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:

>>Dassieklip Wind Energy Facility in South Africa

Version 07
Date: 9 October 2012

A.2. Description of the project activity:

The project developer BioTherm Energy is proposing to establish a commercial Wind Energy Facility and associated infrastructure on a site located near the town of Caledon in the Western Cape Province of South Africa.

Purpose of the project activity

The proposed project activity is an initiative to export renewable electricity produced by Dassieklip to the national grid, which is currently mostly derived from coal. The wind power generated from the project site will be replacing electricity from the national grid.

Pre-project scenario

The project proposed is a green field project. Currently, there are no wind turbines installed on the project site.

Baseline scenario

The baseline as defined by the Approved consolidated baseline and monitoring methodology ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", is electricity generated in the national grid.

Project activity

The project activity proposed is a green field project. It is proposed for a cluster of up to 9 wind turbines (described as a wind energy facility) to be constructed over a broader study area approximately 350 hectares in extent. This facility would be operated as a single facility and will include: up to a maximum of 9 wind turbine generators and one substation with a "loop-in-loop-out" connection to the national grid. Ten turbines have been approved under the Environmental Impact Assessment and constitutes the maximum that can be built, but the Project participant has removed one turbine for technical reasons.

The Project Participant has entered into an Engineer, Procure and Construct "(EPC") Agreement with a consortium of three companies being Group Five, Iberdrola and Sinovel. Heads of Terms were signed. Based on a wind turbine generator capacity of 3 MW, the 9 turbine wind energy facility represents a total installed capacity of 27 MW.

Sustainable Development

The project will contribute to sustainable development in South Africa in the following ways:

Environment

The project will displace some coal-dominated power generation in South Africa with wind power, thereby reducing the carbon footprint of South Africa and leading to water savings at coal fired power plants.

Social

The proposed development also represents an investment in clean, renewable energy, which, given the challenges created by climate change, represents positive social benefit for society as a whole.

The key social issues associated with the construction phase include the creation of employment and business opportunities, and the opportunity for skills development and on-site training. The construction phase will employ up to 106 people over a 10 month period. This is broken down into up to 50 unskilled jobs, up to 21 semi-skilled jobs and up to 35 skilled jobs. There will be an effort to transfer skills and build local capacity across all roles where possible.

The developer has committed to providing tertiary training to three students in the environmental field (as it relates to wind energy) and three in the technical field (as it relates to wind energy) each year for the lifetime of the project (twenty years), adding up to over 100 people trained.

There will be approximately 20 full time jobs created due to the project by the developer or its contractual counterparts.

Economic

In terms of business opportunities for local companies, the capital expenditure of approximately ZAR 586million during the construction phase will create business opportunities for the regional and local economy. Despite the highly technical nature of the wind turbine generators, the opportunity for South African production and local content is likely to increase over time. The sector of the local economy that is most likely to benefit from the proposed development is therefore the local service industry. Tax revenue from the operating phase of the project will benefit the fiscus.

A.3. Project participants:

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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)
Host Party South Africa	Klipheuwel Dassiefontein Wind Energy Facility (RF) (Pty) Ltd Private entity	No
Host Party South Africa	BioTherm Energy (Pty) Ltd	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):

>>South Africa

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

>>Western Cape Province

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

>>Near the town of Caledon

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

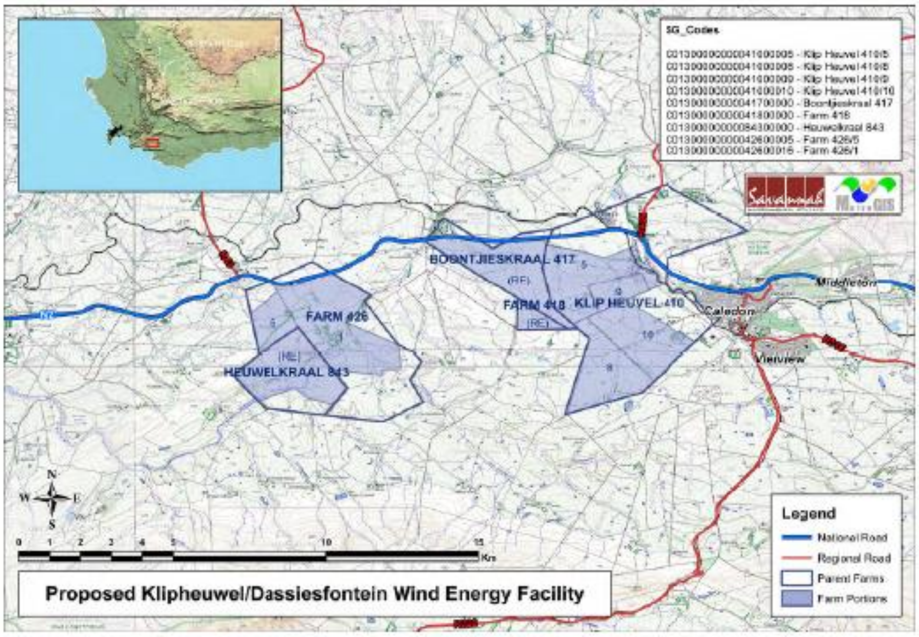
>> The proposed wind farm is to be built on the following farms:

- Klip Heuvel no: 410 sections 5, 8, 9 and 10
- Boontjieskraal no 417 and 418.

The site location is shown in the figure below. The relevant site is the eastern one[1]

[1] FEIR document page v. It should be noted that the initial EIA application was done with the purpose to build a single wind farm on both sites depicted, totalling up to 16 turbines. For technical reasons that relate to the grid connection it was decided after EIA approval to only proceed on the eastern sites mentioned above which meant limiting the wind farm to the ten turbines approved for those farms (eventually nine). Environmental approval is presently being sought to proceed with a separate (CDM) project with the development of the six turbines on the farms Heuwelkraal 843 and Kilp Heuvel Farm 426 (sections 1 and 5) - the western section on the map. These last-mentioned sites are no longer relevant for purposes of this CDM project

Figure 1: Locality map showing the Dassieklip Wind Farm site regionally and locally



The GPS co-ordinates of each turbine are as follows:

Description	X (sddd.dddddd)	Y (sddd.ddd ddd)
Turbine 1	19.373100°	-34.227300°
Turbine 2	19.373400°	-34.231900°
Turbine 4	19.380800°	-34.225500°
Turbine 5	19.380700°	-34.230100°
Turbine 6	19.382903°	-34.235239°
Turbine 7	19.387400°	-34.225400°
Turbine 8	19.387200°	-34.230100°
Turbine 9	19.390200°	-34.235900°
Turbine 10	19.386800°	-34.238900°

Note: Windpro software was used to convert the coordinates

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

>>Category: Renewable electricity in grid-connected applications
Sectoral Scope: 1 Energy industries

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

The proposed project activity will contribute to technology transfer to the host country South Africa, since it utilises wind power technology (Sinovel) developed in China. Sinovel is one of the world's top ten wind turbine suppliers, with an installed capacity in excess of 12,000MW.[2] Wind energy technology is deemed to be a safe and relatively mature technology, and is established in countries worldwide with approximately 197GW of wind capacity installed globally as at the end of 2010.[3]

The scenario existing prior to the start of the implementation of the project activity: The project is a green field project and no wind or power technology has been implemented on the project site. A new substation will be built to loop in and out of an adjacent national gridline. Gravel roads on the site will be upgraded to the standard needed for large vehicles to use the site during the construction period.

The scope of activities/measures that are being implemented within the project activity: The proposed project is the installation of a new grid-connected zero-emission renewable (wind) power generation activity. The purpose of the proposed project is to generate electricity using wind power resources in the project region and replace the same amount of power generation in South African Power Grid.

A list of the equipment(s) and systems that will be installed and/or modified within the project activity:

- Up to 9 wind turbine units of 3 megawatts each
- A 90 meter tower and nacelle;
- Rotor blades of 54 meters with a resultant diameter of 113 meters
- Concrete foundations to support the turbine towers;
- Underground electrical distribution cabling between the turbines;
- One substation (approximately 80m x 100m in size) on the site receiving distribution cabling from each wind turbine;
- Overhead power lines linking the sub to interconnection
- New and upgraded access and internal roads (approximately 3-5 m in width);
- A small office and/or workshop building for maintenance that will occupy a footprint of approximately 400 m^2

<u>The baseline scenario</u>

According to the ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is 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

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[2] See Sinovel spread sheet as received from BioTherm (Will be made available to the validators)

[3] http://www.gwec.net/fileadmin/images/Publications/GWEC_annual_market_update_2010_-_2nd_edition_April_2011.pdf

the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

No wind turbine or electricity generation equipment and systems would have been in place in the absence of the project activity.

