the same annual power output.

Alternative 3: Continuation of the current situation. Electricity will continue to be provided by the existing Panama Interconnected Grid.

Alternative 2 has been ruled out from further consideration (see section B.4).

Sub-step 1b. Consistency with mandatory laws and regulations

All the alternatives comply with the laws and regulatory requirements for electricity generation in Panama; see The Ministry of Economy and Finance, Energy Policy Commission, legal framework (http://www.mef.gob.pa/Cope/).

Regarding renewable sources, the Law No. 45 (of August 4th, 2004) establishes a regime of incentives for the promotion of hydroelectric generation systems and other new, renewable and clean resources[2]. The law entitles such projects (of more than 10MW) to pay zero transmission and distribution fees for the first 10MW of installed capacity, for the first 10 years of operation. However, that incentive applies only to projects up to 20 MW. On the other hand, for wind power projects and other renewable and clean energies, the Law establishes that project developers will able to acquire from the State an equivalent fiscal incentive of up to 25% of the direct investment cost of the respective project, based upon the reduction of tons of equivalent carbon dioxide emissions per year, during the first 10 years after commencing operations. However, this again applies only to projects up to 20MW installed capacity, meaning the project activity does not benefit from these incentives.

[1] Project Idea Note of Santa Fe Energy, S.A. Date submitted 01/02/2006.

[2] Source: Law No. 6 (of February 3rd, 1997) by which the regulatory and institutional framework for the provision of public electricity service is issued. Official gazette. Official publication of the Government of Panama.

In spite of the Law No. 45 the prevailing practice is still large-scale hydroelectric power and thermal power plants, 55.33% and 44.67% of the total capacity in Panama, respectively[3].

Step 2. Investment Analysis

According to the "Tool for the demonstration and assessment of additionality (version 03)" "Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis)". Barrier analysis was chosen.

Step 3. Barrier Analysis

The barrier analysis aims to identify barriers that prevent the implementation of this type of project activity, but which do not prevent the implementation of at least one of the proposed alternatives identified in step 1.

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

The objective of sub-step 3a is to demonstrate that there are barriers that would prevent the project activity from being carried out if it was not registered as a CDM project.

Investment Barriers

In spite of the availability wind resources in Panama, wind energy has not been tested as a mainstream source of electricity generation in the host country. No wind farms are currently commercially operated, and in addition, the high up-front investment requirements have made wind power unattractive in a competitive electricity market, where the long term market price is difficult to estimate. For the financial sector, wind energy is a risky investment because of the intermittent supply of energy, dependent upon the natural wind resource[4]. Also the capital cost per MW of a wind farm is higher than thermal plants[5], making it difficult for wind farms to attract financing. Apart from having to compete with less capital intensive projects, wind power has to compete with existing power stations that have already been depreciated and paid for by tax payers or electricity consumers. For that reason, substantial financial support is needed during the first years of the project, and this makes it less attractive for investors.

[3] Source: Ente Regulador de Servicios Públicos. Statistics of 2006. Supply. http://www.ersp.gob.pa/electric/estadisticas_elec.asp

[4] 2004. BUN-CA. Biomass Users Network. http://www.bun-ca.org. Principales barreras que enfrenta la inversión de proyectos eólicos en América Central.

[5] 2000. BUN-CA. Biomass Users Network http://www.bun-ca.org. Memoria del Primer Encuentro Nacional de Energías Renovables a Pequeña Escala en Panamá.

Technological Barriers

Technical Difficulties

The winds of the project area can reach very high speeds in certain periods, requiring the design and construction of a new type of wind turbines, which have never been commercially tested before (only prototype designs have been tested). Therefore the project developer is likely to face difficulties during the installation which would result in increased costs and time delays during the construction process. The most uncertain part of the process will be the first operational phase, during which the project developer could face unforeseen technical and financial barriers due to the immaturity of the technology.

Infrastructural Barrier

The project is located in difficult topography, which poses a barrier for project implementation. For example the slopes in some cases exceed 50%, and the attitude changes from 300m above sea level to 1,400m above sea level[6].

The complex terrain involves various risks for civil works. Particularly, the harsh tropical climate (heavy rains during the calm season and extreme winds during the dry season). The duration of the rainy season is seven months, and the local precipitation varies between 1,400mm to 2,000mm. As a result of the steep topography and tropical climate, erosion and landslides are common, which can lead to delays and extra costs during construction and even operation. In addition there is a lack of support infrastructure such as communication systems, approach roads, etc. It will be necessary to construct a transmission line (42 km in length) to connect the project with the national transmission system, through an area without high quality infrastructure.

