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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Red Cap Kouga Wind Farm
Version 1
Date: 20/01/2012

A.2. Description of the project activity:

Red Cap Kouga Wind Farm (Pty) Ltd is developing the Kouga Wind Farm (hereinafter the "Project") in Oyster Bay, South Africa. The project will comprise the installation of 32 Nordex N90 2500 HS wind turbines, each turbine of 2.5MW with a total installed capacity of 80 MW.

The project will use wind power to generate renewable electricity, which will be delivered to the national electricity grid of South Africa. The renewable electricity produced by the project will avoid CO_2 emissions from electricity generation in fossil fuelled power plants. Prior to the start of the implementation of the project activity, no power generation had occurred at the project site: this is a greenfield project activity.

The baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity: electricity delivered to the grid by the project activity would have 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 described in the "Tool to calculate the emission factor for an electricity system".

The project will contribute to the sustainable development of South Africa as it will foster and stimulate the expansion of renewable energy technologies. Furthermore, by demonstrating the viability of larger grid-connected wind farms, the project will strengthen and diversify the national energy supply.

Other benefits to sustainable development in South Africa are summarized below[1]:

- Wind power is one of the cleanest renewable resources available;
- Wind power is considered the most appropriate technology in order to bring significant amounts of renewable energy onto the grid in the shortest time period, thus helping preventing the electricity shortages that have been forecasted if new energy generation sources are not up and running soon;

The project will:

- Contribute to national and international efforts to reduce emissions of greenhouse gases and other air pollutants through the displacement of fossil fuel power sources;
- Increase energy supply, diversity and security;
- Provide greater electricity distribution network efficiency, through reduced transmission losses;
- Provide a source of income and employment in regional areas;

[1] Environmental Impact Assessment for a Wind Farm in the Kouga Local Municipality, volume 1 of 3, pages 77 and 143, dated March 2011, prepared by GIBB Engineering & Science

- Reduce regional community and government dependence on fossil fuels;

A project of this nature generates new economic activities within the region together with a broad range of employment opportunities. The civil engineering and construction components of the project will take place over a period of three to four years and will result in an additional 360 jobs being created per year. Of these, 326 will be for semi-skilled workers who will be drawn from the surrounding communities, and could possibly be people who are currently unemployed.

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)
South Africa (host)	• Red Cap Kouga Wind Farm (Pty) Ltd (Private Entity)	No
Belgium	• Electrabel SA/NV	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.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

The project site is located near Oyster Bay, within the Kouga Local Municipality of the Eastern Cape.

The nearest city to the site is Port Elizabeth, located approximately 70 km to the north east and the nearest town is Humansdorp, located approximately 20 km to the north.

A.4.1.1. Host Party(ies):

South Africa

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

Eastern Cape Province

A.4.1.3. City/Town/Community etc.:

Humansdorp

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

The project is located in Eastern Cape Province, near to the town, Humansdorp. The location can be seen in Figure 1 and Figure 2 (in orange) below:

Figure 1. South Africa location (source: Wikipedia)

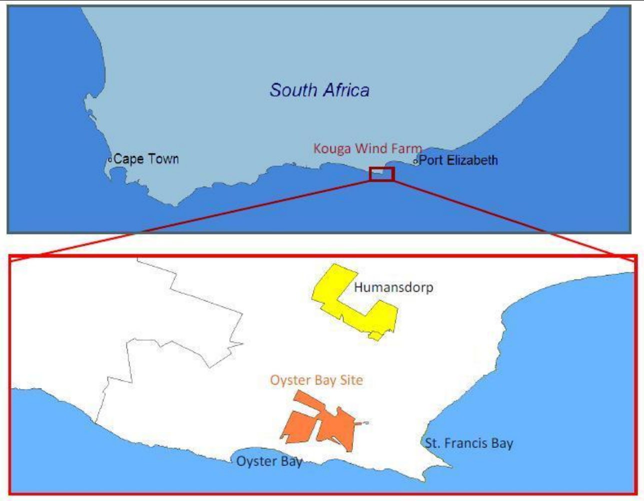

Figure 2. Project activity location

Site coordinates are: 34.1470 S; 24.7110[2] E.

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

Sectoral Scope 1: Energy industries – renewable/non renewable sources.

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

The project activity involves the installation of 32 Nordex N90 2500 HS wind turbines, with a rotor hub height of 80 meters, in a greenfield site. Prior to the start of the implementation of the project activity, no other power generation equipment was installed. The wind turbine details are presented in Table 1 below:

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[2] Nordex, Site assessment report Kouga (South Africa), page 14 converted from UTM WGS84 S Zone: 35, 288,964E and 6,219,176N.

Table 1. Turbine technical details[3]

Operating data	
Expected lifetime	20 years[4]
Rated Power	2500kW
Cut-in wind speed	3m/s
Cut-out wind speed	25m/s
Rotor	
Diameter	90m
Swept area	6,362m2
Speed	10.3 - 18.1 rpm
Tip speed	75 m/s
Speed control	Variable via microprocessor
Overspeed control	Pitch angle
Tower	
Construction	Tubular steel tower
Rotor hub height	80 m

Consequently, the wind farm, considering all wind turbines, will have 80 MW total installed capacity and is expected to generate 290,500 MWh/year, with an average capacity factor of approximately 41.5%, which is a P50 estimate[5].

The project will use an environmentally safe and sound technology in the electricity sector, as it uses a renewable source to produce power. The renewable electricity delivered to the grid by the project activity 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 described in the “Tool to calculate the emission factor for an electricity system”. This is also the baseline scenario.

As the operation of the project is local, know how will be transferred from the turbine manufacturer country (Denmark/Germany) to South Africa. Personnel will be trained to onsite operations.

According to the latest version of ACM0002 page 8, the greenhouse gases accounted for are restricted to CO_2 emissions from fossil fuelled power plants.

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[3]Nordex, available online from http://www.nordex-online.com/fileadmin/MEDIA/Gamma/Nordex_Gamma_en.pdf, , page 12, last accessed on 22 December 2011

[4] Source: EPC contract, page 6

[5] Assessment of the energy production of the proposed Kouga Wind Farm in South Africa, dated October 2011, page 11, prepared by Garrad Hassan & Partners Ltd.

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

Year*	Annual estimation of emission reductions in tones of CO_2e
2014	203,480
2015	305,220
2016	305,220
2017	305,220
2018	305,220
2019	305,220
2020	305,220
2021	305,220
2022	305,220
2023	305,220
2024	101,740
Total estimated reductions (tonnes of CO_2e)	3,052,200
Total number of crediting years	10
Annual average over the crediting period of estimated reductions tonnes of CO_2e)	305,220

* From 6 April 2014 to 5 April 2024

A.4.5. Public funding of the project activity:

There is no public funding from any Annex I Party for this project.

SECTION B. Application of a baseline and monitoring methodology

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

The baseline and monitoring methodology to be applied to the project activity is: ACM0002 "*Consolidated Baseline Methodology for grid-connected electricity generation from renewable sources*", (Version 12.2.0, EB65).

The project will also make use of the following methodological tools:

- "Tool for the demonstration and assessment of additionality" (Version 06.0.0)
- "Tool to calculate the emission factor for an electricity system" (Version 02.2.1)

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

The proposed project activity meets each of the applicability criteria as set out under ACM0002. "Consolidated baseline methodology for grid-connected electricity generation from renewable resources" (Version 12.2.0).

This is demonstrated in Table 2 below:

Table 2. ACM0002 Applicability criteria

Applicability Criteria	Project
This methodology is applicable to grid-connected renewable power generated project activities that: a) Install a new power plant at the site where no renewable energy power plant was operated prior to the implementation of the project activity (Greenfield plant) b) Involve a capacity addition c) Involve a retrofit of an existing plant d) Involve a replacement of an existing plant	The project involves the installation of a grid-connected, renewable power plant on a farm land. The Kouga wind farm will be installed on a site where there is currently no renewable energy power plant. The project is a greenfield plant.
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	The project is the installation of a wind power plant.
In case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 10 to calculate the parameter $EG_{PJ,y}$): the existing plant started commercial operation prior to the start of a minimum historical reference of five years, used for the calculation of baseline emissions and defined in the baseline emissions section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	The project is not a capacity addition, retrofit or replacement. The project is a new (greenfield) power plant.
In the case of hydro power plants, one of the following conditions must apply:	The project is not a hydro power plant.