The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

The emissions sources and the greenhouse gases involved in the project activity, according to the methodology used:

Source		Gas	Included?	Justification / Explanation
Baseline	CO_2 emission from the power plants generating electricity in the national grid	CO_2	Yes	Major source of emissions.
		CH_4	No	Excluded as measure of conservativeness
		N_2O	No	Excluded as measure of conservativeness
Project activity	The proposed project activity	CO_2	No	Excluded as per the methodology.
		CH_4	No	Excluded as per the methodology
		N_2O	No	Excluded as per the methodology

In the absence of the project activity, the electricity (service) would have been provided by the national grid.

Technology

Table 1 describes the expected design parameters for the wind farm based on the Sinovel SL 3000-113, 3MW wind turbine generator.

Table 1: Design parameters

Item	Unit	Index
Rated capacity	MW	3
Number of blades	#	3
Rotor diameter	meter	113
Rotor speed	r/min	6.5 - 13.8 RPM
Cut-in wind speed	m/s	3 m/s
Rated wind speed	m/s	11
Cut-out wind speed	m/s	25
Height of hub	m	90
Rated frequency	Hz	50
Rated voltage of generator	V	690
Average lifetime	years	20 years (IEC IIIA)

Plant Load Factor: for the purpose of estimating the electricity generation for the project, the annual plant load factor has been determined by the project participant's independent wind energy consultant, Windprospect. A load factor of 31.4% applies.

Monitoring Equipment
The main data for calculating emission reductions of the project activity is $EG_{facility,y}$ (Net electricity supplied to grid by the wind power plant in year y). In order to determine the amount of net electricity supplied to the grid, electricity monitors will be implemented.

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

A crediting period of 10 years is selected for the project activity.

The following table represents the emission reductions.

Years	Annual estimation of emissions reductions in tonnes of CO_2 e
01/08/2013 – 31/07/2014	67,397
01/08/2014 – 31/07/2015	67,397
01/08/2015 – 31/07/2016	67,397
01/08/2016 – 31/07/2017	67,397
01/08/2017 – 31/07/2018	67,397
01/08/2018 – 31/07/2019	67,397
01/08/2019 – 31/07/2020	67,397
01/08/2020 – 31/07/2021	67,397
01/08/2021 – 31/07/2022	67,397
01/08/2022 – 31/07/2023	67,397
Total estimated reductions (tonnes CO_2 e)	673,970 tonnes CO_2e
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	67,397

A.4.5. Public funding of the project activity:

>>There is no public funding for this project activity.

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:

Methodology:

Version 12.3.0 of the Approved consolidated baseline and monitoring methodology ACM0002: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”

Tools

Version 06.0.0 of tool for the demonstration and assessment of additionality

Version 02.2.1 of tool to calculate the emission factor for an electricity system

For more information regarding the methodology and the tools as well as their consideration by the Executive Board please refer to 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 following table provides a list of the Applicability Criteria as described in ACM0002 and explains why the project complies with each parameter.

Table 2: Applicability Assessment against ACM0002

Applicability Criteria	Comments
This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable 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(s); or (d) involve a replacement of (an) existing plant(s).	This project activity is a grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (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 proposed project activity is the installation of a wind power plant.
In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2 to calculate the parameter *EGPJ,y*): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission 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;	Not applicable to the proposed project activity as the project activity is the new installation of a wind power plant.
In case of hydro power plants, one of the following conditions must apply: o The project activity is implemented in an existing reservoir, with no change in the volume of reservoir; or	The project is not the implementation of a Hydro plant – therefore this applicability criteria does not apply to the proposed project activity.

Applicability Criteria	Comments
o 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 o The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	
In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m2 after the implementation of the project activity all of the following conditions must apply:	In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m2 after the implementation of the project activity all of the following conditions must apply:
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; • Hydro power plants1 that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m2.	The proposed project activity is not the switch from a fossil fuel plant to a wind power plant at the site of the project activity. The site has no power generation facility constructed at the time when the wind power plant will be established. The proposed project activity does not involve any biomass fired power plants. Not applicable as the project is not the implementation of a Hydro plant.
In the case of retrofits, 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	Not applicable as the project is not a retrofit, replacement or capacity addition.

Applicability Criteria	Comments
to the implementation of the project activity and undertaking business as usual maintenance	

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

>>The spatial extent of the project boundary includes the project site and all the power plants connected physically to the electricity system. The project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints.

According to the methodology ACM0002, a grid-connected wind power project like the proposed project is required to consider only the CO_2 emissions from fossil fuels fired power plants in baseline scenario.

Source		Gas	Included?	Justification / Explanation
Baseline	CO_2 emission from the power plants generating electricity in the national grid	CO_2	Yes	Major source of emissions.
		CH_4	No	Excluded as measure of conservativeness
		N_2O	No	Excluded as measure of conservativeness
Project activity	The proposed project activity	CO_2	No	Excluded as per the methodology.
		CH_4	No	Excluded as per the methodology
		N_2O	No	Excluded as per the methodology

Table 3: Emission sources considered in the baseline and the project

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

According to the ACM0002 if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is 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 emission factor for an electricity system”.

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 activities show the prior consideration of the CDM.

Table 4: Activities demonstrating the prior consideration of CDM

Activity	Date
Consultant appointed to develop CDM component[4]	20 May 2009
Wind monitoring started on the proposed site	February 2010
Environmental Impact Assessment Scoping Study initiated	March 2010 (refer to page 54 of Environmental Impact Assessment Process Draft EIA Report, November 2012)
PIN submitted to South African DNA	16 May 2011
Positive Record of Decision received from the Department of Environmental Affairs	27 June 2011
Engineer Procure and Construct (“EPC”) Agreement Term sheet executed with technology supplier	October 2011
Start date of the project activity – preferred bidder bond lodged	19 December 2011
Validation initiated	March 2012
Project activity loaded onto the UNFCCC website and global stakeholder period starts	6 March 2012
Letter of prior consideration to UNFCCC and to the South African DNA	23 April 2012
Documentation submitted to the South African DNA to request Letter of approval	11 June 2012

The additionality of the proposed project is demonstrated and assessed by the approved “Tool for the Demonstration and Assessment of Additionality”.

Sub-step 1a: Identify realistic and credible alternative baseline scenarios for power generation

According to ACM0002, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is 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 emission factor for an electricity system”.

The alternatives are as follows:

Alternative 1: The proposed project undertaken without being registered as a CDM project;

Alternative 2: 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.

[4] The initial developer of the wind farm was Overberg Wind Power (Pty) Ltd who retained CDM Africa Climate Solutions contractually in May 2009. Overberg Wind power later took in BioTherm Energy as an equity partner. The Special Project Vehicle or Project Participant is a subsidiary of BioTherm Energy with Overberg Wind Power as a minority shareholder

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

Alternative 2 is consistent with mandatory laws and regulations as it is legal for the grid to generate electricity and expand capacity. The project activity complies with regulations and the project without CDM complies with all regulations (alternative 1).

The project is evaluated on its own viability (without CDM) and does not exclude the expansion of grid with other options.

Step 3. Barrier Analysis

As mentioned in Step 1, the project is evaluated on its own viability. The project accords with the criteria in paragraph 6(b) of the additionality tool as it is about renewable energy:

(6b) Switch of technology with or without change or energy source (including energy efficiency improvement as well as use of renewable energies);

There are at present (January 2011 and as late as 20 August 2012) no large scale, grid connected wind farms exporting electricity to the grid[5] and the penetration of wind power into the grid is less than 0.025% of installed capacity.

(a) Barriers due to prevailing practice

- The project activity is the “first of its kind”.

  Note: According to the “Tool for the demonstration and assessment of Additionality”, the “Applicable geographical area covers the entire host country as a default.

  The geographical area is South Africa. Reference to the neighboring countries is not appropriate as the regulatory, commercial and technical hurdles and entire procurement system within which renewables operate in South Africa is entirely unique to the country. In the context of the regulatory and procurement framework, the implementation of wind technology is country specific to South Africa.

From a geographic perspective, the South African wind regime is different from other neighboring countries[6].