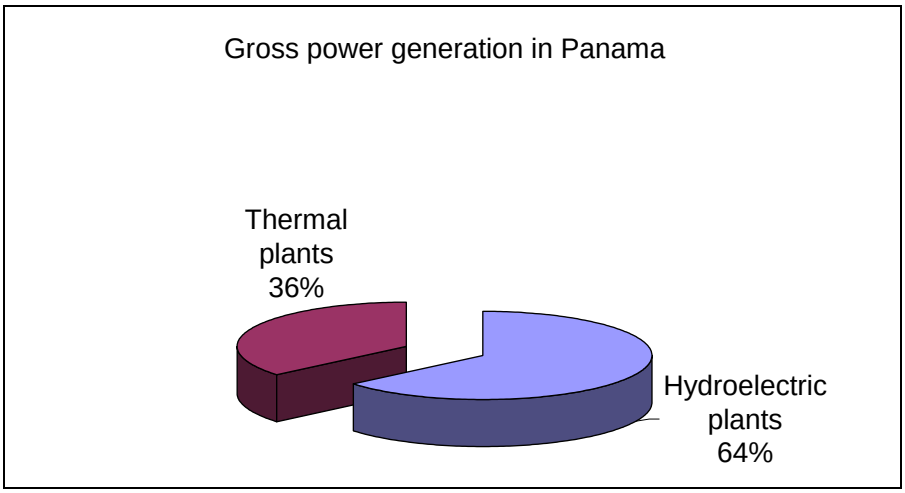
Barriers due to prevailing practice

The Santa Fe Energy Wind Farm will be the first wind farm in Panama, there is no commercially operational wind project in Panama. Secondly, this project will be the first wind project developed by Santa Fe Energy, S.A.

The installed capacity during 2005, including isolated systems, was 846.0 MW for hydroelectric projects and 662 MW for thermal plants. The gross power generation in Panama was 5,826.9 GWh during 2005, 3,723.7 GWh was from hydroelectric plants and 2,103.2 GWh was from thermal plants, it means 63.91% of total generation was from hydroelectric plants and 36.01% was from thermal plants (bunker, diesel and marine diesel)[7].

[6] See: Study of Environmental Impact Assessment. 2007. Approved by the National Environmental Authority of Panama (ANAM). Authorization: DIEORA-IA-252-2007, dated July 12th 2007.

[7] Ministerio de Economía y Finanzas. Comisión de Política Energética. Compendio Estadístico Energético 1970-2005. II Generación de Electricidad. Repuplic of Panama.



Source: Data from The Ministry of Economy and Finance.
Energy Policy Commission. Republic of Panama

It is clear that wind energy is not prevailing practice in Panama, since the market is dominated entirely by thermal and large-scale hydroelectric plants.

Other barriers

Resource uncertainty

Wind energy is an intermittent source of energy, of variable strength and direction. Since the energy that the wind contains is a function of the cube of its speed, small differences in average wind speeds mean large differences in production and, therefore, revenues. The variability of the power generation potential is increased, and thus wind power technology involves more technical and financial risks than fossil fuel energy, for investors, project developers and the national grid authority. All these risks also represent barriers to the implementation of wind projects in the National Interconnected Grid.

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

As mentioned in Sub-step 1a, realistic and credible alternatives to the proposed project include:

- *Alternative 1:* The proposed project activity without CDM.
- *Alternative 2:* Construction of a thermal power plant with the same installed capacity or the same annual power output
- *Alternative 3*: Continuation of the current situation.

According to the analysis, alternative 1 is not considered to be viable, because the project without CDM would face the largest number of barriers (technological and investment). Alternative 3 is considered viable, because the continuation of current situation would not require additional investments, and would not face any other barriers; and alternative 2 would face fewer barriers than alternative 1, but more barriers than alternative 3. Therefore the only realistic and credible alternative is alternative two.

Step 4. Common Practice Analysis

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

Currently there are no wind farms commercially operational in the country. Therefore development of this type of project is not considered common practice.

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

No similar activities are observed in Panama (see Barriers due to prevailing practice), since Santa Fe Energy Wind Farm will be the first commercially operational wind farm in Panama.

B.6. Emission reductions

B.6.1. Explanation of methodological choices:

>>

According to the latest version of ACM0002, the National Interconnected System is selected as the project boundary, as this is the national grid of the country, which is not divided into regional grids, and is not subject to significant transmission constraints.

The National Interconnected System (*Sistema Interconectado Nacional*, *SIN*) Grid is therefore determined as the project boundary applicable for ACM0002.

The baseline emissions factor (EF_y) is calculated as the weighted average of the Operating Margin emission factor and the Build Margin emission factor of the SIN. The data used to calculate the grid emission factor come from:

- *Statistical Energy Survey*, from the Energy Policy Commission of the Panama Ministry of Finance
- 2003, 2004 and 2005 annual reports of the National Dispatch Center, issued by the company of electrical transmission (*Empresa de Transmisión Eléctrica*)

Operating Margin (OM)

The methodology ACM0002 will be applied using the second option (Simple-adjusted Operating Margin) for operating margin calculation described pp.5-8 of the methodology.

Method a) is the simple operating margin. Since low-cost must-run resources constitute more than 50% of total grid generation (as shown in the following table from the Energy Policy Commission), the simple operating margin is not applicable.

Annual generation (GWh) and weight (%) of thermal and hydro generation plants of the National Interconnected Grid of Panama (NIG) [8]					
Year	**All NIG plants**	**Thermal plants**	**Weight (%)**	**Hydro plants**	**Weight (%)**
2002	4847.3	1720.9	35.50%	3126.0	64.49%
2003	4936.9	2377.4	48.16%	2559.2	51.84%
2004	5044.0	1569.3	31.11%	3474.6	68.89%
2005	5158.1	1660.5	32.19%	3497.5	67.81%

Method c) is the Dispatch data analysis, and requires public data, on a 24-hour basis, 365 days a year, during the entire project activity timeline. Since the 24-hour basis data are not being published on a regular basis, it is not possible to carry out proper calculations according to the dispatch analysis.