· The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or · The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2; or · The project activity results in the new reservoirs and the power density of the power plant, as per definitions given the Project Emissions section, is greater than 4 W/m^2.	
The methodology is not applicable to the following: • Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; • Biomass fired power plants; • A hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than 4 W/m2.	The project is not a project activity that involves switching from fossil fuels to renewable energy sources, nor a biomass fired power plant, nor a hydro power plant.
In the case of retrofit, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is “the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance”.	The project is not a retrofit, replacement or capacity addition.

Hence, the project activity complies with all the applicability criteria as specified in the selected methodology.

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

The project boundary encompasses the project power plant and all power plants connected physically to the electricity system which in this case is the South African electricity grid.

The greenhouse gases and emissions sources included in the project boundary are shown below:

Source		Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emissions source from the consumption of fossil-fuels (predominantly coal) to produce electricity for the South African electricity grid
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	The project activity is not a geothermal power plant.
		CH_4	No	The project activity is not a geothermal power plant.
		N_2O	No	The project activity is not a geothermal power plant.
	CO_2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	The project activity is not a geothermal or solar thermal power plant
		CH_4	No	The project activity is not a geothermal or solar thermal power plant
		N_2O	No	The project activity is not a geothermal or solar thermal power plant
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	The project activity is not a hydro power plant
		CH_4	No	The project activity is not a hydro power plant
		N_2O	No	The project activity is not a hydro power plant

Below it is presented the project diagram.

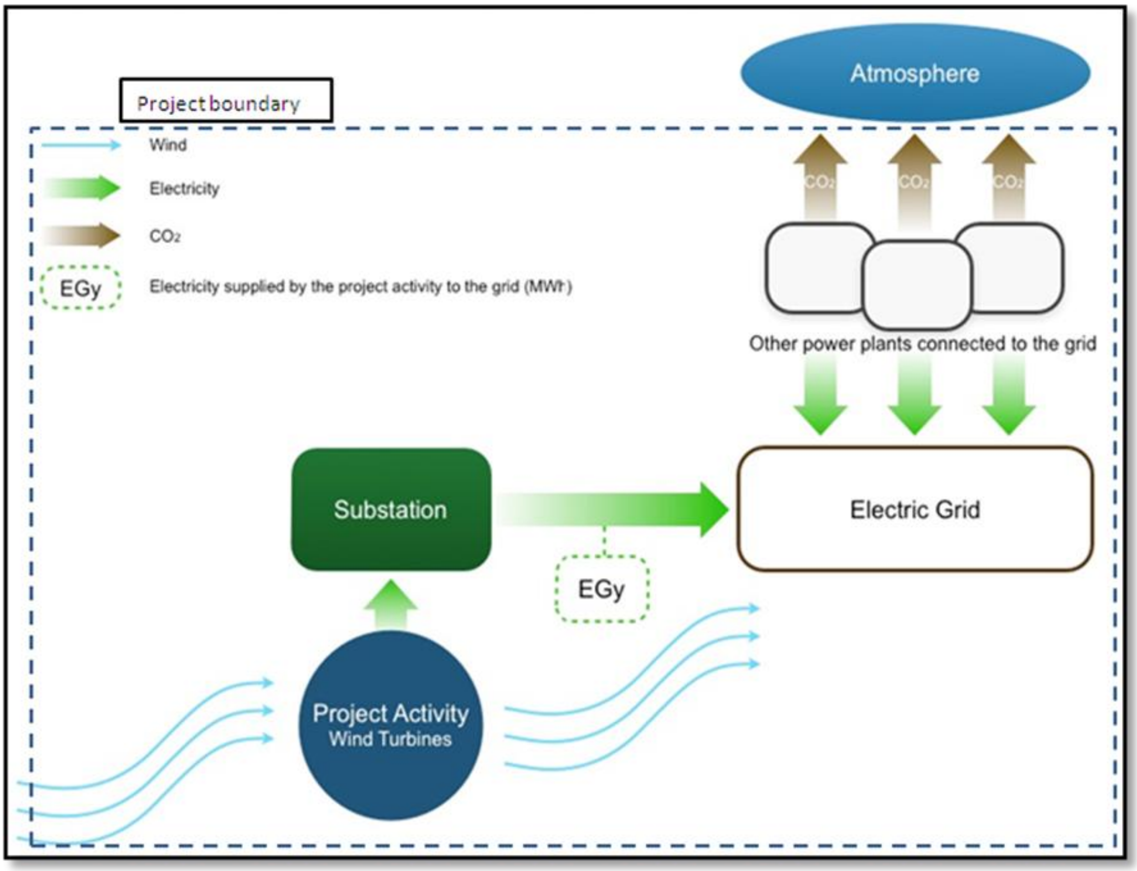

Figure 3. Flow diagram of the project boundary

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

ACM0002 (version 12.2.0) identifies the baseline scenario for a project activity that is a new grid-connected renewable power plant as the following: "*Electricity delivered to the grid by the project activity 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 described in the "*Tool to calculate the emissions factor for an electricity system*".

Therefore the baseline scenario for the Kouga Wind Farm is the production of electricity by the existing fossil-fuelled power plants connected to the national grid. This is represented by the combined margin (CM) Grid Emission Factor for the South African electricity grid as calculated when applying the "*Tool to calculate the emissions factor for an electricity system*" (Version 02.2.0).

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):

Prior Consideration of the CDM

Prior Consideration was addressed accordingly in line with the "Guidelines on the demonstration and assessment of prior consideration of the CDM" version 4 (EB 62, Annex 13) that mentions: "*When validating a project activity with a start date on or after 2 August 2008, DOEs shall ensure by means of confirmation from the UNFCCC secretariat that such a notification had been provided.*"

The start date is defined as *the earliest date at which either the implementation or construction or real action of a project begins*[6]. This is generally the date on which the project participant has committed to expenditures related to the implementation or construction of the project. The date that corresponds to the Kouga project starting date is the 02/11/2011 which is the date corresponding to the date of EPC Term Sheet signature between Red Cap and EPC Engineer, Nordex.

CDM has been considered from the inception of the project. The project participants lodged prior consideration with the UNFCCC secretariat and the South African DNA before the start date of the project. The "Prior Consideration of the CDM" form was registered by the UNFCCC on the 12/05/2011 and sent the same day to the South African DNA. Proof of reception was sent by the DNA to Red Cap on the 13/05/2011.

Additionality

The methodology ACM0002 stipulates the use of the "Tool for the demonstration and assessment of additionality". The latest version (v. 06.0.0, Annex 21 - EB 65) of this tool is used to assess the additionality of the proposed project. The tool follows a stepwise approach consisting of:

- Identification of alternatives to the project activity;
- Barrier analysis and
- Common practice analysis.

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

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

The latest version of *"Tool for the demonstration and assessment of additionality" (version 06.0.0),* states clearly that for projects applying ACM0002, you only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity.
The following are realistic alternatives available to the project developer:

a) The project is undertaken without registration as a CDM project; or

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[6] The Board agreed to clarify that the primary purpose of defining the start date of a project activity is to ensure that project activities submitted for registration comply with the requirements of paragraph 13 of Decision 17/CP.7. In this context, it has always been the Board's view that the start date of a CDM project activity is the earliest of the dates at which the implementation or construction or real action of the project activity begins.

b) No project activity is undertaken.

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

Alternative a): This alternative, and likewise the project activity, is in compliance with South African laws and regulations.

Alternative b): There is no requirement imposed on the project developers to build a wind farm, and therefore not undertaking the project activity would not be in contravention of any South African laws or regulations.

Therefore both alternatives are real and credible options available to the project developer.

Step 3: Barrier Analysis

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

Barriers due to prevailing practice, *inter alia*:
the project activity is the "first-of-its-kind".

According to EB 65 annex 21 (paragraph 40.2), the project activity is a "first-of-its-kind":

"(a) For the measures identified under paragraph 6, a proposed project activity is the First-of-its-kind in the applicable geographical area if:

> *(ii) The project is the first in the applicable geographical area that applies a technology that is different from any other technologies able to deliver the same output and that have started commercial operation in the applicable geographical area before the start date of the project; and*
>
> *(iii) Project participants selected a crediting period for the project activity that is .a maximum of 10 years with no option of renewal.*

(b) For the measures identified under paragraph 6, a proposed project activity that was identified as the First-of-its-kind project activity is additional and Sub-step 3 b does not apply.

(c) For other measures, the project proponents shall propose approach for demonstrating that a project is a .first-of-its-kind. and Sub-step 3 b applies."