According to the “Guidelines on additionality of first-of-its-kind project activities”, (Version 02.0), a proposed project activity is the first of its kind in the applicable geographical area if:

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[5] See the supporting letter of Ms Ayanda Nakedi, Eskom representative on the South African Wind Energy Association Board (will be made available to validators). For more detail see http://en.wikipedia.org/wiki/List_of_power_stations_in_South_Africa. As appears from the list, there are only three installations of which the largest is a 5,2 MW wind farm. The total installed capacity for wind power in the country is 10.16 MW out of approximately 45,000 MW installed in the grid, meaning that the penetration in terms of installed capacity is presently under 0.025%.

[6] Renewable Energy in Africa: Prospects and Limits, Operationalizing the NEPAD Energy Initiative, United Nations, page 15

(a) The project is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier;
In terms of the definitions referenced in the "Tool for the demonstration and assessment of Additionality", a wind power plant will thus be a first of its kind if no other wind power plants of the same output have reached commercial operation within the borders of South Africa at the start date of the project.

The starting date is defined by the CDM glossary as "*In the context of a CDM project activity or PoA, the earliest date at which either the implementation or construction or real action of a CDM project activity or PoA begins*".

In South Africa, projects presently need to go through a procurement process and be awarded "preferred bidder" before they can move toward financial close and sign a Power Purchase Agreement. When a bid is entered, a bid bond has to be posted that equals ZAR 100,000/MW bid. This is a very sizeable commitment of funds by the developer but not an irrevocable one as the amount is refunded in the event that the bid is compliant but unsuccessful. However, if a project as awarded with "preferred bidder status", the developer is required to post a bond double the initial one within two weeks. This bond is then no longer refundable – if financial close is not reached within the prescribed time, the full amount will be forfeited. In this case it equates to ZAR 5,4 million.

In terms of the definition of start date, the construction only starts after financial close – typically seven months or more after preferred bidder status. The "real action" commences when then developer chooses to post the preferred bidder bond and thus commits itself to reaching financial close within 6-7 months thereafter. At this point the developer is committeed to the project. Thus, if the earliest date is chosen in terms of the definition of Starting Date, the preferred bidder bond posting date is the Starting Date.

As stated above, there is no grid connected wind power power plants of comparable scale exporting power into the South African grid.

(b) The project implements one or more of the measures;
The project activity is power generation from renewable energy, which is in line with the definition of 'measure' as per paragraph 2(a) of the "Guidelines on additionality of first-of-its-kind project activities".

(c) The project participants selected a crediting period for the project activity that is "a maximum of 10 years with no option of renewal".
This is in line with the selection of this project activity.

All three of the requirements (a) to (c) are met. The project activity is additional as a first of its kind

Step 4: Common practice analysis
The project is a first of its kind and therefore, common practice analysis is not conducted.

Conclusion

According to paragraph 4 of the "Tool for demonstration and assessment of additionality", "Project activities that apply this tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity. " For this project activity, the more attractive alternative is the continued operation and expansion of the grid under management of the national utility.

The project activity is additional as first-of-kind.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>

Baseline emissions

Baseline emissions include only CO2 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:

$$BE_y = EG_{PJ,y} * EF_{GRID,CM,y}$$

Equation 1

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2/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. (tCO_2/MWh)
$EG_{PJ,y}$	=	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)

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:

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

Equation 2

Where

$EF_{Facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y* (MWh/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)

Project emissions

$PE_y = 0$

The GHG emission calculation of the proposed project was based on the instruction of "Tool to calculate the emission factor for an electricity system". All the data employed in the calculation is based on the available data from South African Power Grid that is publicly available. The baseline emission factor (EFy) is calculated as a combined margin (CM), consisting of the combination of simple operating margin (OM) and build margin (BM) factors:

The following steps are applied to calculate the emission factor for an electricity system:

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) emissions factor.

The procedure is applied in Annex 3.

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, transport). These emissions sources are neglected.

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BEy - PEy$$

Equation 3

Where:

ER_y = Emission reductions in year y (t CO_2e/yr)

BE_y = Baseline emissions in year y (t CO_2/yr)

PE_y = Project emissions in year y (t CO_2e/yr)

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 unit m in year y
Source of data used:	Calculated based on the national utility information for the South African national grid. Eskom published data, *Source: FuelConsumptionElectricityGen.xls published by Eskom* Website short cut access is: http://www.eskom.co.za/c/article/236/cdm-calculations/. The file published by Eskom that is visible on the website link now (2012) is Appendix 61_GEF data Final_vr1.
Value applied:	Refer to Annex 3, **Determination of $EF_{EL,m,y}$ according to Option A2** The fuel consumption information for each of the four single cycle turbines for the three-year period prior 2011 is not available. Option A2 is applied to determine $FE_{EL,m,y}$ for these plants only. For the four single cycle turbines, option A2 from guidance in Step 4 (a) is used and the default values provided in Annex 1 are used to determine the parameter $\eta_{m,y}$ for validation purposes. **Determination of $EF_{EL,m,y}$** $$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}}$$ **Equation 4** Where: $EF_{ELm,y}$ = 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). A default value is adopted from “Tool to calculate the emission factor for an electricity system, Annex 1” i = All fossil fuel types combusted in power sources m in the project electricity system in year *y* m = The power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid y = The relevant year as per the data vintage chosen in Step 3 Table 6: Power stations in the Operating Margin for detailed information on the

	fuel consumption for power stations.
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per "Tool to calculate the emission factor for an electricity system" (i)Simple OM: Once for the 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* option).
Any comment:	Information is used to calculate the combined margin emission factor

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data used:	• For coal: Eskom published data, *Source* Eskom Holdings Limited Integrated Report 2011, page 324..See GEF spreadsheet, Sheet Base_Data. • For Other Kerosene: IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. See GEF spreadsheet, Sheet 'DV', Cell D14 • For Diesel: IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. See GEF spreadsheet, Sheet 'DV', Cell D16
Value applied:	Coal (GJ/ton) Eskom: Coal (GJ/ton) 2008/9 – 19.1 2009/10 – 19.22 2010/11 – 19.5 Other Kerosene –42.4GJ/ton Diesel- 41.4GJ/ton
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per "Tool to calculate the emission factor for an electricity system". Monitoring frequency is once for the 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.
Any comment:	Calculation of baseline emissions. Information is used to calculate the combined margin emission factor

Data / Parameter:	$EG_{m,y}$
Data unit:	MWh
Description:	Net electricity generated by power plant/unit *m* (or in the project electricity system in case of EG_y) in year *y*
Source of data used:	Source: Published information from Eskom, the national utility. FuelConsumptionElectricityGen.xls published by Eskom.

	Website short cut access is: http://www.eskom.co.za/c/article/236/cdm-calculations/
Value applied:	Refer to Annex 3, **Determination of $EF_{EL,m,y}$ according to Option A2** The fuel consumption information for each of the four single cycle turbines for the three-year period prior 2011 is not available. Option A2 is applied to determine $FE_{EL,m,y}$ for these plants only. For the four single cycle turbines, option A2 from guidance in Step 4 (a) is used and the default values provided in Annex 1 are used to determine the parameter $\eta_{m,y}$ for validation purposes. **Determination of $EF_{EL,m,y}$** $$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \times 3.6}{\eta_{m,y}}$$ **Equation 4** Where: $EF_{ELm,y}$ = 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). A default value is adopted from “Tool to calculate the emission factor for an electricity system, Annex 1” i = All fossil fuel types combusted in power sources m in the project electricity system in year *y* m = The power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid y = The relevant year as per the data vintage chosen in Step 3 Table 6: Power stations in the Operating Margin for detailed information
Justification of the choice of data or description of measurement methods and procedures actually	As per “Tool to calculate the emission factor for an electricity system”. Monitoring frequency is once for the crediting period using the most recent three historical years for which data is available at the time of submission of the CPA-PDD to the DOE for validation. Note that the specific information for each of the four single cycle turbines was

applied :	not available when the PDD was submitted for validation. The information that was available was one generation figure for all four stations. This figure was divided between the four stations in a ration that coincides with their capacity.
Any comment:	Information is used to calculate the combined margin emission factor