Method d) is the average operating margin. This method doesn't represent properly the actual operating margin of Panama, since it does not take into account the relative contribution of the low-cost/must-run sources VS non low-cost/must-run sources, and the hours per year that each one these are on the margin. In the specific case of Panama, it is especially important to take into account these parameters, since the low-cost/must-run sources represent an important fraction of the total grid load.

Method b) is the simple adjusted operating margin, and consists of a variation of the simplified operating margin. It takes into account the load factor for each type of plant (Low-Cost Must-Run and the other ones), and the % of the time each of these types are on the grid margin. The "Lambda factor" represents the % of time the Low-Cost Must-Run power plants (in Panama case, mostly hydro plants) are on the load margin. The rest of the time (1-Lambda), the emission factor of all the other fossil plant is taken into account. This segregation of Low-Cost Must-Run and fossil plants makes the simple adjusted method more representative of the operating margin emission factor and it can easily be carried out. For these reasons, the most appropriate choice to calculate the operating margin emission factor of the present case is the method b): the simple adjusted operating margin.

The equation used for simple adjusted margin is similar to the simple (a) and the average (d) operating margin. However, through the Lambda factor does separate into low-cost/must-run power sources (*k*) and other power sources (*j*):

$$EF_{OM,\,simple\_adjusted,\,y} = (1-\lambda_y).\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_{j} GEN_{j,y}} + \lambda_y.\frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_{k} GENk_{k,y}}$$

Where:

- *F* is the amount of fuel (mass or volume unit) consumed by relevant power sources
- *j* refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants

[8] Source: http://www.mef.gob.pa/Cope/

- *k* refers to the low-operating cost and must-run power sources delivering electricity to the grid
- *COEF* is the CO_2 emission coefficient of fuel *i* (tCO_2/mass or volume of the fuel)
- *GEN* is the electricity (MWh) delivered to the grid by source *j*.
- Lambda factor (λ) represents the fraction of the time (%) during which the low-operating cost and must-run power sources are on the grid margin. Lambda is calculated according to Step 1 to 4 of the ACM0002, and through the load duration curve. Please refer to Annex 3 for more details.

Build Margin (BM)

The build margin (BM) is calculated as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants *m*, according to the following formula (equation 5):

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

where *F*, *COEF* and *GEN* are analogous to the variables described for the operating margin (OM). The BM is calculated *ex ante* using data the five power plants most recently built. The total of these five most recently built power plants produce 1,176,800 MWh per year of the chosen vintage, which represent 21.66 % of the total grid generation.

The baseline emission factor EF_y as the weighted average of the Operating Margin emission factor (EFOM,y) and the Build Margin emission factor (EFBM,y):

$$EF_y = \omega_{OM} * EF\_OM_y + \omega_{BM} * EF\_BM_y$$

Where:

EF: baseline emission factor (tCO_2e / MWh)
ω_{OM}: Operation Margin weight, which is 0.75 by default
EF_OM: Operational Margin emission factor (tCO_2e / MWh)
ω_{BM}: Build Margin weight, which is 0.25 by default
EF_BM: Build Margin emission factor (tCO_2e / MWh)
y: refers to a given year

Combined Margin (CM)

Combined margin (CM) is simply a weighted average of BM and OM. As stated in ACM-002, the default weights for winds projects are as follows: w_{OM} = 0.75 and w_{BM}=0.25 (owing to their intermittent and non-dispatched nature).

B.6.2. Data and parameters that are available at validation:

(Copy this table for each data and parameter)

Data / Parameter:	EF_{OM}
Data unit:	tCO_2/MWh
Description:	Operating Margin emission factor of National Interconnected Grid
Source of data used:	Factor calculated with data from Energy Policy Commission and National Dispatch Center
Value applied:	0.723
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	EF_{BM}
Data unit:	tCO_2/MWh
Description:	Build Margin emission factor of National Interconnected Grid
Source of data used:	Factor calculated with data from Energy Policy Commission and National Dispatch Center
Value applied:	0.625
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	EF_y or CM
Data unit:	tCO_2/MWh
Description:	Combined Margin emission factor of National Interconnected Grid
Source of data used:	Calculated (weighted average of BM and OM)
Value applied:	0.699
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	Installed Capacity
Data unit:	MW
Description:	The installed capacity
Source of data used:	Preliminary site assessment report
Value applied:	81
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is from the site assessment report
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

>>

The *ex-ante* emission reductions calculations are as follows:

$$ER_y = BE_y - PE_y - L_y$$

Where:

ER: Emission reduction (t CO_2e)
BE: Baseline emissions (t CO_2e)
PE: Project Emissions (t CO_2e)
L: Leakage emissions (t CO_2e)
y: a given year

According to ACM0002, there are no expected project emissions related to the generation of electricity, as generation is based on a renewable resource. Therefore, $PE_y = 0$.

According to ACM0002, the leakage of the proposed project is not considered. No leakage is expected. Therefore, $L_y = 0$.

Therefore:

$$ER_y = BE_y$$

Refer to Section B.6.1. for equations used to estimate baseline emissions.

$$BE_y = GEN_y * EF_y$$

Where:

BE: Baseline emissions (t CO_2e)

GEN: Electricity supplied by the project to the grid (MWh)
EF: baseline emission factor (tCO_2e / MWh)
y: refers to a given year

The expected electricity supplied annually by the project to the grid (*GEN*) = 261,751 MWh. Baseline emission factor with combined margin (*EF*) = 0.699 tCO_2e / MWh. Therefore, BE_y equals to 182,854tCO_2/year.