The four types of measures identified in paragraph 6 are:

"*6. **Measure** (for emission reduction activities) is a broad class of greenhouse gas emission reduction activities possessing common features. Four types of measures are currently covered in the framework:*

(a) Fuel and feedstock switch;

(b) *Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies);*

(c) *Methane destruction;*

(d) *Methane formation avoidance."*

The project activity is covered by the framework of the paragraph 6, point (b): "*Switch of technology with or without change of energy source (including energy efficiency improvement as well as use of renewable energies)*", as described in the Annex 21 of the EB 65.

Different technologies in the context of first of its kind are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed CDM project and applicable geographical area):

(a) Energy source/fuel;

(b) Feed stock;

(c) Size of installation (power capacity):

(i) Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision 3/CMP.6);

(ii) Small (as defined in paragraph 28 of Decision 1/CMP.2);

(iii) Large. [7]

In terms of the definitions in EB63 annex 11 "*Guidelines on additionality of first-of-its-kind project activities*", the Kouga wind power plant will thus be a first-of-its-kind project if no other large scale (> 15 MW) wind power plants have reached commercial operation within the borders of South Africa (*applicable geographical area*[8]) before 02/11/2011 (start date of the project).

The renewable energy sector in South Africa is still in the early stages of development. Even though small, government demonstration[9] wind farms (pilot projects) are operational in South Africa (Klipheuwel (3.16MW), Darling (5.2 MW) and Coega (1.8 MW) wind farms), large commercial wind farms have not yet been developed. Therefore, there are at present (January 2012) or at the project

[7] EB63, Annex 11 "*Guidelines on additionality of first-of-its-kind project activities*" paragraph 4

[8] In terms of EB 63, annex 11, paragraph 1: "*Applicable geographical area covers the entire host country as a default".*

[9]South African Department of Energy. Wind Power. Available online from: http://www.energy.gov.za/files/windEnergyCampaign/WindEnergyEconomicsFactSheet3.pdf , last accessed on 16 January 2012. This fact sheet is part of the South African Wind Energy Awareness Campaign: Powered by Wind, launched by South Africa's Minister of Energy, Dipuo Peters together with Danish Minister for Climate, Energy and Building, Martin Lidegaard on the 08/12/2011. It is the country's first campaign focused on creating all-important awareness around wind energy and its benefits on a local environmental and economic level.

starting date (November 2011) no large scale, grid-connected wind farms exporting electricity to the South African electricity grid.

Table 3 gives a list of all wind farm projects currently (January 2012) in operation in South Africa and compares it with the proposed project activity (Kouga Wind Farm). The list of wind farm projects in operation has been confirmed by Andre Otto[10] the former project manager of the South Africa Wind Energy Programme (SAWEP) at the South African Department of Energy.

Table 3. Comparison between the Klipheuwel Wind Farm, the Darling Wind Farm, the Coega Wind Farm and the Kouga Wind Farm

	Klipheuwal Wind Farm[11]**:**	**Darling Wind Farm**[12]	**Coega Wind Farm (first phase)** [13:]	**Kouga Wind Farm –"project activity"**
Total capacity (MW)	3.16	5.2	1.8	80
Scale of the project	Small (pilot project)	Small (pilot project)	Small (pilot project)	Large scale
Year of Operation	The first unit started generating on 16/08/2002 and the last unit on 20/02/2003.	May-08	Jun-10	Apr-14

The Kouga Wind Farm project is considered a First-of-its-kind because:

1. No other large scale (> 15 MW) wind power plants have reached commercial operation within the borders of South Africa (*applicable geographical area*) before 02/11/2011 (start date of the project) as demonstrated in Table 3.

2. The Project participant selected a crediting period for the project activity that is a maximum of 10 years with no option of renewal.

Outcome of step 3a:

The proposed project activity was identified as a First-of-its-kind project activity and is therefore additional.

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[10] Email dated 18/01/2012.

11 South African Department of Energy. Wind Power. Available online from: http://www.energy.gov.za/files/renewables_frame.html. Please select wind power tab on the left hand side of the webpage in order to access data [Accessed 22/12/2011].

12 Darling Wind Power (Pty) Ltd. Available online from http://www.darlingwindfarm.co.za/aboutus.htm , last accessed on 22/12/2011

13 Electrawinds. Available online from http://www.electrawinds.be/electrawinds_powered_by_nature-electrawinds_artikels.asp?taal=en&paginaID=623&artikelID=11934, last accessed on 16/01/2012

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

For the measures identified under paragraph 6 of the "Tool for the demonstration and assessment of additionality" version 6, a proposed project activity that was identified as the First-of-its-kind project activity is additional and Sub-step 3 b does not apply (paragraph 40 of the "Tool for the demonstration and assessment of additionality" version 6).

Step 4: Common practice analysis

The latest version (v. 06.0.0, Annex 21 - EB 65) of the " Tool for the demonstration of additionality" stipulates, in paragraph 43, that "*unless the proposed project type has demonstrated to be first-of-its kind (according to Sub-step 3a), and for measures different from those listed in paragraph 6 the above generic additionality tests shall be complemented with an analysis of the extent to which the proposed project type (e.g. technology or practice) has already diffused in the relevant sector and region.".* As Kouga Wind Farm is demonstrated to be first-of-its kind (according to Sub-step 3a), no common practice analysis is required.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Project Emissions

According to the latest version of ACM0002, the project emissions shall be calculated using the following equation:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

As this project does not involve fuel consumption, geothermal power generation or water reservoirs, the project emissions are deemed zero; i.e.: PE = 0

Baseline emissions

According to the latest version of ACM0002, the baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are to be calculated as follows:

$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y}$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2e/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"

<u>Calculation of $EG_{PJ,y}$</u>

The calculation of $EG_{PJ,y}$ is different for (a) Greenfield plants, (b) retrofits and replacements, and (c) capacity additions. The project activity is case (a) Greenfield plants, described as follows:

(a) Greenfield renewable energy power plants

If the project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$EG_{PJ,y} = EG_{facility,y}$

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh/yr)
$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/yr)

Therefore, the baseline emissions are calculated using the formula below:

$BE_y = EG_{facility,y} \cdot EF_{grid,CM,y}$

Leakage

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing and transport). These emissions sources are neglected.

Emission reductions

Emission reductions are calculated as follows:

$ER_y = BE_y – PE_y$

Where

ER_y	=	Emissions reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)
PE_y = Project emissions in year *y* (tCO_2e/yr)

As stated above, no project emissions are considered in this project activity, thus $ER_y = BE_y$ and consequently:

$$ER_y = EG_{facility,y} \cdot EF_{grid,CM,y}$$

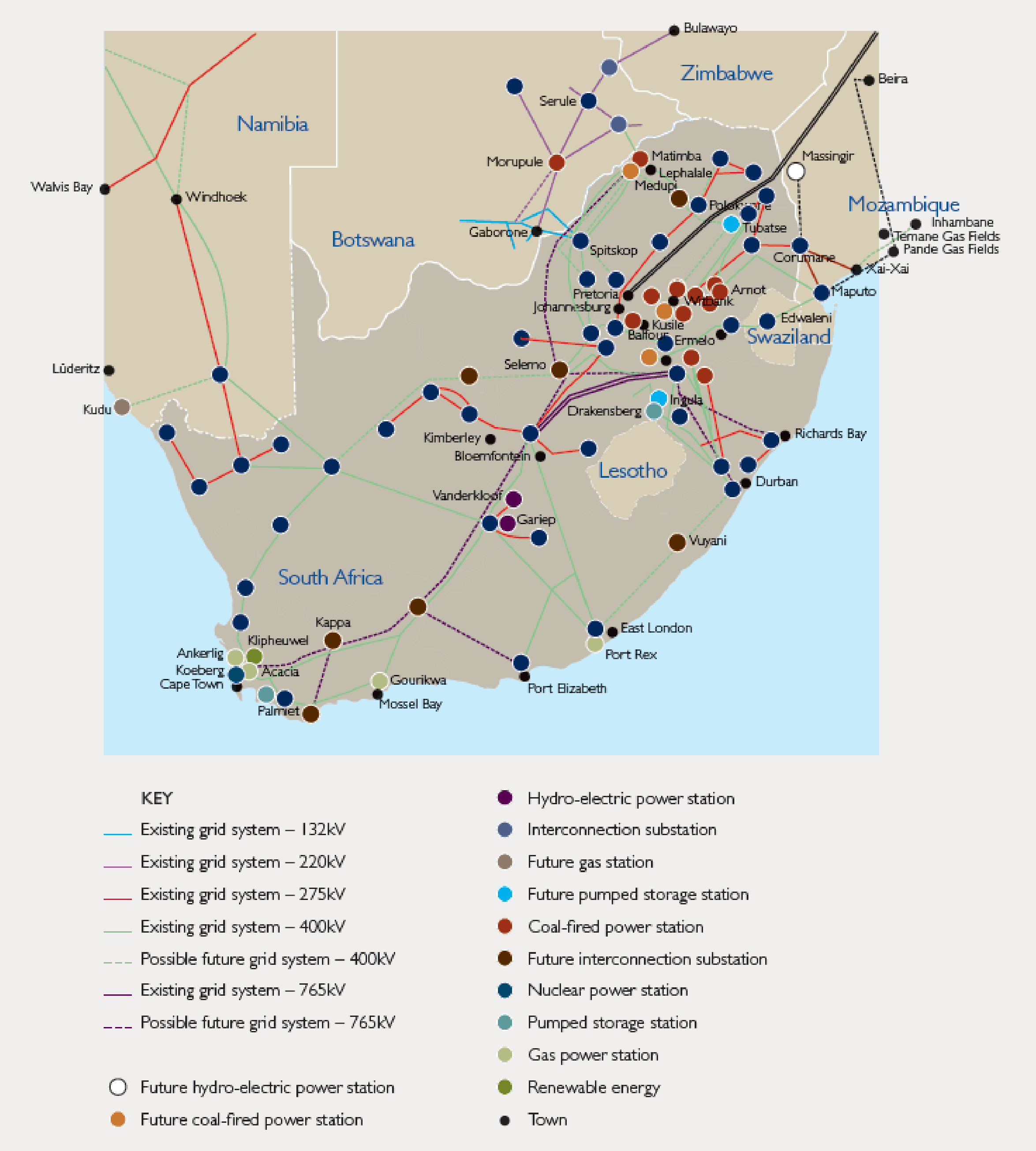
Calculation of $EF_{grid,CM,y}$

According to the latest version of ACM0002, the $EF_{grid,CM,y}$ shall be calculated according to the "Tool to calculate the emission factor for an electricity system". This tool requires the project participants to apply the following six steps:

STEP 1. Identify the relevant electricity systems;
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3. Select a method to determine the operating margin (OM);
STEP 4. Calculate the operating margin emission factor according to the selected method;
STEP 5. Calculate the build margin (BM) emission factor;
STEP 6. Calculate the combined margin (CM) emission factor;

Step 1: Identify the relevant electricity system

The South African DNA has no delineation on the project electricity system and connected electricity system. Thus the project participants define the project electricity system as the complete South African electricity grid, as it is recommended in the tool to use the national grid as a default. The grid map is presented below:



The map indicates the South African power network and some interconnections with neighbouring countries.

Figure 4. South African electricity grid (source: Eskom)[14]

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[14] Eskom holding, available online from: http://financialresults.co.za/2010/eskom_ar2010/profile_sa_grid_map.htm and last accessed on 21/12/2011

Eskom, the grid operator, generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customers and also to redistributors in South Africa. This company generated 95.86% of the South African national grid generation in 2010. The 4.14% remainder was imported from other neighbouring countries[15].

For the purpose of determining the operating margin emission factor, the electricity imports are considered to have an emission factor of 0 tCO_2/MWh.

STEP 2: Choose whether to include off-grid power plants in the project electricity system

Option I was chosen: Only grid-connected power plants are included in the calculation

STEP 3: Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under step 4:

(a) Simple OM; or
(b) Simple adjusted OM; or
(c) Dispatch data analysis OM; or
(d) Average OM.

The simple OM method (Option a) can only be used if low-cost/must-run sources constitute less than 50% of total grid generation in: 1) based on the average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

The dispatch data analysis (Option c) cannot be used if off-grid power plants are included in the project electricity system as per Step 2 above.

The South African electricity grid is mostly dependent on coal power generation, as noted in Table 4 below:

Table 4. Electricity generation by source (source: Eskom[16])

	2006	2007	2008	2009	2010
Coal-fired	89.3%	88.5%	89.1%	89.0%	88.9%
Hydro-electric	0.5%	1.0%	0.3%	0.5%	0.5%
Pumped storage	1.2%	1.2%	1.2%	1.2%	1.1%
Gas turbine	0.0%	0.0%	0.5%	0.1%	0.0%
Nuclear	4.9%	4.8%	4.5%	5.5%	5.3%
Wind energy	0.0%	0.0%	0.0%	0.0%	0.0%
Foreign imports	4.0%	4.4%	4.4%	3.8%	4.1%

[15]Eskom holding, available online from http://financialresults.co.za/2010/eskom_ar2010_/profile_key_facts.htm, last accessed on 22/12/2011

[16] Eskom holding, available online from http://financialresults.co.za/2010/eskom_ar2010/profile_key_facts.htm, last accessed on 22/12/2011

Hydro, Wind and Nuclear are deemed low-cost/must-run sources for this electricity grid. As it represents between 5% and 6% of the grid generation the (a) Simple OM method can be used.

For the simple OM, the emission factor can be calculated using either of the two following data vintages:

- *Ex ante* option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For the grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation;
- *Ex post* option: If the *ex post* option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year *y* is usually only available later than six months after the end of year *y*, alternatively the emission factor of the previous year (*y*-1) may be used. If the data is usually only available 18 months after the end of year *y*, the emission factor of the year preceding the previous year (*y-2)* may be used. The same data vintage (*y*, *y-1* or *y-2*) should be used throughout all crediting periods.

For this project activity, the *ex ante* option is chosen, using data from years 2008-2009, 2009-2010 and 2010-2011.

STEP 4: Calculate the operating margin emission factor according to the selected method

(a) <u>Simple OM</u>

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated by one of the following two options:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or
Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option B can only be used if:

(a) The necessary data for Option A is not available; and
(b) Only nuclear and renewable power generation are considered as low-cost/must run power sources and the quantity of electricity supplied to the grid by these sources is known; and
(c) Off-grid power plants are not included in the calculation.

Option A – Calculation based on average efficiency and electricity generation of each plant

Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year *y* (tCO_2e/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	=	All power units serving the grid in year *y* except low-cost/must run power units
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EF_{EL,m,y}$

The emission factor of each power unit m should be determined as follows:

Option A1. If for a power unit *m* data on fuel consumption and electricity generation is available (as in this project case), the emission factor ($EF_{EL,m,y}$) should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_{i} \left(FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y} \right)}{EG_{m,y}}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2e/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type *i* consumed by power unit m in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	=	All power units serving the grid in year *y* except low-cost/must run power units
i	=	All fossil fuel types combusted in power sources in the project electricity system in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

$EG_{m,y}$ is determined once for each crediting period, using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex-ante*).

For this approach (simple OM) to calculate the operating margin, the subscript *m* refers to power plants/units delivering electricity to the grid, not including low-cost/must run power plants and including electricity imports to the grid. Electricity imports should be treated as one power plant *m*.

STEP 5: Calculate the build margin (BM) emission factor

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, *ex post*, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated *ex ante*, as described in Option I above. For the third crediting period, the build margin emission factor calculated for the second period should be used.

Option 1 was chosen for the build margin calculation.

According to the "Tool to calculate the emission factor for an electricity system", capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor. The project participants followed this rule.

The sample group of power units *m* used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as a CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities, (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as a CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\geq 20\%}$, in MWh);

(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case ignore steps (d), (e) and (f).

Otherwise:

(d) Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent that this is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);

If the annual electricity generation of that set is comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f).

Otherwise:

(e) Include in the sample group $SET_{sample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

(f) The sample group of power units *m* used to calculate the build margin is the resulting set ($SET_{sample\text{-}CDM\text{->}10yrs}$).

In this project case, the sub-steps (a), (b), (c), (e) and (f) were used. Due to the South Africa electricity grid specifics, the project participants found necessary to add CDM power plants and power plants older than 10 years to the build margin set. The set defined can be seen in the annex 3.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year *y* for which electricity generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which electricity generation data is available

According to the “Tool to calculate the emission factor for an electricity system”, the CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) should be determined as per the guidance in Step 4 (a) for the simple OM using options A1, A2 or A3, using for *y* the most recent historical year for which electricity generation data is available, and using for *m* the power units included in the build margin.

However, if the power units included in the build margin *m* correspond to the sample group $SET_{sample\text{-}CDM\text{->}10yrs}$ (as in this project case), the option A2 shall be used and the default values provided in the "Tool to calculate the emission factor for an electricity system" annex I shall be used.

Option A2

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}}$$

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	Power units included in the build margin
y	=	Most recent historical year for which electricity generation data is available

STEP 6: Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or
(b) Simplified CM.

