



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

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**SECTION A. General description of project activity.****A.1. Title of the project activity:**

West Coast 1 Wind Farm in South Africa
Version 02
Date: 07 June 2012

A.2. Description of the project activity:

The project developer Moyeng Energy (Pty) Ltd is proposing to establish a commercial Wind Energy Facility and associated infrastructure on a site located near the town of Vredenburg 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 West Coast 1 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, consequently avoiding CO₂ emissions from fossil fuelled power plants connected to the 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 Version 12.3.0 of 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 47 wind turbines (described as a wind energy facility) of 2 MW each, to be constructed over a broader study area approximately 2300 hectares in extent. This facility will have a maximum capacity of 94 MW. The expected annual power output is 293.4 GWh¹.

Sustainable Development

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

Environment

¹ “Assessment of the energy production of the proposed West Coast one Wind Farm”, 08/02/2012, Garrad Hassan & Partners Ltd, page iii, net energy output under P50 scenario.



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The project will displace some coal-dominated power generation in South Africa with wind power, thereby reducing the carbon footprint of South Africa.

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 people. Part of the construction phase employment opportunities will be for low skilled job categories. Other jobs will fall within the skilled category. There will be an effort to transfer skills and build local capacity across all roles where possible.

Based on information from similar studies the proposed wind energy facility will create potential employment opportunities in the Western Cape Province of South Africa. However, given that the wind energy sector in South Africa is relatively new it may be necessary to initially import the required operational and maintenance skills from overseas.

Economic

In terms of business opportunities for local companies, 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.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Host Party South Africa	Moyeng Energy (Pty) Ltd Private Entity	No
Host Party South Africa	Micawber 862 (Pty) Ltd Private Entity	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

A.4.1.1. Host Party(ies):



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>>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 Vredenburg

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 lies within an area mainly by the by the following planned geographical coordinates of the turbines:

Turbine	GPS coordinates
T1	18.0371E,32.8301S
T2	18.0352E,32.8246S
T3	18.0353E,32.8179S
T4	18.0318E,32.8266S
T5	18.0283E,32.8254S
T6	18.0233E,32.8409S
T7	18.0198E,32.8424S
T8	18.0183E,32.8356S
T9	18.0159E,32.8420S
T10	18.0147E,32.8351S
T11	18.0130E,32.8467S
T12	18.0115E,32.8385S
T13	18.0104E,32.8238S
T14	18.0096E,32.84509S
T15	18.0099E,32.8315S



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T16	18.0081E,32.8513S
T17	18.0071E,32.8385S
T18	18.0061E,32.8460S
T19	18.0059E,32.8313S
T20	18.0055E,32.8177S
T21	18.0035E,32.8513S
T22	18.0036E,32.8405S
T23	18.0022E,32.8301S
T24	18.0018E,32.8168S
T25	18.0000E,32.8384S
T26	17.9996E,32.8510S
T27	17.9985E,32.8307S
T28	17.9978E,32.8125S
T29	17.9962E,32.8410S
T30	17.9955E,32.8489S
T31	17.9943E,32.8320S
T32	17.9938E,32.8202S
T33	17.9919E,32.8481S
T34	17.9921E,32.8414S
T35	17.9910E,32.8265S
T36	17.9898E,32.8171S
T37	17.9884E,32.8487S
T38	17.9886E,32.8408S

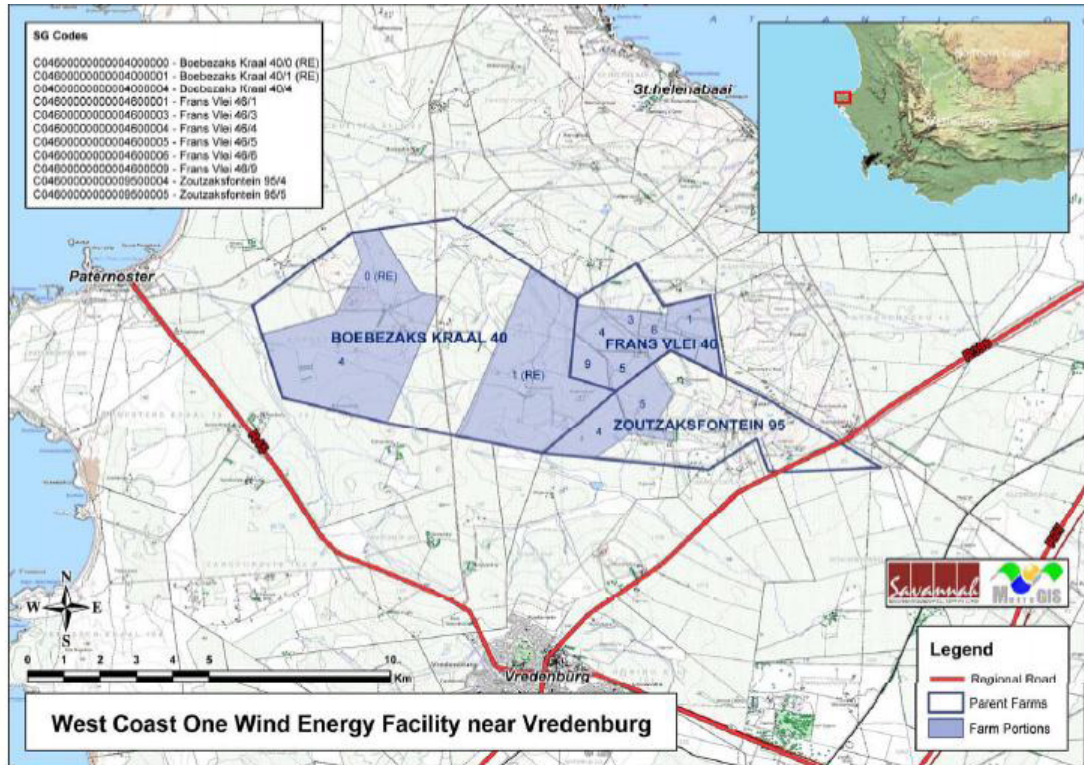


T39	17.9871E,32.8342S
T40	17.9874E,32.8239S
T41	17.9847E,32.8486S
T42	17.9848E,32.8399S
T43	17.9850E,32.8291S
T44	17.9826E,32.8346S
T45	17.9809E,32.8478S
T46	17.9800E,32.8396S
T47	17.9777E,32.8450S