Please see the table bellow for a summary of the values used and the results of the calculation.

B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

Years	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2009	0	182,854	0	182,854
2010	0	182,854	0	182,854
2011	0	182,854	0	182,854
2012	0	182,854	0	182,854
2013	0	182,854	0	182,854
2014	0	182,854	0	182,854
2015	0	182,854	0	182,854
Total (tonnes of CO_2)	0	1,279,975	0	1,279,975

B.7 Application of the monitoring methodology and description of the monitoring plan:

The project uses the approved monitoring methodology ACM0002 "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", Version 6, 19 May 2006.

All data required for verification and issuance will be kept for at least two years after the end of the crediting period or the last issuance of CERs of this project.

B.7.1 Data and parameters monitored:	
(Copy this table for each data and parameter)	
Data / Parameter:	Electricity quantity (EG_y)
Data unit:	MWh
Description:	Electricity delivered to the grid
Source of data to be used:	Electricity meter reading at project boundary
Value of data applied for the purpose of calculating expected emission reductions in section B.5	261,751
Description of measurement methods and procedures to be applied:	The electricity output will be continuously measured using an electricity meter, and recorded monthly. Data will be archived by means of electronic and paper backup.
QA/QC procedures to be applied:	Meter readings can be cross checked against electricity sales receipts.
Any comment:	

B.7.2 Description of the monitoring plan:

>>

This section details the steps taken to monitor the GHG emissions reductions from the Santa Fe Energy Wind Farm Project in Panama.

The Monitoring Plan for this project has been developed to ensure that from the start, the project is well organised in terms of the collection and archiving of complete and reliable data.

1. Monitoring organisation

Prior to the start of the crediting period, the organisation of the monitoring team will be established. Clear roles and responsibilities will be assigned to all staff involved in the CDM project and the Plant Manager will coordinate and be responsible for all CDM monitoring. The Plant Manager will have the overall responsibility for the CDM monitoring system on this project.

Plant Manager -> CDM manager -> Monitoring Staff

A formal set of monitoring procedures will be established prior to the start of the project. These procedures will detail the organisation, control and steps required for certain key monitoring system features, including:

a) CDM staff training
b) CDM data and record keeping arrangements
c) Data collection
d) CDM data quality control and quality assurance

e) Equipment maintenance
f) Equipment calibration
g) Equipment failure

The procedures will be agreed and signed off by Santa Fe Energy, S.A. and EcoSecurities. Any changes to procedures will need to be agreed by both parties. The Plant Manager will be responsible for ensuring that the procedures are followed on site and for continuously improving the procedures to ensure a reliable monitoring system is established.

All staff involved in the CDM project will receive some relevant training from the project consulting company laid down in training procedures agreed on by the project developer and EcoSecurities Group Plc. Records of trained CDM staff will be retained by the Project Developer. The Plant Manager will ensure that only trained staff is involved in the operation of the monitoring system.

For further details on the CDM data quality control and quality assurance procedures see the CDM Monitoring System Procedures in Annex 4.

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>

The baseline study and the monitoring methodology were concluded on September 5th 2007. The entity determining the baseline study and the monitoring methodology and participating in the project as the Carbon Advisor is EcoSecurities Group PLC, listed in Annex 1 of this document as a project participant.
Contact: mathieu.dumas@ecosecurities.com

Detailed baseline information is attached in Annex 3.

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:

>>

October 1st 2007

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

>>

The expected lifetime of the Santa Energy Wind Farm is 20 years

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:

>>

01/01/2009

C.2.1.2. Length of the first crediting period:

>>

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

Not applicable

C.2.2.2. Length:

>>

Not applicable

SECTION D. Environmental impacts

>>

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

>>

The Study of Environmental Impact Assessment, Category III, was completed in February 2007 and approved by The National Environmental Authority of Panama (Environmental Authorization DIEORA-IA-252-2007, dated July 12th 2007).

Identified environmental impacts[9]	Measures taken
Water and soil pollution	
Oil from vehicles	Periodic maintenance
Wastewater from the staff	Use of portable latrine
Air pollution	
Contaminant emissions during the use of heavy machinery	Maintenance and control supervision of the machinery used on site.
Dust during the construction	A showering system is to be installed to dampen and control dust/particulate matter.
Dust during the transportation	Supervision during the material/construction waste's transportation. Cover construction materials on site and during transportation.
Noise pollution	
Site preparation work and excavation during construction	Maintenance and control of equipments, arrange construction time, and construction activity is banned in the evenings.
Transportation during the construction	Adjust transportation car's speed while passing residential areas.
Solid waste	
Waste from the construction	To the specific landfill.
Waste from the staff	Collect and send to local site disposal centre
Biodiversity and ecosystems	
Tree felling during construction	Reforestation of the area and donations
Erosion impact assessment	

[9] See: Study of Environmental Impact Assessment. 2007. Approved by the National Environmental Authority of Panama (ANAM). Authorization: DIEORA-IA-252-2007, dated July 12th 2007.

Land erosion in the project area by removal of vegetation	Cover areas with soil movement, hillside's stabilization, e.g. re-vegetation, compacting

D.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:

>>

Most of the project's impacts were identified as minor[10] in the EIA process, the noise from the turbines is considered to be within acceptable parameters, furthermore the project will contribute to sustainable development for the local and national area, and the project is expected to have an overall positive impact on the local and global environment. All negative environmental impacts are subject to mitigation measures as described above.