The project participants followed the recommendation to use the weighted average CM method (option (a)) as the preferred option.

<u>(a) Weighted average CM</u>

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} * w_{OM} + EF_{grid,BM,y} * w_{BM}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

The following default values should be used for w_{OM} and w_{BM}:

- Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;
- All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM}=0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

This is a wind power project, thus w_{OM} = 0.75 and w_{BM} = 0.25.

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

Data / Parameter:	**$FC_{i,m,y}$**
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*
Source of data used:	Eskom records[17]
Value applied:	(see table below)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Eskom is the local utility. This data is determined only once in this crediting period (*ex-ante*), using the most recent three historical years for which data is available at the time of submission of the CDM-PDD.
Any comment:	Eskom annual reports, used for fuel consumptions cover the period from April to March. Thus this is the reason each column presents two years

	Fuel consumption (ton) [1]		
Plant Name	**2008-09**	**2009-10**	**2010-11**
Arnot	6,395,805	6,794,134	6,525,670
Duvha	11,393,553	11,744,606	10,639,393
Hendrina	7,122,918	6,905,917	7,139,198
Kendal	15,356,595	13,866,514	15,174,501
Kriel	9,420,764	8,504,715	9,527,185
Lethabo	16,715,323	18,170,227	17,774,699
Matimba	13,991,453	14,637,481	14,596,842
Majuba	12,554,406	12,261,833	13,020,512
Matla	12,689,387	12,438,391	12,155,421
Tutuka	11,231,583	10,602,839	10,191,709
Acacia			360
Port Rex			228
Camden	3,876,211	4,732,163	4,629,763
Grootvlei	674,538	1,637,371	2,132,979
Komati		664,497	1,271,010

Data / Parameter:	**$NCV_{i,y}$**
Data unit:	TJ/Mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	2006 IPCC guidelines on National GHG Inventories; provided in Table 1.2 of Chapter 1 of Vol. 2
Value applied:	(see table below)

Fuel type	**NCV[TJ/ton]**

[17] Eskom holding, available online from http://www.eskom.co.za/live/click.php?u=%2Fcontent%2FCEF_CalculatorFINAL2010-2011%7E2.xls&o=Item%2B236&v=62a438 and last accessed on 19/01/2012

	Coal 0.0216 Kerosene 0.0424
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using IPCC default values at the lower limit of the uncertainty at a 95% confidence interval. Determined for the purpose of OM and BM calculation using the *ex-ante* option.
Any comment:	From the relevant IPCC table; the project participants used the values of “anthracite” for the coal consumption “other kerosene” for the kerosene consumption.

Data / Parameter:	**$EF_{CO2,i,y}$**
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data used:	2006 IPCC guidelines on National GHG Inventories; provided in Table 1.4 of Chapter 1 of Vol. 2
Value applied:	**Fuel type** / **EF_{CO2}[tCO2/TJ]** Coal 94.6 Kerosene 70.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	Using IPCC default values at the lower limit of the uncertainty at a 95% confidence interval. Determined for the purpose of OM and BM calculation using the *ex-ante* option.
Any comment:	From the relevant IPCC table; the project participants used the values of “anthracite” for the coal consumption “other kerosene” for the kerosene consumption.

Data / Parameter:	**$\eta_{m,y}$**
Data unit:	-
Description:	Average net energy conversion efficiency of power unit *m* in year *y*
Source of data used:	Tool to calculate the emission factor for an electricity system version 02.2.1, annex 1.
Value applied:	**Plant Name** / **$\eta_{m,y}$ [5]** Majuba 37% Kendal 37%
Justification of the choice of data or description of measurement methods and procedures	-

actually applied :	
Any comment:	-

B.6.3. Ex-ante calculation of emission reductions:

Baseline emissions

According to section B.6.1, the baseline emissions are calculated as follows:

$BE_y = EG_{facility,y} \cdot EF_{grid,CM,y}$

Emission reductions

Emission reductions are calculated as follows:

$ER_y = BE_y – PE_y$

Where

ER_y = Emissions reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)

PE_y = Project emissions in year *y* (tCO_2e/yr)

As stated above, no project emissions are considered in this project activity, thus $ER_y = BE_y$ and consequently:

$ERy = EG_{facility,y} \cdot EF_{grid,CM,y}$

Calculation of $EF_{grid,CM,y}$

According to the latest version of ACM0002, the $EF_{grid,CM,y}$ shall be calculated according to the “Tool to calculate the emission factor for an electricity system”. This tool requires the project participants to apply the following six steps:

STEP 1. Identify the relevant electricity systems;
STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3. Select a method to determine the operating margin (OM);
STEP 4. Calculate the operating margin emission factor according to the selected method;
STEP 5. Calculate the build margin (BM) emission factor;
STEP 6. Calculate the combined margin (CM) emission factor;

Step 1: Identify the relevant electricity system

The relevant system is described in section B.6.1.

STEP 2: Choose whether to include off-grid power plants in the project electricity system

Option I was chosen: Only grid-connected power plants are included in the calculation

STEP 3: Select a method to determine the operating margin (OM)

According to section B.6.1., the method chosen is the Simple OM *ex ante*.

STEP 4: Calculate the operating margin emission factor according to the selected method

Table 7 in annex 3 summarizes the simple OM calculation. The resulting values of this calculation are:

$EF_{grid,OMsimple,2008-2009}$ = 1.1082 tCO_2/MWh;
$EF_{grid,OMsimple,2009-2010}$ = 1.0939 tCO_2/MWh;
$EF_{grid,OMsimple,2010-2011}$ = 1.0819 tCO_2/MWh;

The weighted average, $EF_{grid,OMsimple,2008-2011}$= 1.0944 tCO_2/MWh.

STEP 5: Calculate the build margin (BM) emission factor

The *ex-ante* build margin emission factor ($EF_{grid,BM,2010}$)is 0.9194 tCO2/MWh. The set of power plants and the calculation is presented in annex 3 Table 8.

STEP 6: Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

$EF_{grid,CM,2008-2010y}$ = 1.0944 * 0.75 + 0.9194 * 0.25 = 1.0507 tCO_2/MWh

Consequently, the Emissions Reductions are calculated in accordance with Table 5 below:

Table 5. Emission reductions calculation

	A	B	C= A x B
Year	**Estimated net generation (MWh)**	**Emission factor (tCO_2e/MWh)**	**GHG emissions reductions(tCO_2e)**
2014	193,667	1.0507	203,480
2015	290,500	1.0507	305,220
2016	290,500	1.0507	305,220
2017	290,500	1.0507	305,220
2018	290,500	1.0507	305,220
2019	290,500	1.0507	305,220
2020	290,500	1.0507	305,220
2021	290,500	1.0507	305,220
2022	290,500	1.0507	305,220
2023	290,500	1.0507	305,220
2024	96,833	1.0507	101,740

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

Year*	Estimation of project activity emission (tonnes of CO_2e)	Estimation of baseline emission (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of overall emission reductions (tonnes of CO_2e)
2014	0	203,480	0	203,480
2015	0	305,220	0	305,220
2016	0	305,220	0	305,220
2017	0	305,220	0	305,220
2018	0	305,220	0	305,220
2019	0	305,220	0	305,220
2020	0	305,220	0	305,220
2021	0	305,220	0	305,220
2022	0	305,220	0	305,220
2023	0	305,220	0	305,220
2024		101,740		101,740
Total (tonnes of CO_2e)	0	3,052,200	0	3,052,200

* From 06/04/2014 to 05/04/2024

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

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$EG_{facility,y}$**
Data unit:	MWh/yr
Description:	Quantity of net electricity supplied by the project to the grid in year *y*
Source of data to be used:	Measured at the project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	290,500
Description of measurement methods and procedures to be applied:	The net electricity supplied to the grid from the project will be continuously measured using energy meters and recorded at least monthly. The precision of the energy meters is class 0.5s or better.
QA/QC procedures to	The electricity meters measuring electricity supplied to the grid will be

be applied:	calibrated according to the relevant national standard (or manufacturer's recommendation where there is no national standard). The calibration frequency for the energy meters is at least once a year.The recorded data will be cross-checked against records for electricity sold.
Any comment:	Data will be archived electronically for at least two years after the end of the last crediting period or the last issuance of CERs, for this project activity, whichever occurs later

B.7.2. Description of the monitoring plan:

The monitoring plan is designed to ensure that accurate and timely data are obtained, recorded and archived. The monitoring system consists of the following components:

1. Management Structure and Responsibility

The Project Owner is responsible for daily monitoring and reporting. A staff (monitoring team) will be dedicated to execute the monitoring tasks. A monitoring manual will be developed under the responsibility of the project owner.