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. For the sake of a conservative approach the IPCC default value at the lower limit of the uncertainty at a 95% confidence interval is used. For Coal: GEF spreadsheet, Sheet, ‘DV’, Cell M31 For Other Kerosene: GEF spreadsheet, Sheet, ‘DV’, Cell M14 For Diesel: GEF spreadsheet, Sheet ‘DV’, Cell D16
Value applied:	Bituminous Coal: 0.0895 tCO_2/GJ, for other bituminous at the lower limit. Other Kerosene 70.8 tCO_2/TJ Diesel: 72.6 tCO_2/TJ
Justification of the choice of data or description of measurement methods and procedures actually applied :	Some information is available about the various coal resources in South Africa, all of which is classified as bituminous. However, sufficient information is not available for each coal fired power station and therefore the IPCC default is applied. Refer to Appendix 30: ‘Future_of_South_African_Coal’, Section 2 “Overview of South African coal sector”, page 2 where it is mentioned that: “South Africa’s economically recoverable coal reserves are estimated at between 15 and 55 billion tonnes. 96% of reserves are bituminous coal; metallurgical coal accounts for approximately 2% and anthracite another 2%. Production is mainly steam coal of bituminous quality.”
Any comment:	

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, Annex 1
Value applied:	Open cycle diesel implemented after 2000: Efficiency is 39.5% Open cycle diesel implemented before 2000: Efficiency is 30% For the calculation for the Build margin: Sub-critical Power stations implemented before 2000: Efficiency is 37% Sub-critical Power stations implemented after 2000: Efficiency is 39%
Justification of the	As per “Tool to calculate the emission factor for an electricity system”.

choice of data or description of measurement methods and procedures actually applied :	To determine the power station emission factor for the four single cycle turbine power stations (Ankerlig, Gourikwa, Port Rex and Acacia), Option A2 is applied because the fuel consumption for these power stations are not available for all three years used to determine the operating margin. The default efficiencies provided in Annex 1 of the Tool is applied which is conservative.
Any comment:	Information is used to calculate the combined margin emission factor ex ante

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

Project emissions

The project emissions from a wind farm are considered to be zero.

Leakage

No leakage is anticipated as a result of this project activity.

Baseline emissions

Baseline emissions include only CO2 emissions from electricity generation in the national grid 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:

$$BE_y = EG_{PJ,y} \times EF_{Grid,CM,y}$$

Equation 4

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)
$EF_{grid,CM,y}$	=	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” (tCO_2/MWh)

$$BE_y = EG_{PJ,y} \times EF_{Grid,CM,y}$$

Equation 4 becomes:

BE_y = 74,267 x 0.9075

= 67,397

(a) Greenfield renewable energy power plants

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

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

Equation 5

Where

$EG_{facility,y}$	=	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh/yr)

Therefore, $EG_{PJ,y}$ = 74,267 MWh

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$

Equation 6

Where

ER_y	=	Emission reductions in year y (t CO_2e/yr)
BE_y	=	Baseline emissions in year y (t CO_2e/yr)
PE_y	=	Project emissions in year y (t CO_2e/yr)

ERy = 67,397 **– 0** tCO_2

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

For the single phased approach the following emission reductions will occur:

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of emission reductions (tonnes of CO_2 e)
1	0	67,397	0	67,397
2	0	67,397	0	67,397
3	0	67,397	0	67,397
4	0	67,397	0	67,397
5	0	67,397	0	67,397
6	0	67,397	0	67,397
7	0	67,397	0	67,397
8	0	67,397	0	67,397
9	0	67,397	0	67,397
10	0	67,397	0	67,397
Total (tonnes of CO2 e)	0	673,970	0	673,970

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

B.7.1 Data and parameters monitored:

Data / Parameter:	1. $EG_{facility,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project to the grid in year *y*.
Source of data to be used:	Readings of electricity meter installed at the project site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	74,267 MWh per annum (calculated from the Windprospect report)
Description of measurement methods and procedures to be applied:	The readings of the electricity meter will be continuously measured and monthly recorded. Data will be archived for 2 years following the end of the last crediting period by means of electronic and paper backup. The precision of the meter is not lower than 0.5s. The calibration frequency is at least once a year or as specified by the equipment supplier. The net electricity supplied to the grid by the proposed project will be calculated through electricity supplied by the project to

	the grid ($EG_{output,y}$) deducting electricity purchased from the grid.
QA/QC procedures to be applied:	The electricity supplied to the grid will be monitored and recorded at the central control room. The project operator is responsible for recording such data. Electricity sales receipts will be kept for cross checking purposes. The electricity meters measuring electricity supplied to the grid will be calibrated according to the relevant national standard (or manufacturer's recommendation where there is no national standard) by an accredited entity. 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. The accuracy class of the metering equipment will be class 0.5 or better. The following two standards apply: - NERS 057-4, Electricity Metering Part 4: Code of Practice - IEC 60255-6 Electrical relays Part 6: Measuring relays and protection equipment.
Any comment:	

Data / Parameter:	2. $EG_{m,y}$
Data Unit:	MWh
Description:	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y*
Source of data to be used:	Public information based on the national utility information for the South African national grid. Official statistics, publicly available and reliable data source.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Refer to Table 5: Power stations in the operating margin and the figures in GEF spreadsheet for calculating the build margin, Sheet "Base_data"
Description of measurement methods and procedures to be applied:	The information is not metered by the Project Participant, but will be collected from publicly available information. There are no measurement methods applied.
QA/QC procedures to be applied:	The data will be collected annually from the public sources. This data is not monitored on the site, but is collected from published information. Therefore, no specific quality control procedures are applied.
Any comment:	Calculation of baseline emissions. The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter:	3. $FC_{i,m,y}$
Data Unit:	Mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by power unit *m* in year *y*
Source of data to be used:	Public information based on the national utility information for the South African national grid. Official statistics, publicly available and reliable data source (national utility).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Refer to the figures in GEF spreadsheet for calculating the build margin, Sheet "Base_data"
Description of measurement methods and procedures to be applied:	The information is not metered by the Project Participant, but will be collected from publicly available information. There are no measurement methods applied.
QA/QC procedures to be applied:	The data will be collected yearly from the public sources. The above data will be kept for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later.

Any comment:	The purpose of this data is to calculate baseline emissions. This information is used to determine the build margin ex post.

Data / Parameter:	4. $EF_{CO2,i,y}$
Data Unit:	tCO_2/GJ
Description:	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data to be used:	<table><tr><th>Data source</th><th>Conditions for using the data source</th></tr><tr><td>Values provided by the fuel supplier of the power plants in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr><tr><td>Regional or national average default values</td><td>If values are reliable and documented in regional or national energy statistics / energy balances</td></tr><tr><td>IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr></table>
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Bituminous Coal: 0.0895 tCO_2/GJ, for other bituminous at the lower limit. Other Kerosene 70.8 tCO_2/TJ Diesel: 72.6 tCO_2/TJ For validation purposes: IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. Some information is available about the various coal resources in South Africa, all of which is classified as bituminous. However, sufficient information is not available for each coal fired power station and therefore the IPCC default is applied. Refer to Appendix 30: ‘Future_of_South_African_Coal’, Section 2 “Overview of South African coal sector”, page 2 where it is mentioned that: “South Africa’s economically recoverable coal reserves are estimated at between 15 and 55 billion tonnes. 96% of reserves are bituminous coal; metallurgical coal accounts for approximately 2% and anthracite another 2%. Production is mainly steam coal of bituminous quality.”
Description of measurement methods and procedures to be applied:	The information is not metered by the Project Participant, but will be collected from publicly available information or from IPCC figures. There are no measurement methods applied.
QA/QC procedures to be applied:	The data will be collected yearly from the public sources.

Any comment:	Calculation of baseline emissions. This data is not monitored on the site, but is collected from published information. Therefore, no specific quality control procedures are applied.

Data / Parameter:	5. $NCV_{i,y}$
Data Unit:	GJ/mass or volume unit
Description:	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data to be used:	<table><tr><th>Data source</th><th>Conditions for using the data source</th></tr><tr><td>Values provided by the fuel supplier of the power plants in invoices</td><td>If data is collected from power plant operators (e.g. utilities)</td></tr><tr><td>Regional or national average default values</td><td>If values are reliable and documented in regional or national energy statistics/energy balances</td></tr><tr><td>IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td></td></tr></table>
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Coal (GJ/ton) Eskom: Coal (GJ/ton) 2008/09 – 19.1 2009/10 – 19.22 2010/11 – 19.45 Other Kerosene –42.4GJ/ton Diesel- 41.4GJ/ton • For coal: Eskom published data, *Source* Eskom Holdings Limited Integrated Report 2011, page 324. • See GEF spreadsheet, Sheet Base_Data, Cells S12, T12 and U12. • For Other Kerosene: IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. See GEF spreadsheet, Sheet 'DV', Cell D14 • For Diesel: IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. See GEF spreadsheet, Sheet 'DV', Cell D16
Description of measurement methods and procedures to be applied:	The information is not metered by the Project Participant, but will be collected from publicly available information or from IPCC figures. There are no measurement methods applied.