SECTION E. Stakeholders' comments

>>

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

>>

The National Environmental Authority (ANAM) made the Environmental Impact Assessment public to all officials, organizations, community representatives. The document was publicly available at the documentation center of the ANAM and comments/recommendations were submitted to the General Administration of ANAM.

A Forum of Public Consultation was held in accordance with the General Environmental Law of Panama. The announcements were made by:

- The Panamanian newspaper "*Panamá América*". The announcements were posted on 31st March 2007 and 1st April 2007.
- Radio Veraguas, inviting to communities
- Informative pamphlets which contained information about the consultation. They were distributed to communities which didn't have access to the newspapers.
- Personal invitations to local authorities, health centers, organizations.
- Santa Fe Municipality. An announcement was posted on the informative area.

The forum was held on 4th April 2007 at the Santa Fe fair area, Veraguas Province, Panama.

E.2. Summary of the comments received:

>>

Overall, positive comments and observations were provided by participants of the public forum. The following list includes general comments and observations about the project from the participants at the public consultation.

- About labour force. No qualify labour force will be contracted from the local communities.
- Wind turbines distribution. The distribution of wind turbines will be according to wind measurement.

[10] Study of Environmental Impact Assessment. 2007. Approved by the National Environmental Authority of Panama (ANAM). Authorization: DIEORA-IA-252-2007, dated July 12th 2007.

- Electricity supply to the communities. Local electrification will be made to supply electricity to the communities near to the project; also Santa Fe Energy S.A. will make support the communities through sustainable projects.
- Access road. It will be used the current access road, but it will be stabilize.

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

>>

No negative comment was provided by the participants. The project developer expressed that the ANAM is in charge of the project follow-up. They also mentioned that because of the financial incentive and environmental awareness, Santa Fe Energy, S.A. is obligated to comply with all regulations.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Santa Fe Energy, S.A
Street/P.O.Box:	Apartado 0831-01992
Building:	
City:	Punta Paitilla
State/Region:	Panama
Postfix/ZIP:	
Country:	Panama
Telephone:	(507) 64-1157
FAX:	(507) 64-1157
E-Mail:	ramt@panamet.com
URL:	
Represented by:	Roberto A. Moreno T
Title:	President
Salutation:	Mr.
Last Name:	Moreno
Middle Name:	
First Name:	Roberto
Department:	
Mobile:	
Direct FAX:	(507) 6614 60 52
Direct tel:	(507) 6614-6052
Personal E-Mail:	ramt@pananet.com

Organization:	EcoSecurities Group Plc.
Street/P.O.Box:	40 Dawson Street
Building:	
City:	Dublin
State/Region:	
Postfix/ZIP:	02
Country:	Ireland
Telephone:	+353 1613 9814
FAX:	+353 1672 4716
E-Mail:	info@ecosecurities.com
URL:	www.ecosecurities.com
Represented by:	
Title:	COO & President
Salutation:	Dr.
Last Name:	Moura Costa
Middle Name:	
First Name:	Pedro
Department:	
Mobile:	

Direct FAX:	
Direct tel:	+44 1865 202 635
Personal E-Mail:	cdm@ecosecurities.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding.

Annex 3

BASELINE INFORMATION

Grid dispatch generation (MWh) by type for 2003-2004-2005

Type	Plant	Generacion por planta en el SIN (GWh/year)			Generacion por planta en el SIN (MWh/year)		
		2003	2004	2005	2003	2004	2005
Hydros	Arkapal Auto-Edechi	2.8	1.8	1.3	2800	1800	1300
	Ascanio Villalaz (Bayano)	483.8	478.00	559.9	483800	478000	559900
	Dolega - edechi	16.4	14.7	15.8	16400	14700	15800
	Edwin Fabrega (Fortuna)	1403.9	1779.4	1656.2	1403900	1779400	1656200
	Esti	90.3	615.6	660.1	90300	615600	660100
	Hidro panama - Indep-edemet	8.5	11.30	10.3	8500	11300	10300
	La Estrella	231.6	241.9	250.9	231600	241900	250900
	La Yeguada - edemet	41.2	39.5	36.2	41200	39500	36200
	Los Valles	268.6	280.7	295.9	268600	280700	295900
	Bayano	483.625	478.15	559.9	483625	478150	559900
	Bayano expansion	0	182.784	1.534	0	182784	1534
	Macho Monte	12.1	11.7	10.9	12100	11700	10900
TOTAL		3042.825	4135.534	4058.934	3042825	4135534	4058934
Bunker	Central 9 de Enero - 2	50.9	99.6	96.4	50900	99600	96400
	Central 9 de Enero - 3	128.9	155.2	194.6	128900	155200	194600
	Central 9 de Enero - 4	78	72.2	200.6	78000	72200	200600
	Panam	704.3	612	693	704300	612000	693000
	Pedregal Power	370.7	375.8	379.5	370700	375800	379500
	Petroelectrica	283.4	4.1	0	283400	4100	0
TOTAL		1616.2	1318.9	1564.1	1616200	1318900	1564100
Diesel	Petroterminales	12.8	12.6	13.9	12800	12600	13900
	Copesa	3	1.2	3.2	3000	1200	3200
	Subestacion Panama	0.5	0.2	0.3	500	200	300
	Central 9 de Enero	757.7	249	92.9	757700	249000	92900
TOTAL		774	263	110.3	774000	263000	110300
TOTAL TOTAL					5433025	5717434	5733334