2. Generation of Monitoring Data

The net quantity of electricity supplied to the grid is monitored by metering equipment that is also used for billing purposes. The accuracy class of the metering equipment will be class 0.5 or better. A Facility Metering configuration (owned by the Project Owner) is used for invoicing purposes and will provide main metering data that will be used for the calculation of the emission reductions. A System Metering configuration (Back up) provides data for comparison purposes against the data that is provided by the Facility Metering configuration and will be installed adjoining the Facility Metering configuration at the Delivery Point.

The installation of the monitoring equipment is represented below in a Project Activity Diagram which includes the process overview with relevant information and the monitoring structure.

Project Activity Diagram Kouga Wind Farm - Overview Energy Metering

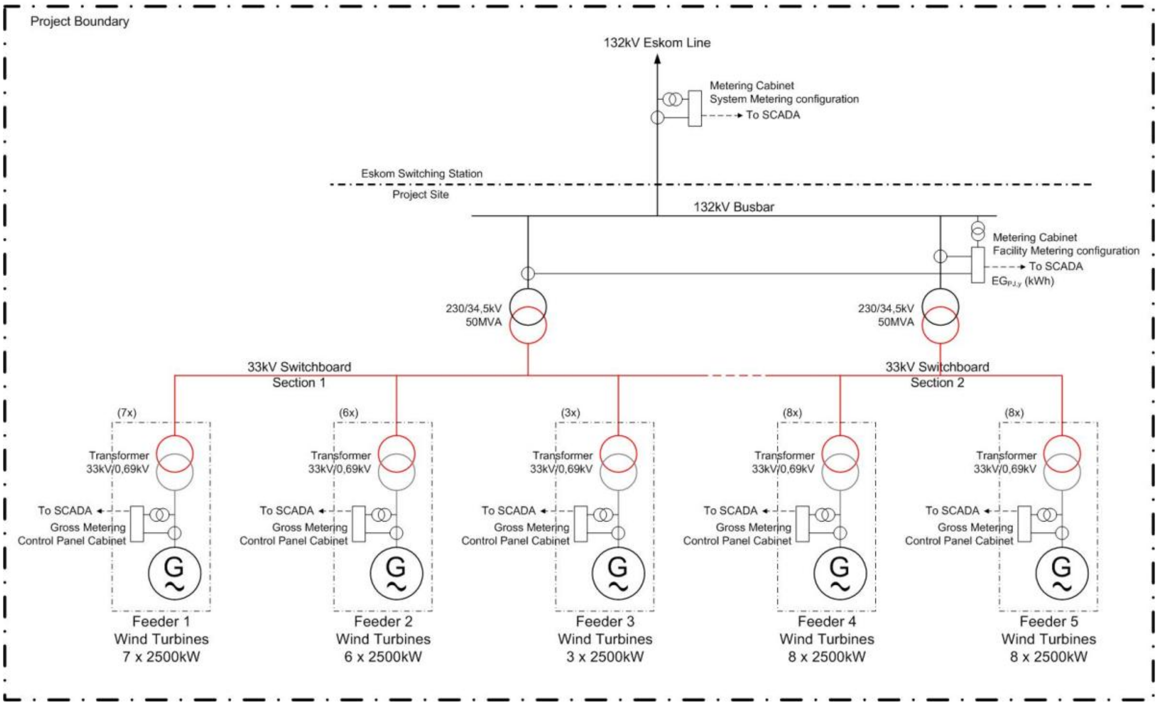

Figure 5. Layout of installation of monitoring equipment (single line diagram)

3. Calibration of Measuring Instruments

All measurement instruments will be regularly calibrated to ensure that, at all times, the measured values are within the specified accuracy margins. Calibration tests will be performed periodically and in accordance with relevant industry standards. Calibration frequency is at least once a year. The Parties (Project Owner and Grid Company) will provide each other with copies of calibration records. The Project Owner will keep these copies of calibration records for future reference and verification.
The Project Owner will take corrective actions in a case where an erroneous measurement, deviation or equipment malfunction is recognized.

If a calibration test reveals that the reading of the Facility Metering configuration is inaccurate by more than the allowed error margin, or has functioned improperly, the net electricity generation supplied by the project to the grid shall be determined:

- first, by reading the System Metering configuration, unless a test by either party reveals it to be inaccurate;
- second, if the System Metering configuration is not with acceptable limits of accuracy or operation is performed improperly, by the Project Owner and the Grid Operator who shall jointly prepare a reasonable and conservative estimate of the correct reading and provide sufficient evidence that this estimation is reasonable and conservative when DOE undertakes verification;
- third, if the Project Owner and the Grid Operator fail to agree on an estimate of the correct reading, by referring the matter for arbitration according to agreed procedures.

4. Data control and handling

The Project Owner will develop data control activities to guarantee the accuracy and consistency of the metering data which is used for the calculation of CER's. In accordance with the applied methodology (ACM0002), main metering data will be cross-checked with records for sold electricity.

The Project Owner will develop and use specific spreadsheet applications to gather, aggregate, calculate, control and (internally) report the CDM relevant data.

5. Data storage and safeguarding

Data will be archived in electronic spreadsheets. For data security, a backup of the electronic spreadsheets will be stored every month at two different physical locations (one of them not being the project site). The data will be kept at least 2 years after the end of the last crediting period or the last issuance of CERs for this project activity, whichever occurs later. The Project Owner will also collect and keep electricity sales receipts from the Grid Operator for the purpose of cross-checking with the main metering data.
All physical documents such as invoices, paper-based maps, drawings, diagrams and other relevant monitoring documents will be collected and stored in a central place, together with this monitoring plan.

6. Training

Operational Staff involved in the CDM monitoring will be given proper training. The training will be organised and supervised by the PO Monitoring Manager. The training will provide an overview of the CDM requirements for monitoring emission reductions and will cover all the elements of the monitoring plan in detail.
Prove of all training undertaken, together with a list of participants and the content of the training (e.g. slides) will be stored together with the CDM Documents.

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):

EcoMetrix drafted the first version of the PDD, which was later concluded by Tractebel Engineering. Tractebel Engineering contacts are presented below:

Date of completion: 20/01/2012
Responsible person/s:
Francois-Xavier van Innis
Tractebel Engineering
Belgium
+32 2 773 84 58
Francois-xavier.vaninnis@gdfsuez.com

The persons and entities responsible for the completion of the application of the baseline study and monitoring methodology are not project participants.

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:

02/11/2011 – date of the EPC Term Sheet signature.

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

20 years[18].

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:

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

06/04/2014 (expected commissioning date) or the date of registration, whichever occurs later.

C.2.2.2. Length:

10 years.

SECTION D. Environmental impacts

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

The Environmental Impact Assessment was conducted in accordance with the host country regulations for this project activity. This study was conducted by Arcus GIBB (Pty) Ltd in March 2011 and it was

[18] Source: EPC contract, page 6

approved by the South African Department of Environmental Affairs on 13 of June 2011. Below is a summary of the material potential environmental impacts resulting from the project activity:

Impacts on Vegetation and Wetlands

The potential impacts on vegetation and wetlands are considered under the following categories:

- Direct loss of vegetation and habitat
- Changes to species composition and ecological processes
- Loss of species of special concern (SSC) and their habitat
- Changes in natural fire regime and increased risk of alien infestations

Impact on Terrestrial Fauna

The potential impacts on terrestrial fauna are considered under the following categories:

- Direct habitat destruction through site clearing and construction of turbines and associated infrastructure
- Road mortality by vehicle activity
- Entrapment or exclusion
- Disruption of ecological corridors
- Poaching.

The construction impacts of habitat destruction and road mortality from trucks, cars and other service vehicles on reptiles, amphibians and mammals, were found to have a high significance before mitigation and these reduced to low and medium significance after mitigation. No impacts of high significance were identified either pre- or post-mitigation for the operation phase and in fact there were two positive impacts after mitigation during this phase. Some of the major mitigation measures foreseen are; search and rescue operations, maintenance of corridors, particularly where roads cross rivers and wetland areas, and careful driving practices.

Impact on Groundwater, Hydrology and Surface / Links with Wetlands

From a groundwater perspective, the proposed wind farm would have a low and insignificant impact. The infrastructure associated with the development of the wind farm has been located and designed to minimise any impact on the hydrology of the area. The wetlands will be impacted by the development, but as only about 1% of the more than 9,000 ha will be permanently altered and this will be spread across the three clusters, this potential impact is not seen as being significant if standard mitigation is implemented.