QA/QC procedures to be applied:	The data will be collected yearly from the public sources.
Any comment:	Calculation of baseline emissions. Information is used to calculate the combined margin emission factor. This data is not monitored on the site, but is collected from published information. Therefore, no specific quality control procedures are applied.

Data / Parameter:	6. $\eta_{m,y}$
Data Unit:	%
Description:	Average net energy conversion efficiency of power unit *m* or *k* in year *y*
Source of data to be used:	Use either: • Documented manufacturer's specifications (if the efficiency of the plant is not significantly increased through retrofits or rehabilitations); or • For grid power plants: data from the utility, the dispatch center or official records if it can be deemed reliable; or • The default values provided in the table in Annex 1 (if available for the type of power plant)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Refer to CER calculation spreadsheet in the calculation for the Build margin. Sub-critical Power stations implemented before 2000: Efficiency is 37% Sub-critical Power stations implemented after 2000: Efficiency is 39% Open cycle diesel implemented after 2000: Efficiency is 39.5%
Description of measurement methods and procedures to be applied:	The information is not metered by the Project Participant, but will be collected from publicly available information or from IPCC figures. There are no measurement methods applied.
QA/QC procedures to be applied:	The data will be collected yearly from the public sources.
Any comment:	Calculation of baseline emissions. Information is used to calculate the combined margin emission factor. If the data obtained from the manufacturer, the utility, the dispatch center of official records is significantly lower than the default value provided in Annex 1 for the applicable technology, project proponents should assess the reliability of the values, and provide appropriate justification if deemed reliable. Otherwise, the default values provided in Annex 1 shall be used

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 Monitoring Officer will be appointed from among the senior technical staff from the BioTherm Operations & Maintenance (Pty) Ltd ("Monitoring Officer").

Before the Monitoring Officer commences monitoring duties, he/she will receive training on monitoring requirements and procedures.

A staff (monitoring team) will be dedicated to execute the monitoring tasks. A detailed Monitoring Manual of the project will be completed during the first year of monitoring period.

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, owned by the Grid Company) 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.

3. Calibration of Measuring Instruments

All measurement instruments will be regularly calibrated to ensure that the measured values are within the specified accuracy margins. Calibration tests will be performed 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.

Corrective actions will be taken 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, than 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 within 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 (from the Facility Metering configuration) will be cross-checked with records for sold electricity.

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

5. Data storage and safeguarding

Data will be archived in electronic spread sheets. For data security, a backup of the electronic spread sheets 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 Project Owner 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):

>>Date of completion of the baseline study: 25 February 2012

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The entity that carried out the baseline study is not a project participant.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

The start date is 19 December 2011, when the Preferred Bidder Bond was posted. As explained in section B.5 above, this date corresponds to the earliest date of “Implementation, Construction or Real Action”.

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

20 Years 0 months

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

C.2.1. Renewable crediting period:

Not applicable left open on purpose

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

Not applicable left open on purpose

C.2.1.2. Length of the first crediting period:

Not applicable left open on purpose

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/08/2013

C.2.2.2. Length:

10 Years 0 months

SECTION D. Environmental impacts

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

The environmental impact assessment (EIA) for the proposed project activity has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

A full Environmental Impact Assessment as is required by law, was carried out with expert reports in the following fields (refer to the Final Environmental Impact Assessment Report, provided as Appendix 81 to the DOE):

- Vegetation
- Terrestrial Fauna and Habitats
- Aviflaura
- Geology and soils
- Agricultural potential
- Visual impacts
- Heritage impacts
- Noise
- Social impacts
- Cumulative impacts

No environmental fatal flaws were identified to be associated with the proposed wind energy facility. A number of issues requiring mitigation have been highlighted and these are discussed in Section D.2.

The most significant impacts were found to be the following[7]:

- Visual impacts on the natural scenic resources of the region imposed by the components of the facility;
- Mortality of aviflaura in the operational phase;
- Impacts on biodiversity as a result of the construction and operation of the Facility.

No trans-boundary impacts were identified as a result of the project activity.

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:

The Department of Environment issued a positive Record of Decision, i.e. the Department of Environment granted authorisation for the project on 27 June 2011.

[7] SEE FEIR Executive Summary, p ix.

Reference documentation:

- Positive Record of Decision issued by the Department of Environment on 27 June 2011, provided to the DOE as Appendix 80.
- Amendment of the Environmental Authorisation for the proposed establishment of the Klipheuwel/Dassiesfontein Wind Energy Facility, issued on 16 July 2912, provided to the DOE as Appendix 82. This document lists the monitoring requirements regarding impacts on birds and bats.
- Final Environmental Impact Assessment Report (FEIR) provided to the DOE as Appendix 81.

A comprehensive discussion of all impacts appears in the FEIR Table 6.2 page 146 and further. The aspects with high impact were considered to be the following:

- Loss of vegetation within the development footprint
- Mortality of aviflaura in the operational phase
- Visual impact of the development

The mitigation of these impacts are discussed in detail in the FEIR. The Executive Summary provides the following summary:

- The majority of potential impacts on natural vegetation and onsite habitats have been avoided by the developer through its consultations and discussions with the specialists to develop a project around the identified environmentally sensitive areas on the site during the design of the preliminary layout of the facility. The only areas of potential impact identified include that associated with the construction of the Dassiesfontein substation and the local access road and cabling between turbines 2 and 3 and turbines 2 and 6. Impacts in this regard can be avoided through the relocation of the infrastructure outside of the natural vegetation areas and the developer has begun this process[8];
- Impacts on avifauna relate to impacts on birds and bats in the region. The developer has embarked on a bat monitoring program to determine the likelihood of rare species traversing the site. Impacts on avifauna associated with construction and operational activities include disturbance, loss of foraging habitat (in terms of the area covered by the construction footprint and by displacement from areas with operating turbines),energetic costs associated with routing around a barrier of wind turbines when commuting between resource areas, and/or mortalities associated with collisions with the turbine blades. These effects may be reduced to acceptable and sustainable levels by adherence to a proposed mitigation scheme. A comprehensive programme to fully monitor the actual impacts of the facility on the broader avifauna of the area was recommended and outlined, from preconstruction and into the operational phase of the project[9].
- It was found that while the primary visual impact, namely the appearance and dimensions of the wind energy facility (mainly the wind turbines) is not possible to mitigate to any significant extent within this landscape, the overall impact was found to be acceptable.[10]

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[8] See FEIR p x

[9] See FEIR p xi

[10] See FEIR p xv

The Amendment of the Environmental Authorisation for the proposed establishment of the Klipheuwel/Dassiesfontein Wind Energy Facility, issued on 16 July 2912, provided to the DOE as Appendix 82, lists the monitoirng requirements regarding impacts on birds and bats.

SECTION E. Stakeholders' comments

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

>> The Environmental Impact Assessment (EIA) for the proposed facility has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

These regulations stipulate that public participation has to be part of the process.

The process comprised of the following:

- Notification of the EIA process in the printed media and on site, as well as through written notification to identified stakeholders and affected landowners;
- Identification and registration of Interested and Affected Parties (I & AP's") and key stakeholders
- Compilation of a Background Information Document sent to all the "I & Aps" and key stakeholders;
- Members of the public, local communities and stakeholders were invited to comment on the Draft EIA Report which was made available for public review and comment at the Caledon Library, the Bot River Library and at www.savannahSA.com from 4 November 2010 to 4 December 2010; The Draft EIA specifically mentioned the CDM on pages xxv, 18, and 126 (printed numbers, not PDF numbers);
- A public feedback meeting was held on 23 November 2010 at Caledon to provide feedback on the studies undertaken.

E.2. Summary of the comments received:

>>
A comprehensive record of comments and responses appears in Appendix E.2 to the Final Environmental Impact Report.

Summary of relevant comments received:

- Does the calculation of the lowering the electricity grid carbon footprint include the need for standby power? [11]
- The involvement of a foreign owned private equity firm the financing structure suggests that carbon credits could accrue off-shore – how will this be prevented?[12]

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[11] See "Proposed BioTherm Energy Klipheuwel Dassiefontein Wind Energy Facility Environmental Impact Assessment, Western Cape: Final Environmental Impact Assessment Report, Annex E.2, comment 82

[12] As above, comment 95

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

The comments and responses were logged in Annexure E.2 to the FEIR. Each question was answered by the Project Participant.