Fuel consumption by plant for 2003-2004-2005

		Fuel consumption (1000 barrels)			Fuel consumption (m3/year)			Fuel consumption (t/year)		
		2003	2004	2005	2003	2004	2005	2003	2004	2005
Bunker Plants NCV: 40.4 GJ/t EF: 0.077 tCO2/GJ	Central 9 de Enero - 2	87	169	164	13833	26871	26076	13695	26602	25815
	Central 9 de Enero - 3	220	266	332	34980	42294	52788	34630	41871	52260
	Central 9 de Enero - 4	133	124	341	21147	19716	54219	20936	19519	53677
	Panam	978	851	963	155502	135309	153117	153947	133956	151586
	Pedregal Power	512	522	528	81408	82998	83952	80594	82168	83112
	Petroelectrica	421	6	0	66939	954	0	66270	944	0
Diesel Plants NCV: 43 GJ/t EF: 0.074 tCO2/GJ	Petroterminales	22	23	25	3498	3657	3975	3148	3291	3578
	Panam	29	26	29	4611	4134	4611	4150	3721	4150
	Pedregal Power	16	16	16	2544	2544	2544	2290	2290	2290
	Copesa	5	2	6	795	318	954	716	286	859
	Subestacion Panama	1	0	1	159	0	159	143	0	143
	Central 9 de Enero	1105	359	135	175695	57081	21465	158126	51373	19319
Hydros Plants	Arkapal Auto-Edechi	0	0	0	0	0	0	0	0	0
	Ascanio Villalaz (Bayano)	0	0	0	0	0	0	0	0	0
	Dolega - edechi	0	0	0	0	0	0	0	0	0
	Edwin Fabrega (Fortuna)	0	0	0	0	0	0	0	0	0
	Esti	0	0	0	0	0	0	0	0	0
	Hidro panama - Indep-edemet	0	0	0	0	0	0	0	0	0
	La Estrella	0	0	0	0	0	0	0	0	0
	La Yeguada - edemet	0	0	0	0	0	0	0	0	0
	Los Valles	0	0	0	0	0	0	0	0	0
	Macho Monte	0	0	0	0	0	0	0	0	0

Emission (tCO_2e/year) by Plant for 2003-2004-2005

		Heat flow (GJ/year)			Emissions (tCO2/year)			Emissions factor (tCO2/MWh)		
		2003	2004	2005	2003	2004	2005	2003	2004	2005
Bunker Plants NCV: 40.4 GJ/t EF: 0.077 tCO2/GJ	Central 9 de Enero - 2	553265	1074733	1042936	42804	83148	80688	0.8409478	0.83482402	0.8370172
	Central 9 de Enero - 3	1399060	1691591	2111309	108241	130873	163345	0.83972548	0.84325221	0.83938812
	Central 9 de Enero - 4	845795	788561	2168543	65436	61008	167773	0.83892784	0.84499095	0.8363557
	Panam	6219458	5411819	6124068	481179	418694	473799	0.70196736	0.70350326	0.70276417
	Pedregal Power	3255994	3319588	3357744	251905	256825	259777	0.69921096	0.70281408	0.70374057
	Petroelectrica	2677292	38156	0	207133	2952	0	0.7308863	0.72000409	0
Diesel Plants NCV: 43 GJ/t EF: 0.074 tCO2/GJ	Petroterminales	135373	141526	153833	10027	10482	11394	0.78332791	0.83193267	0.81970219
	Panam	178446	159986	178446	13217	11850	13217	0.70196736	0.70350326	0.70276417
	Pedregal Power	98453	98453	98453	7292	7292	7292	0.69921096	0.70281408	0.70374057
	Copesa	30767	12307	36920	2279	912	2735	0.7595907	0.7595907	0.85453954
	Subestacion Panama	6153	0	6153	456	0	456	0.91150884	0	1.5191814
	Central 9 de Enero	6799397	2209035	830696	503609	163616	61527	0.66465439	0.65709171	0.66229114
Hydros Plants	Arkapal Auto-Edechi	0	0	0	0	0	0	0	0	0
	Ascanio Villalaz (Bayano)	0	0	0	0	0	0	0	0	0
	Dolega - edechi	0	0	0	0	0	0	0	0	0
	Edwin Fabrega (Fortuna)	0	0	0	0	0	0	0	0	0
	Esti	0	0	0	0	0	0	0	0	0
	Hidro panama - Indep-edemet	0	0	0	0	0	0	0	0	0
	La Estrella	0	0	0	0	0	0	0	0	0
	La Yeguada - edemet	0	0	0	0	0	0	0	0	0
	Los Valles	0	0	0	0	0	0	0	0	0
	Macho Monte	0	0	0	0	0	0	0	0	0