Avian Impact

The findings of the bird study indicate the possible occurrence of 74 species of conservation concern in the study area. These species are categorised as either near-threatened or vulnerable. The potential impacts on birds have been identified as follows:

- Collision of birds with wind turbines
- Habitat destruction associated with the construction of the turbines
- Disturbance of birds by the turbines and associated infrastructure.
- Habitat destruction during construction of associated infrastructure.

Collision of birds with the turbines is the only impact that was given a high negative significance before mitigation. Mitigation measures proposed to reduce the significance of impacts on birds include turbine design requirements and pre- and post-construction monitoring. The latter will be facilitated by the proposed phased construction plan which will enable a better understanding of the avian impacts, based on the results of monitoring during the first phase, as a basis for mitigation during subsequent construction and operational phases.

Impact on Bats
The specialist study identifies two categories of potential impacts during the operation phase:
- Site specific mortality from wind turbine blades
- Mass mortality affecting bat recruitment on a regional scale

From this specialist assessment of the impact on bats it was found that, with suitable mitigation, there would be no impacts of high negative significance and no fatal flaws to the development. The proposed mitigation measures, which include phasing the project, setting the turbines back from major water sources and conducting a monitoring program are expected to allow for any significant impacts to be avoided.

Visual Impact
The findings of the specialist study resulted in the identification of five types of visual impact:
- Intrusion of large and highly visible construction activities on sensitive viewers
- Changes to views from mixed coastal resort-agricultural landscape
- Intrusion of large wind turbines on the existing views of sensitive visual receptors
- Impact of night lights on existing nightscape
- Impact of shadow flicker on residents in proximity to the wind farm.

From a visual perspective, the landscape into which the wind farm will be introduced is largely agricultural and contains relatively few man-made structures. The impact of the turbines in changing the landscape is rated as high, but this could be negative or positive as it is very subjective and will most likely also reduce over time.

Noise Impact
The most significant impacts were identified to potentially be greater during the operational phase of the development. The predicted noise levels during operation were calculated using the manufacturer’s specifications for two commonly used types of wind turbines. The noise modelling that was done for this study was very conservative as it did not take into consideration the effect that any ambient noise and, specifically, the sound of the prevailing wind, may have on masking the operational noise of the turbines. This means that at a setback distance of 500m, it is highly likely that the operation of the turbines may not be audible above the background noise of the prevailing winds, especially as the wind speed increases. The two most important mitigation measures in this regard are micro-siting of the turbines affecting 6 identified noise sensitive areas and ambient noise monitoring once these turbines are erected to determine the exact power mode settings of the turbines needed to comply with the guideline limits at the noise sensitive areas.

Socio-Economic Impact
Potential impacts were assessed in relation to the following:
- Institutional factors and policy
- Financial viability

- Financial benefit to landowners
- Land values in the potentially affected surroundings
- Tourism potential and development
- Economic spin-off during the construction and operations phases, including job creation, upliftment of the local communities through a BBBEE trust and corporate social investment initiatives.

The only impacts with high significance are positive impacts after mitigation, both during construction and operation. Benefits would be particularly prominent for the project proponents, land owners on the site, Historically Disadvantaged South Africans (HDSAs) residing within the geographic location of the Kouga Local Municipality through the proposed Broad-Based Black Economic Empowerment (BBBEE) trust, the general community through Corporate Social Investment (CSI) initiatives and in the achievement of national and regional energy policy goals.

Impact on Cultural Heritage

The proposed configuration of the wind farm ensures that there are no direct impacts on historical or stone age sites. The only site seen to have a high negative impact before mitigation was a site in the Central Cluster. The development layout was has been altered so that this site is no longer impacted. One negative impact was the impact on the cultural landscapes and viewscapes for sensitive visual cultural receptors. However, this is a subjective impact and depending on the cultural receptor the significance could vary. A positive impact was the impact on the Cultural Landscapes and viewscapes with regard to conservation of heritage resources. It was noted that the wind farm, due to it taking up a large area of land but only permanently impacting about 1% of this, may be a good means to identify cultural resources and a good way to ensure that the land is not used for other more destructive activities in the future, thus conserving those resources.

As a result of the EIA, no transboundary impact was found. All impacts will occur inside South Africa borders.

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:

As previously stated, the Environmental Impact Assessment (EIA) was submitted to the local authorities who have accepted the EIA and have granted authorisation to proceed with the project. This authorisation is dated of 13/06/2011, NEAS reference DEAT/EIA/12095/2010 and DEA Reference 12/12/20/1756.

Consequently no environmental impacts are considered significant by the host party. The project participants agree and share the same opinion.

SECTION E. Stakeholders' comments

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

Stakeholder comments and queries were invited via 3 routes:

- Interested and Affected Parties, identified during the EIA process, were contacted directly and asked to provide their input;
- An advert was placed in the St Francis Chronicle, on 03/06/2011, inviting input from members of the public;
- An invitation to provide comments was also placed on the EcoMetrix Africa website, along with details of the project.

Input from local stakeholders was collated by EcoMetrix Africa and the project developer responded as described below.

E.2. Summary of the comments received:

Table 6. Stakeholders comments and PP comments

No.	Date Received	Submission Route	Comment	PP comments
1	09/06/2011	e-mail	Stakeholder wanted to know why African citizens should have to pick up the tab for Europe's dirty energy and was opposed to South Africa paying the price for another country's dirty emissions.	It was explained that the concept behind the CDM is that developed countries which previously emitted a lot of CO_2 from 'dirty' energy sources are actually funding the emission reduction projects through the purchase of carbon credits from the project.
2	09/06/2011	e-mail & letter	Stakeholders were concerned that the wind turbines will devastate the natural beauty, contribute to environmental devastation and kill a large number of the natural birdlife in the area.	The stakeholders were informed that this concern was identified during the EIA process and that mitigating actions were identified and approved by the Department of Environmental Affairs.
3	08/06/2011	e-mail	Stakeholder was concerned that another wind farm in the area would turn it into an industrial zone.	The stakeholder was informed that the project could not influence how many wind farms were constructed in the area and it was suggested that this be addressed with the local government.
4	09/06/2011	e-mail	Stakeholder is of the opinion that "green energy produced from wind is not as 'green' as it is being made out to be. Wind farms are not as efficient as they are made out to be. They are not baseline."	It was communicated to the stakeholder that an internationally recognised methodology is followed to calculate the emission reductions achieved by the project.
5	08/06/2011	letter	Stakeholder is disputing the amount of CO_2 saved by the project claiming that it is only 22,800 tCO_2 per annum and that wind turbines do not reduce CO_2	The stakeholder was advised that the estimated amount of emission reductions was not exact but based on the grid emission factor and the estimate

			emissions.	electricity supplied to the grid. The stakeholder was also informed that any emission reductions claimed would be based entirely on verifiable monitoring data and would be attested to by a third party auditor.
6	08/06/2011	letter	Stakeholder is concerned that the electricity used by the wind turbines in their operation would not be taken into account when calculating the amount of carbon credits.	It was communicated to the stakeholder that an internationally recognised methodology is followed to calculate the emission reductions achieved by the project.
7	08/06/2011	letter	Stakeholder is concerned that the carbon credits generated by the wind farm are unearned.	The stakeholder was informed that any emission reductions claimed would be based entirely on verifiable monitoring data and would be attested to by a third party auditor.
8	06/07/2011	email	Stakeholder wanted to know if the project would go out to open tender.	It was communicated to the stakeholder that the procurement phase of the project was being conducted separately and his email was provided to the project manager.
9	15/06/2011	letter	Stakeholder commented that all environmental authorisation requests should be submitted to the Regional Office of the Department of Water Affairs	The authorization for the project has already been granted thus indicating the end of the environmental permitting process.
10	06/07/2011	email	Stakeholder requested the contact details of the project developer in order to provide heavy lighting equipment and related services.	Stakeholder's was informed that his email would be forwarded to the project developer.