Response to the first question above: The carbon footprint offset calculation is based on the projected load factor of the wind farm and not on the installed capacity running at 100%.

Response to the second question above: The project will be owned by a Special Purpose Vehicle registered in South Africa and any carbon credits would accrue to that entity.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Klipheuwel Dassiefontein Wind Energy Facility (RF) (Pty) Ltd
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<u>Annex 2</u>

INFORMATION REGARDING PUBLIC FUNDING

No public funding was used was involved in this project.

Annex 3

BASELINE INFORMATION

South African Grid

In South Africa, our most abundant source of energy is coal[13]. The majority of our coal deposits which are suitable for cheap power generation are found in eastern and south-eastern Gauteng and in the northern Free State. In Gauteng it is generally found at shallow depths and in thick seams, whereas in KwaZulu-Natal, the seams are deeper and thinner, but of higher quality.

Africa's only nuclear power station, Koeberg, is also a base load station, with an installed capacity of 1 930 MW of power. Koeberg's total net output is 1 800 MW.

The generation mix further includes two conventional hydroelectric power stations and two hydro pumped storage schemes. These stations are used when there is a sudden increase, or peak, in the demand for electricity that cannot immediately be met by the base load stations. They have a combined installed capacity of 2,000 MW.

Determination of the grid emission factor

The GHG emission calculation of the proposed project is based on the instruction of "Tool to calculate the emission factor for an electricity system". To estimate figures for validation purposes, all the data employed in the calculation is based on the available data from South African Power Grid or IPCC default figures. The baseline emission factor (EFy) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors:

The following steps are applied to calculate the emission factor for an electricity system:

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. Provide evidence that the simple operating margin is still the applicable selection.

STEP 4. Calculate the simple operating margin emission factor according to the selected method, ex ante

STEP 5. Calculate the build margin (BM) emission factor, ex post.

STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electric power system

A **project electricity system** is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints.

[13] http://www.eskom.co.za/live/content.php?Category_ID=96

Project electricity system

The DNA of South Africa has, to date, not published a delineation of the project electricity system and connected electricity systems.

Spot markets: There exists no spot market in South Africa for electricity. The National Electricity Regulator (NER) regulates the prices at which electricity can be sold. There is no public information available regarding the operation of transmission lines and therefore it is not possible to define a grid boundary. Electricity generated by the proposed project activity will displace the power production in the national grid of South Africa, which is defined as the project electricity system by default.

The project electricity system forms part of a connected electricity system whereby it is connected by transmission lines to the national grid of Botswana (Botswana Power Corporation), Mozambique, Namibia (NamPower), Zimbabwe (ZESA), Lesotho (Lesotho Electricity Company), Swaziland and Zambia (ZESCO).

Connected electricity system

The South African grid is connected by transmission lines to grids in neighboring countries Mozambique, Botswana, Namibia and Zimbabwe. South Africa exports some electricity to neighboring countries and import some as well. Therefore, this larger grid is defined as the **connected electricity systems**. The connected electricity systems are not partially or totally located in Annex 1 countries.

For the purpose of determining the operating margin emission factor, the CO2 emission factor(s) for net electricity imports from a connected electricity system is 0 tCO2/MWh, because information is not available for emission factors of any of the neighboring countries.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

<u>Off-grid power plants are not included in the calculations as information is not available.</u>

Step 3: Provide evidence that the simple operating margin can be applied

<u>Motivation for using Simple Operating Margin</u>

The simple OM method can be used for as long as the low-cost/must-run resources constitute less than 50% of the total grid generation in the five most recent years.

Figure 2: Statistical overview of electricity production in South Africa for 5 years

	2011	2010	2009	2008	2007
Coal-fired (GWh)	**220 219**	215 940	211 941	222 908	215 211
Hydro-electric (GWh)	**1 960**	1 274	1 082	751	2 443
Pumped storage (GWh)	**2 953**	2 742	2 772	2 979	2 947
Gas turbine (GWh)	**197**	49	143	1 153	62
Nuclear (GWh)	**12 099**	12 806	13 004	11 317	11 780
Wind energy (GWh)[6]	**2**	1	2	1	2
Total own production (GWh)	**237 430**	232 812	228 944	239 109	232 445

Source of information for the table: Eskom Integrated Report 2011, page 13

Total GWh from coal from 2007 - 2011= 1,086,219

Total GWh production from 2007 – 2011 = 1,170,740

%Share of coal fired in power stations: 92.78%.

It is therefore confirmed that the low-cost/must-run resources constitute less than 50% of the total grid generation.

Data vintage

In terms of data vintages, the *ex ante* option were chosen to calculate the simple OM.

In this option a 3 year generation-weighted average are used for the grid power plants.

The data used in OM calculations are for the 3-year period indicated in the following Table. This is the latest public available data at the time of submitting the PDD for validation.

Table 5: Power stations in the operating margin

No.	Name of Power Unit/country	Installed Capacity (MW) *Source: FuelConsumptionElectricityGen.xls puplished by Eskom, Appendix 61*	Net Electricity Generation (MWh) *Source: Appendix 61_FuelConsumptionElectricityGen.xls puplished by* Eskom. Source for single cycle gas turbines for 2010/11: Appendix 61_GEF data Final_vr1 published by Eskom Website short cut access is:			Main Fuel Type/ Energey Source	Main Fuel Consumption (t (mass or volume unit)) *Source: Appendix 61_FuelConsumptionElectricityGen.xls puplished by Eskom* Website short cut access is: http://www.eskom.co.za/c/article/236/cdm-calculations/			Net Calorific Value of Main Fuel (GJ/t (GJ/mass or volume unit)) *Source: Appendix 66_Eskom Integrated Report 2011, page 324*			Generation technology for Option A2	Emission Factor Caluculation Option
			2008-2009	2009-2010	2010-2011		2008-2009	2009-2010	2010-2011	2008-2009	2009-2010	2010-2011		
Electricity import														
i-1	International imports		12,189,000	13,754,000	13,613,000									
i-2	IPPs		0	0	1,833,000									
Electricity generation in the project electricity system														
1	Arnot	1980	11,987,281	13,227,864	12,194,878	Other Bituminous Coal	6,395,805	6,794,134	6,525,670	19.1	19.22	19.45		A1
2	Duvha	3450	21,769,489	22,581,228	20,267,508	Other Bituminous Coal	11,393,553	11,744,606	10,639,393	19.1	19.22	19.45		A1
3	Hendrina	1895	12,296,687	12,143,292	11,938,206	Other Bituminous Coal	7,122,918	6,905,917	7,139,198	19.1	19.22	19.45		A1
4	Kendal	3840	23,841,401	23,307,031	25,648,258	Other Bituminous Coal	15,356,595	13,866,514	15,174,501	19.1	19.22	19.45		A1
5	Kriel	2850	18,156,686	15,906,816	18,204,910	Other Bituminous Coal	9,420,764	8,504,715	9,527,185	19.1	19.22	19.45		A1
6	Lethabo	3558	23,580,232	25,522,698	25,500,366	Other Bituminous Coal	16,715,323	18,170,227	17,774,699	19.1	19.22	19.45		A1
7	Matimba	3690	26,256,068	27,964,141	28,163,040	Other Bituminous Coal	13,991,453	14,637,481	14,596,842	19.1	19.22	19.45		A1
8	Majuba	3843	22,676,924	22,340,081	24,632,585	Other Bituminous Coal	12,554,406	12,261,833	13,020,512	19.1	19.22	19.45		A1
9	Matla	3450	21,863,400	21,954,536	21,504,422	Other Bituminous Coal	12,689,387	12,438,391	12,155,421	19.1	19.22	19.45		A1
10	Tutuka	3510	21,504,122	19,847,894	19,067,501	Other Bituminous Coal	11,231,583	10,602,839	10,191,709	19.1	19.22	19.45		A1
11	Ankerlig	1327	78,772	26,992	108,518	Gas/Diesel Oil							Oil -Open cycle	A2
12	Gourikwa	740	43,927	15,052	60,515	Gas/Diesel Oil							Oil -Open cycle	A2
13	Acacia	171	10,151	3,478	13,984	Other Kerosene							Oil -Open cycle	A2
14	Port Rex	171	10,151	3,478	13,984	Other Kerosene							Oil -Open cycle	A2
15	Camden *	1600	6,509,079	7,472,070	7,490,836	Other Bituminous Coal	3,876,211	4,732,163	4,629,763	19.1	19.22	19.45		A1
16	Grootvlei	1200	1,249,556	2,656,230	3,546,952	Other Bituminous Coal	674,538	1,637,371	2,132,979	19.1	19.22	19.45		A1
17	Komati	1000	0	1,016,023	2,060,141	Other Bituminous Coal	0	664,497	1,271,010	19.1	19.22	19.45		A1