Build Margin Emission Factor (tCO_2e/year) Calculation

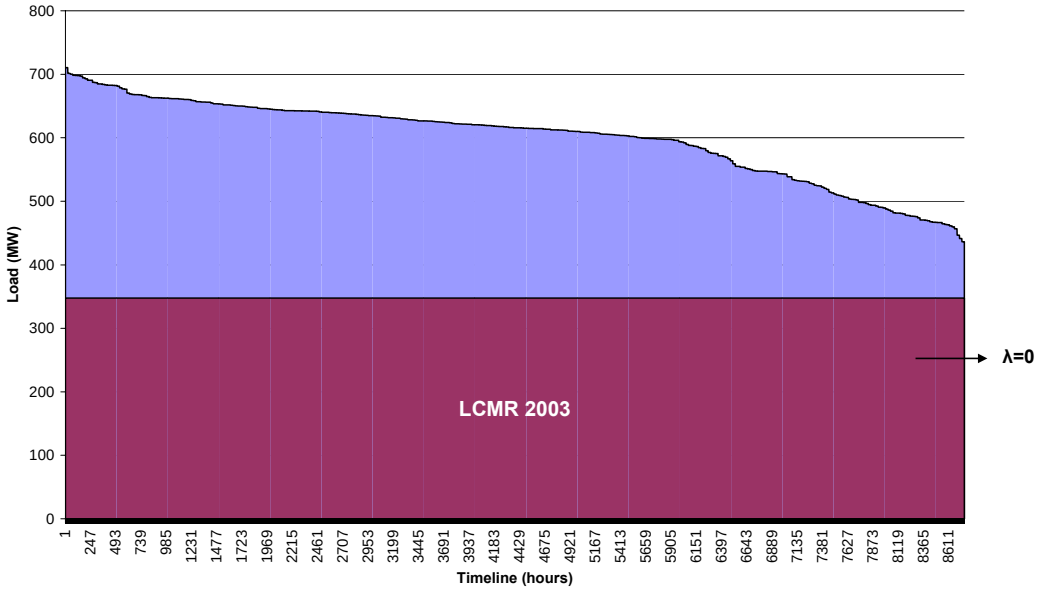
Build Margin Emission Factor (tCO2e/MWh)			
Recent plants	**Operation start year**	**MWh/year**	**tCO2/year**
Esti	**2003**	90300	0
Hidro panama	**2000**	8500	0
Panam	**1998**	704300	481179
Pedregal Power	**2002**	370700	251905
Copesa	**1996**	3000	2279
SUM		1176800	735362.9
MWh/year			1176800.0
tCO2e/y			735362.9
Build Margin (tCO2e/year)			**0.625**

Operating Margin Emission Factor (tCO_2e/year) Calculation

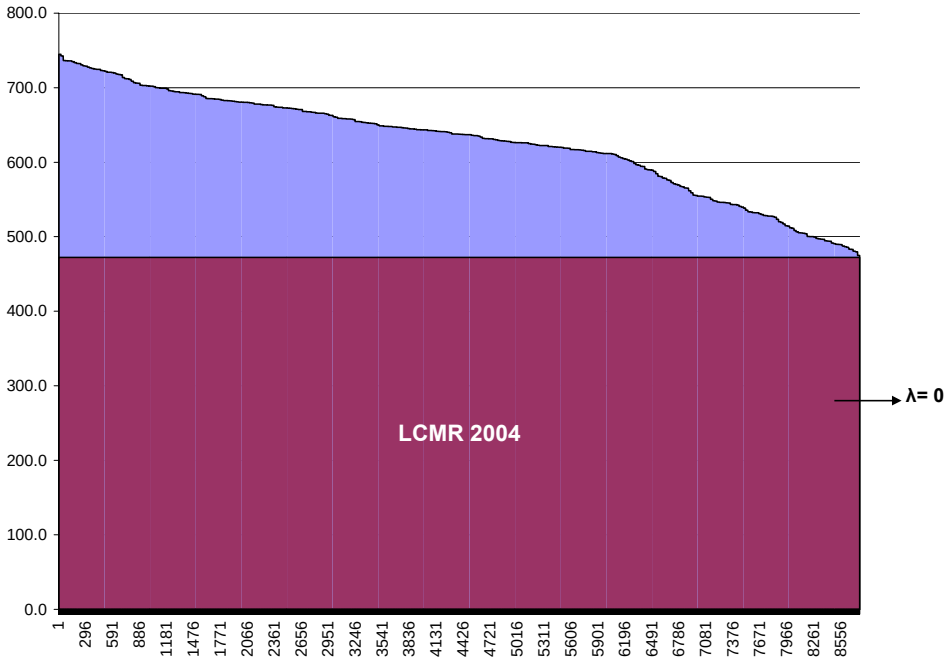
Operating Margin AVERAGE (2003, 2004, 2005)						
Fuel type	**Total emissions**	**Total generation**	**EF (by type)**	**λ**	**(1-λ)**	**EF OM**
	tCO2/yr	MWh/yr	tCO2/MWh	%	%	tCO2/MWh
Bunker plants	3,255,582	4,499,200	0.724	0.000%	100.000%	**0.723**
Diesel plants	827,650	1,147,300	0.721			
Total fossil	4,083,233	5,646,500	0.723			
Hydro	0	11,237,293	0.000			