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

All the comments made by the stakeholders were answered. There were no serious negative comments, consequently the project participants decided to proceed with the project activity development.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project participant 1:

Organization:	Red Cap Investments (Pty) Ltd
Street/P.O.Box:	Unit B5 Mainstream Shopping Centre, Main Road,
Building:	
City:	Hout Bay, Cape Town
State/Region:	
Postcode/ZIP:	
Country:	South Africa
Telephone:	+27 (0) 21 790 1392
FAX:	
E-Mail:	info@red-cap.co.za
URL:	www.red-cap.co.za
Represented by:	
Title:	Technical director
Salutation:	Mr.
Last name:	Nicol
Middle name:	
First name:	David
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal e-mail:	david@red-cap-co.za

Project participant 2:

Organization:	Electrabel SA/NV
Street/P.O.Box:	Boulevard du Régent, 8
Building:	
City:	Brussels
State/Region:	
Postcode/ZIP:	1000
Country:	Belgium
Telephone:	
FAX:	
E-Mail:	co2@gdfsuez.com
URL:	www.electrabel.com
Represented by:	Thomas Papazov
Title:	CDM/JI Business Developer
Salutation:	Mr.

Last name:	Papazov
Middle name:	
First name:	Thomas
Department:	Carbon Procurement
Mobile:	+32 472 26 01 86
Direct FAX:	+32 2 501 59 16
Direct tel:	+32 2 519 36 69
Personal e-mail:	thomas.papazov@gdfsuez.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No Annex I public funding was used in this project activity.

Annex 3

BASELINE INFORMATION

Table 7.Operating margin emission factor determination

				Electricity generation MWh [1]			Fuel consumption (ton) [1]								
Plant Name	**Installed capacity (MW)**	**Commissioning date**	**Fuel type**	**2008-2009**	**2009-2010**	**2010-2011**	**2008-2009**	**2009-2010**	**2010-2011**	$EF_{EL,m,2008-2009}$	$EF_{EL,m,2009-2010}$	$EF_{EL,m,2010-2011}$	$EG_{2008}*EF_{EL,m,2008-2009}$	$EG_{2009}*EF_{EL,m,2009-2010}$	$EG_{2010}*EF_{EL,m,2010-2011}$
Arnot	1980	21/09/1971	Coal	11,987,281	13,227,864	12,194,878	6,395,805	6,794,134	6,525,670	1.0902	1.0495	1.0934	13068932.1	13882861.65	13334293.05
Duvha	3450	18/01/1980	Coal	21,769,489	22,581,228	20,267,508	11,393,553	11,744,606	10,639,393	1.0694	1.0627	1.0726	23281130.46	23998458.12	21740110.08
Hendrina	1895	12/05/1970	Coal	12,296,687	12,143,292	11,938,206	7,122,918	6,905,917	7,139,198	1.1836	1.1620	1.2219	14554685.72	14111274.56	14587951.63
Kendal	3840	01/10/1988	Coal	23,841,401	23,307,031	25,648,258	15,356,595	13,866,514	15,174,501	1.3161	1.2156	1.2089	31379051.96	28334280.05	31006968.36
Kriel	2850	06/05/1976	Coal	18,156,686	15,906,816	18,204,910	9,420,764	8,504,715	9,527,185	1.0602	1.0925	1.0693	19250012.33	17378194.44	19467468.74
Lethabo	3558	22/12/1985	Coal	23,580,232	25,522,698	25,500,366	16,715,323	18,170,227	17,774,699	1.4484	1.4547	1.4242	34155422.41	37128315.04	36320108.95
Matimba	3690	04/12/1987	Coal	26,256,068	27,964,141	28,163,040	13,991,453	14,637,481	14,596,842	1.0888	1.0695	1.0590	28589575.4	29909643.18	29826603.07
Majuba	3843	01/04/1996	Coal	22,676,924	22,340,081	24,632,585	12,554,406	12,261,833	13,020,512	1.1312	1.1215	1.0800	25653171.04	25055339.08	26605593.4
Matla	3450	29/09/1979	Coal	21,863,400	21,954,536	21,504,422	12,689,387	12,438,391	12,155,421	1.1859	1.1576	1.1550	25928985.82	25416110.63	24837901.05
Tutuka	3510	01/06/1985	Coal	21,504,122	19,847,894	19,067,501	11,231,583	10,602,839	10,191,709	1.0672	1.0915	1.0921	22950167.44	21665417.1	20825330.5
Koeberg	1800	21/07/1984	Nuclear	,	,	,	,	,	,	0.0	0.0	0.0	0	0	0
Acacia	171	13/05/1976	Gas*	,	,	992	,	,	360	0.0	0.0	1.0906	0	0	1081.937507
Port Rex	171	30/09/1976	Gas*	,	,	5,507	,	,	228	0.0	0.0	0.1244	0	0	685.5551046
Ankerlig	1338	29/03/2007	Gas*	,	,	6303.225	,	,	,	0.0	0.0	0.0	0	0	0
Gourikwa	746	30/03/2007	Gas*	,	,	,	,	,	,	0.0	0.0	0.0	0	0	0
Colley Wobbles	42	01/01/1985	Hydro	,	,	,	,	,	,	0.0	0.0	0.0	0	0	0
First Falls	6	01/02/1979	Hydro	,	,	,	,	,	,	0.0	0.0	0.0	0	0	0
Gariep	360	08/09/1971	Hydro	,	,	,	,	,	,	0.0	0.0	0.0	0	0	0
Ncora	2	01/03/1983	Hydro	,	,	,	,	,	,	0.0	0.0	0.0	0	0	0
Second Falls	11	01/04/1979	Hydro	,	,	,	,	,	,	0.0	0.0	0.0	0	0	0
Van der Kloof	240	01/01/1977	Hydro	,	,	,	,	,	,	0.0	0.0	0.0	0	0	0
Drakensberg	1000	17/06/1981	Pump storage	,	,	,	,	,	,	0.0	0.0	0.0	0	0	0
Palmiet	400	18/04/1988	Pump storage	,	,	,	,	,	,	0.0	0.0	0.0	0	0	0
Camden	1600	21/12/1966	Coal	6,509,079	7,472,070	7,490,836	3,876,211	4,732,163	4,629,763	1.2168	1.2940	1.262913	7920494.509	9669512.588	9460272.524
Grootvlei	1200	30/06/1969	Coal	1,249,556	2,656,230	3,546,952	674,538	1,637,371	2,132,979	1.1030	1.2595	1.228786	1378323.968	3345738.407	4358443.969
Komati	1000	06/11/1961	Coal	,	1,016,023	2,060,141	,	664,497	1,271,010	0.0	1.3363	1.260657	0	1357806.59	2597130.994
IPPs [2]			Renewable	,	,	1,833,000	,	,	,	0.0	,	,	0	,	,
Imports [2]				12,189,000	13,754,000	13,613,000	,	,	,	0	0	0	,	,	,

Grid generation w/o LC/MR w/ Imports		223,879,925	229,693,904	235,672,102				$EF_{grid,OM,simple,y}$ =	1.1082	1.0938	1.0818

Table 8. Build Margin calculation

Build margin calculation (STEP 5)

Set		Plant Name	Installed capacity (MW)	Commissioning date	Fuel type	Electricity generation MWh [1] 2010	$\eta_{m,y}$ [5]	$EF_{EL,m,2010}$	$\Sigma EG_m \times EF_{EL}$
SET 5-units; SET ?20%	0%	Bethlehem Hydroelectric project (CDM) [6]	7	11/11/2009	Hydro	34 031	-	0	0
SET 5-units; SET ?20%	0%	PetroSA Biogas to Energy Project (CDM) [7]	4.248	01/10/2007	LFG	23 000		0	0
SET 5-units; SET ?20%	10%	Majuba	3843	01/04/1996	Coal	24 632 585	37.00%	0.920432	22672630.1
SET 5-units; SET ?20%	21%	Kendal	3840	01/10/1988	Coal	25 648 258	37.00%	0.920432	23607488.5
SET 5-units	33%	Matimba	3690	04/12/1987	Coal	28 163 040	37.00%	0.920432	25922175.4
SET 5-units	44%	Lethabo	3558	22/12/1985	Coal	25 500 366	37.00%	0.920432	23471363.9
SET 5-units	52%	Tutuka	3510	01/06/1985	Coal	19 067 501	37.00%	0.920432	17550346.3

Table 9. CM emission factor

Ex-ante emission factor for the South African interconnected system

Baseline	EF_{OM} [tCO_2/MWh]	Generation [GWh]
2008	1.1082	223 880
2009	1.0939	229 694
2010	1.0819	235 672
	$EF_{OM\ simple,\ 2008-2010}$ 1.0944	$EF_{grid,BM,2010}$ 0.9194
	Weights_wind and solar projects w_{OM} = 0.75 w_{BM} = 0.25	Weights_all other projects w_{OM} = 0.50 w_{BM} = 0.50
	$EF_{2008-2010}$ [tCO_2/MWh] 1.0507	$EF_{2008-2010}$ [tCO2/MWh] 1.0069

Annex 4

MONITORING INFORMATION

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