Source: Copied sheet from the GEF Spreadsheet for calculating the Operating margin. Information in the spreadsheet sourced from FuelConsumptionElectricityGen.xls published by Eskom. Website short cut access is: http://www.eskom.co.za/c/article/236/cdm-calculations/

Step 4: Calculate the simple operating margin emission factor

Option A1 is used for all the coal-fired power stations because the national utility published the net electricity generation and fuel consumption for each power plant and therefore the data is available in the public domain. As such, a CO_2 emission factor for each coal fired power plant can be determined. *Option A2* is applied to determine the power station emission factor for the four single cycle turbines stations (Acacia, Ankerlig, Port Rex and Gourikwa) running on diesel or kerosene because the information regarding historic fuel consumption for each of these turbine power stations is not available for the necessary years at the time of submitting the PDD for validation. Therefore, Option A2, the conservative approach, is applied to determine the emission factors for these four power stations and the relevant default efficiency factors provided in Annex 1 of the Tool are applied.

Determination of $EF_{grid,OMsimple,y}$

Option A - Based on the net electricity generation and a CO_2 emission factor of each power unit

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:

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

Equation 1

Where:

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating 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	=	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 $EF_{EL,m,y}$ according to Option A1

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_{m,y}}$$

Equation 2

Where:

$EF_{ELm,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/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)
i	=	All fossil fuel types combusted in power unit *m* in year *y*
m	=	The power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid
y	=	The relevant year as per the data vintage chosen in Step 3

For the four single cycle turbines, option A2 from guidance in Step 4 (a) is used and the default values provided in Annex 1 are used to determine the parameter $\eta_{m,y}$ for validation purposes.

Determination of $EF_{EL,m,y}$ according to Option A2

The fuel consumption information for each of the four single cycle turbines for the three-year period prior 2011 is not available. Option A2 is applied to determine $FE_{EL,m,y}$ for these plants only. For the four single cycle turbines, option A2 from guidance in Step 4 (a) is used and the default values provided in Annex 1 are used to determine the parameter $\eta_{m,y}$ for validation purposes.

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

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

Equation 4

Where:

$EF_{ELm,y}$	=	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). A default value is adopted from "Tool to calculate the emission factor for an electricity system, Annex 1"
i	=	All fossil fuel types combusted in power sources m in the project electricity system in year *y*
m	=	The power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid
y	=	The relevant year as per the data vintage chosen in Step 3

Table 6: Power stations in the Operating Margin

Operating Margin Calculation Option	Simple OM

No.	Name of Power Unit	2008-2009		2009-2010		2010-2011	
		Net Electricity Generation	CO2 Emission Factor	Net Electricity Generation	CO2 Emission Factor	Net Electricity Generation	CO2 Emission Factor
		MWh	t-CO_2/MWh	MWh	t-CO_2/MWh	MWh	t-CO_2/MWh
Electricity import							
i-1	International imports	12,189,000		13,754,000		13,613,000	
i-2	IPPs	0.0		0.0		1,833,000.0	
Electricity generation in the project electricity		-		-		-	
1	Arnot	11,987,281	0.9121	13,227,864	0.8835	12,194,878	0.9315
2	Duvha	21,769,489	0.8947	22,581,228	0.8947	20,267,508	0.9138
3	Hendrina	12,296,687	0.9902	12,143,292	0.9783	11,938,206	1.0410
4	Kendal	23,841,401	1.1011	23,307,031	1.0234	25,648,258	1.0299
5	Kriel	18,156,686	0.8870	15,906,816	0.9197	18,204,910	0.9110
6	Lethabo	23,580,232	1.2118	25,522,698	1.2246	25,500,366	1.2134
7	Matimba	26,256,068	0.9109	27,964,141	0.9004	28,163,040	0.9022
8	Majuba	22,676,924	0.9464	22,340,081	0.9442	24,632,585	0.9202
9	Matla	21,863,400	0.9922	21,954,536	0.9746	21,504,422	0.9840
10	Tutuka	21,504,122	0.8928	19,847,894	0.9189	19,067,501	0.9305
11	Ankerlig	78,772	0.6617	26,992	0.6617	108,518	0.6617
12	Gourikwa	43,927	0.6617	15,052	0.6617	60,515	0.6617
13	Acacia	10,151	0.8496	3,478	0.6617	13,984	0.8496
14	Port Rex	10,151	0.8496	3,478	0.6617	13,984	0.8496
15	Camden *	6,509,079	1.0180	7,472,070	0.6617	7,490,836	0.8496
16	Grootvlei	1,249,556	0.9228	2,656,230	1.0604	3,546,952	1.0468
17	Komati	0	-	1,016,023	1.1250	2,060,141	1.0740
18		-	-	-	-	-	-
19		-	-	-	-	-	-
20		-	-	-	-	-	-
Annual Electricity		224,022,925		229,742,904		235,862,603	
Simple Operating Margin CO2 Emission Factor		EFgrid, OMsimple,y1	0.9270	EFgrid, OMsimple,y2	0.9208	EFgrid, OMsimple,y3	0.9215
Operating Margin Emission Factor (t-CO_2/MWh)							**0.9230**

Source: GEF Spreadsheet for calculating the operating margin, Sheet "OM"

Step 5 Calculate the build margin (BM) emission factor

Data Vintage – Option 2 is selected (ex post)

Option 2: Calculate the build margin emission factor *ex post* based on the most recent information available on units already built for sample group *m*.

(a) (a) According to the information provided by the national utility, $SET_{5\text{-units}}$ consist of the following 5 units (based on the power stations most recently added to the national grid):

SET5-units						
No.	Name of power unit and source of information	Year commissioned	Fuel Type Energey Source	Net Electricity Generation (MWh/y) of the latest year	CO2 Emission Factor (t-CO_2/MWh) of the latest year	CO2 Emissions (t-CO_2)
26	Komati	2009	Other Bituminous Coal	2,060,141	0.8262	1,701,993
25	Grootvlei	2008	Other Bituminous Coal	3,546,952	0.8262	2,930,328
13	Gourikwa	2007	Gas/Diesel Oil	60,515	0.6617	40,041
12	Ankerlig	2007	Gas/Diesel Oil	108,518	0.6617	71,803
24	Camden *	2005	Other Bituminous Coal	7,490,836	0.8262	6,188,583

Source of information:
***Grootvlei: Re-commissioned power plant,** Eskom Holdings Limited Integrated Report 2011, page 148
****Komati: Re-commissioned power plant,** Eskom Annual Report 2010, page 126,
http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf
*****Camden: Re-commissioned power plant,** Eskom Annual Report 2010, page 127,
http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf

The re-commissioned power stations were taken off the grid (mothballed) years ago and were rebuild completely before commissioning them onto the national grid.

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

SET≥20%						
No.	Name of power unit and source of information	Year commissioned	Fuel Type Energey Source	Net Electricity Generation (MWh/y) of the latest year	CO2 Emission Factor ($t\text{-}CO_2$/MWh) of the latest year	CO2 Emissions ($t\text{-}CO_2$)
25	Grootvlei	2008	Other Bituminous Coal	3,546,952	0.8262	2,930,328
13	Gourikwa	2007	Gas/Diesel Oil	60,515	0.6617	40,041
12	Ankerlig	2007	Gas/Diesel Oil	108,518	0.6617	71,803
24	Camden *	2005	Other Bituminous Coal	7,490,836	0.8262	6,188,583
27	Wind	2002	Wind	2,000	0.0000	0
8	Majuba	1996	Other Bituminous Coal	24,632,585	0.8708	21,450,321
4	Kendal	1988	Other Bituminous Coal	25,648,258	0.8708	22,334,780

Source: GEF spreadsheet for calculating the Build margin and operating margin, Sheet “BM”

In the GEF spreadsheet, the set of power units will be selected from $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ that comprise the larger annual generation to calculate the build margin (SET_{sample}).

SET_{sample} is equal to $SET_{\geq 20\%}$ because $SET_{\geq 20\%}$ comprises the larger annual generation.

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.