Lambda (λ) Calculation Graphical

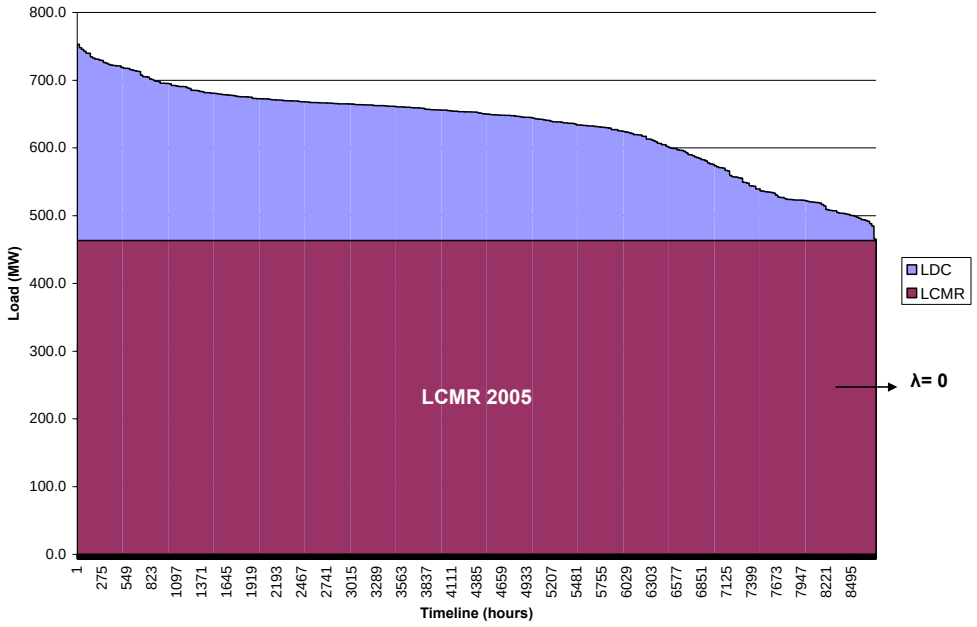
Load Duration Curve (LDC) 2003



Load Duration Curve (LDC) 2004



Load Duration Curve 2005



Combined Margin emission Factor (EF)

Combined margin (tCO2/MWh)		
	Weights	**tCO2/MWh**
OM	75%	0.723
BM	25%	0.625
CM	0.699	

Summary of the Emission Reduction Calculation

Summary of ex-ante ERs calculation			
Parameter	**Value**	**Units**	**Source**
Annual gross production	322,254	MWh/year	Wind ressource assessment
High wind hysteresis episodes	10%	%	Wind ressource assessment
Net annual production 1	290,029	MWh/year	Calculated
Grid unavailability losses	5%	%	Wind ressource assessment
Net annual production 2	275,527	MWh/year	Calculated
Electrical losses	5%	%	Wind ressource assessment
Net annual production 3	261,751	MWh/year	Calculated
CEF	0.699	tCO2/MWh	Simple adjusted calculation
Annual ERs flow	**182,854**	CERs/year	Calculated
Full load hours	3,231	hours/year	Calculated
Actual load factor	**36.89%**	**%**	Calculated

Annex 4

MONITORING INFORMATION

Table: CDM Monitoring System Procedures

Procedure name	Description	Scope
CDM Staff training	This procedure outlines the steps to ensure that staff receives adequate training to collect and archive complete and accurate data necessary for CDM monitoring.	This procedure will be followed by all staff on site prior to performing any monitoring duties for the CDM project.
CDM data and record keeping arrangements	This procedure provides details of the sites data and record keeping arrangements. The arrangements ensure that complete and accurate records are retained by the CDM Manager within the quality control system. Data and records will be stored and archived according to this procedure.	All data and records will be managed following this procedure. All staff are responsible for ensuring that any data or records are dealt with according to this procedure.
Data collection	This procedure will outline the steps to collect the data from the main grid company electricity meter and the cross check meter (on site).	The procedure for the data collection of the revenue meter will be agreed on by the grid company and the project developer
CDM data quality control and quality assurance	Data and records will be checked prior to being stored and archived. Data from the project will be checked to identify possible errors or omissions. The data checks will include cross checks of the two electricity meters, and checks of the electricity figures on the receipts. All records will be checked for completeness.	All staff are responsible for ensuring the collection and archiving of complete and accurate data and records.
Electricity meter maintenance	This procedure outlines the steps to provide regular and preventative maintenance to the main electricity meter and the cross-check electricity meter.	This procedure will be followed by all staff involved in checking and maintaining the on site electricity meter. The revenue meter will be sealed by the project developer and the grid company jointly. One party cannot unseal or modify the electricity meter in the absence of the

Procedure name	Description	Scope
		other party.
Equipment calibration	This procedure details the process of organising and managing the calibration process. The procedure includes details of how a suitable company or organisation is commissioned to undertake the calibration to the relevant standards.	The calibration of the electricity meters will be conducted by a suitable company according to the relevant standards. The CDM Manager is responsible for organising the calibration and ensuring that records are retained.
Equipment failure	This procedure details the process of data collection in the case that a problem with both the revenue and the cross-check meter occur	This procedure will be agreed on by the grid company and the project developer

Task	On-site technician	Operations manager	Project developer's head office	Head of Maintenance / External company	EcoSecurities
Collect Data	E	R	N/A	N/A	N/A
Enter data into Spreadsheet	N/A	E	R	N/A	N/A
Make monthly and annual reports	N/A	E	E/R	N/A	I
Archive data & reports	N/A	E	R	N/A	N/A
Calibration/ Maintenance	I	R	I	E	I
Training	N/A	N/A	N/A	N/A	C

Table: Operational procedures and responsibilities for monitoring and quality assurance of emissions reductions from the project activity:

E = Responsible for executing data collection,
R = Responsible for overseeing and assuring quality,
C = Responsible for instructing about CDM,
I = To be informed,
N/A = Not applicable.

- - - - -