It is clear that Kendal and Majuba in SET_{sample} have started to supply electricity to the grid more than 10 years ago.

(d) Exclude from SET_{sample} the power units that started to fsupply electricity to the grid more than 10 years ago. This excludes the following power plants from SET_{sample}.

- Kendal (1988)
- Majuba (1996)

The only CDM project activity that started supply electricity to the grid, is the Bethlehem Hydro plant. It is assumed that the Bethlehem Hydro plant delivers the expected MWh per year that is indicated in the PDD on page 12, i.e. 34,031 MWh.

SETsample-CDM						
No.	Name of power unit and source of information	Year commissioned	Fuel Type Energey Source	Net Electricity Generation (MWh/y) of the latest year	CO2 Emission Factor ($t\text{-}CO_2$/MWh) of the latest year	CO2 Emissions ($t\text{-}CO_2$)
28	Bethlehem Hydro	2009	Hydro	34,031	0.0000	0
25	Grootvlei	2008	Other Bituminous Coal	3,546,952	0.8262	2,930,328
13	Gourikwa	2007	Gas/Diesel Oil	60,515	0.6617	40,041
12	Ankerlig	2007	Gas/Diesel Oil	108,518	0.6617	71,803
24	Camden *	2005	Other Bituminous Coal	7,490,836	0.8262	6,188,583
27	Wind	2002	Wind	2,000	0.0000	0

Source: GEF Spreadsheet for calculating the build margin and operating margin, Sheet “BM”

$AEG_{SET\ sample\ CDM} < 0.2 \times AEG_{total}$. Therefore, continue to the next step below:

(e) The plants that have to be added to make up the set that comprises 20% of the grid are Majuba and Kendal.

The sample group of power units m used to calculate the build margin	SETsample-CDM->10yrs

No.	Name of power unit and source of information	Year commissioned	Fuel Type Energey Source	Net Electricity Generation (MWh/y) of the latest year	CO2 Emission Factor ($t\text{-}CO_2$/MWh) of the latest	CO2 Emissions ($t\text{-}CO_2$)
26	Komati	2009	Other Bituminous Coal	2,060,141	0.8262	1,701,993
28	Bethlehem Hydro	2009	Hydro	0	0.0000	0
25	Grootvlei	2008	Other Bituminous Coal	3,546,952	0.8262	2,930,328
13	Gourikwa	2007	Gas/Diesel Oil	60,515	0.6617	40,041
12	Ankerlig	2007	Gas/Diesel Oil	108,518	0.6617	71,803
24	Camden *	2005	Other Bituminous Coal	7,490,836	0.8262	6,188,583
27	Wind	2002	Wind	2,000	0.0000	0
8	Majuba	1996	Other Bituminous Coal	24,632,585	0.8708	21,450,321
4	Kendal	1988	Other Bituminous Coal	25648258	0.8708	22,334,780
Total				**63,549,804**		**54,717,850**
Build Margin Emission Factor ($t\text{-}CO_2$/MWh)						**0.8610**

Source: GEF spreadsheet for calculating the Build margin and operating margin, Sheet “BM”

Determining $EF_{grid,BM,y}$

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 power generation data is available, calculated as follows:

Equation 3

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

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 power generation data is available

The power units included in the build margin *m* correspond to the sample group SETsample-CDM->10yrs, therefore, option A2 from guidance in Step 4 (a) is used and the default values provided in Annex 1 are used to determine the parameter $\eta_{m,y}$ for validation purposes.

Option A2

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

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

Where:

$EF_{ELm,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2 /GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit m in year y (ratio). A default value is adopted from “Tool to calculate the emission factor for an electricity system, Annex 1”
i	=	All fossil fuel types combusted in power sources m in the build margin in the project electricity system in year *y*
m	=	The power plants/units in the build margin
y	=	The relevant year as per the data vintage

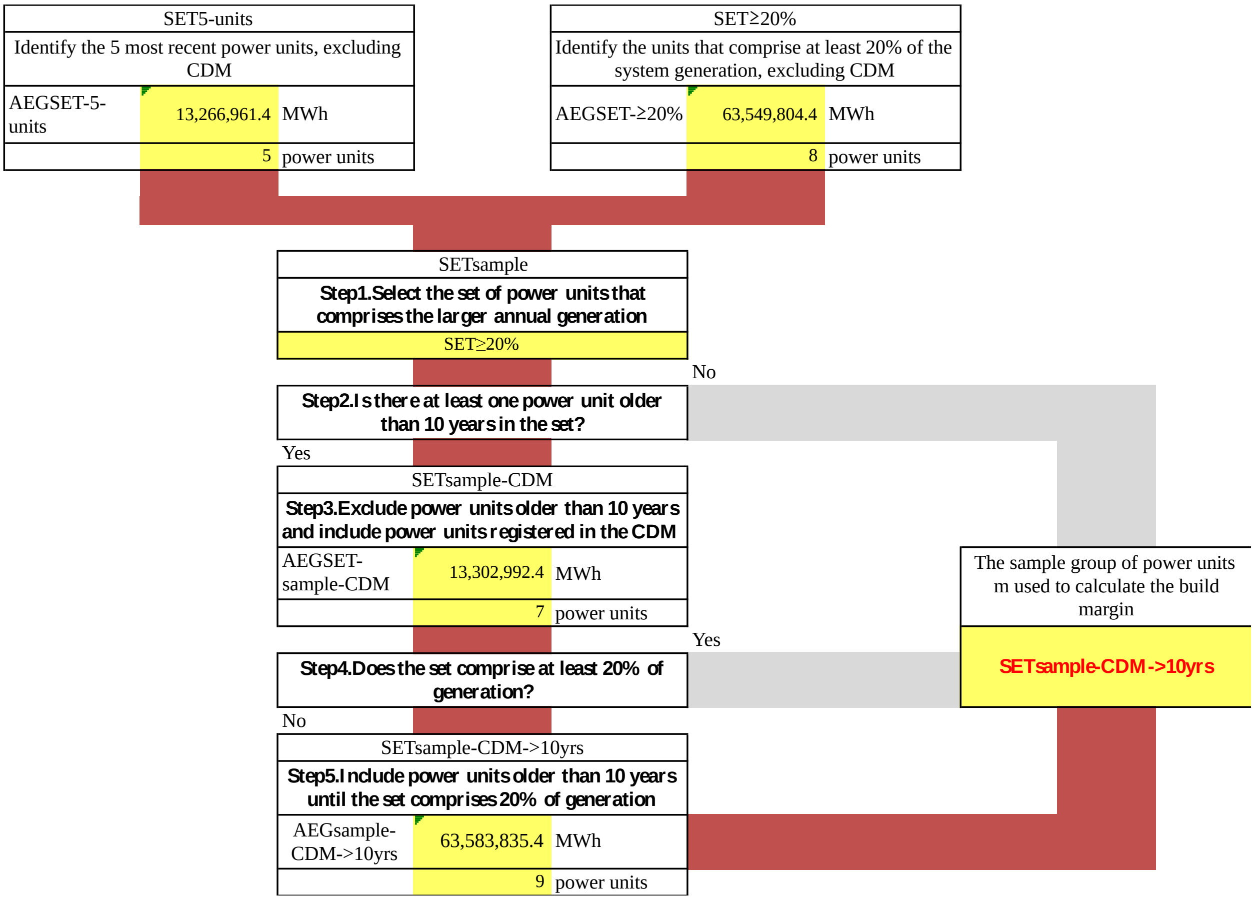
The average net energy conversion efficiencies are shown in the GEF spreadsheet for the BM, Sheet “Base-Data”, Column AV.

Sub-critical Power stations implemented before 2000: Efficiency is 37%

Sub-critical Power stations implemented after 2000: Efficiency is 39%

Open cycle diesel implemented after 2000: Efficiency is 39.5%

The diagram below demonstrates the build margin determination process in diagram format. The diagram can be found in the grid emission spreadsheet on sheet ‘BM Diagram’.



Step 6: Calculate the combined margin emissions factor

The calculation of the combined margin emission factor ($EF_{grid,CM,y}$) is determined by the Weighted average CM.

(a) Weighted average CM

The combined margin emissions factor is calculated as follows:

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

Equation 4

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 methodology specifies default values of wOM = 0.75 and wBM = 0.25

The combined margin is calculated as 0.9075 tCO_2/MWh. [refer to grid emission spreadsheet, CM Cell I9].

Annex 4

MONITORING INFORMATION

Contained in section B.7.2 above