The proposed construction is near the town of Vredenburg, in the Local Municipal area of Saldanha in the Western Cape Province.

The site location and boundary co-ordinates are shown in the figure below; the boundaries of participating properties are outlined in white

Figure 1: Locality maps showing the West Coast 1 Wind Farm site regionally and locally





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 (Vestas) developed outside South Africa.

The Project has carried out a comparison of technological parameters and prices of various models with different unit capacities, while taking into account power generation, cost and benefit. As a result, the V90 – 2MW turbines manufactured by Vestas Wind Systems A/S of Denmark is selected for the Project³. The implementation of which will be conducive to the technology transfer.

Wind energy technology is deemed to be a safe and relatively mature technology, and is established in countries worldwide.

³ See also <http://www.vestas.com/en/media/brochures.aspx> for more technological details



The **V90-2.0 MW turbines** have been designed specifically for IEC III sites. Highly tested and verified, these turbines have proven availability and reliability with the following operational data:

Rated power: IEC IIIA – 50 Hz: 2,000 kW
Cut-in wind speed: 4 m/s
Rated wind speed: 12 m/s
Cut-out wind speed: 25 m/s
Wind class: IEC IIIA
Operating temperature: range standard range -20°C to 40°C, low temperature option -30°C to 40°
Technical lifetime: 20 years⁴

Net energy output: an independent analysis of the wind climate and energy production of the proposed wind farm has been executed by Garrad Hassan and Partners Ltd. The projected energy capture of the proposed wind farm is 293.4 GWh/annum for the Vestas V90 2 MW turbine model at a hub height of 80 m.⁵

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. There exists a substation operated by Eskom at ~30km of project site and this substation will be utilised and connected to the future site by an over head line to be built by Eskom. A gravel road exists on the site and construction will happen to upgrade this road to the standard needed for large vehicles to use the site during the construction period.

The proposed project is the installation of a new grid-connected 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.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.

⁴ Technical brochure, available through: <http://www.vestas.com/en/media/brochures.aspx>

⁵ “Assessment of the energy production of the proposed West Coast one Wind Farm”, 08/02/2012, Garrad Hassan & Partners Ltd, page iii.



Years	Annual estimation of emissions reductions in tonnes of CO ₂ e
1/1/2015	280,754
2016	280,754
2017	280,754
2018	280,754
2019	280,754
2020	280,754
2021	280,754
2022	280,754
2023	280,754
31/12/2024	280,754
Total estimated reductions (tonnes CO ₂ e)	2,807,540
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes ofCO ₂ e)	280,754

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 and Guidelines

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 tables provide a list of the Applicability Criteria as described in ACM0002 / Version 12.3.0 and in the relevant tools and explains why the project complies with each parameter.

Table 1: Applicability Assessment against ACM0002 / Version 12.3.0

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 capacity addition projects for which the electricity generation of the existing power plant(s) or unit(s) is not affected): 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 addition 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.
<p>In case of hydro power plants, at least one of the following conditions must apply:</p> <ul style="list-style-type: none"> o The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or o The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the 	The project is not the implementation of a Hydro plant – therefore this applicability criteria do not apply to the proposed project activity.



Applicability Criteria	Comments
<p>definitions given in the Project Emissions section, is greater than 4 W/m² after the implementation of the project activity; or</p> <p>o The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m² after the implementation of the project activity.</p>	
<p>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:</p> <ul style="list-style-type: none"> • The power density calculated for the entire project activity using equation 5 is greater than 4 W/m²; • All reservoirs and hydro power plants are located at the same river and were designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant; • The water flow between the multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity; • The total installed capacity of the power units, which are driven using water from the reservoirs with a power density lower than 4 W/m², is lower than 15 MW; • The total installed capacity of the power units, which are driven using water from reservoirs with a power density lower than 4 W/m², is less than 10% of the total installed capacity of the project activity from multiple reservoirs. 	<p>The project is not the implementation of a Hydro plant – therefore this applicability criteria does not apply to the proposed project activity.</p>
<p>The methodology is not applicable to the following:</p> <ul style="list-style-type: none"> • 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 plants that result in new reservoirs or in the 	<p>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.</p> <p>The proposed project activity does not involve any biomass fired power plants.</p> <p>Not applicable as the project is not the implementation of a Hydro plant.</p>



Applicability Criteria	Comments
increase in existing reservoirs where the power density of the reservoir is less than 4 W/m ² .	
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 to the implementation of the project activity and undertaking business as usual maintenance	Not applicable as the project is not a retrofit, replacement or capacity addition.

Table 2: Applicability Assessment against the tools (Tool to calculate the emission factor for an electricity system)

Applicability Criteria	Comments
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	This project activity is located totally in South Africa, which is a non-Annex I country.

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

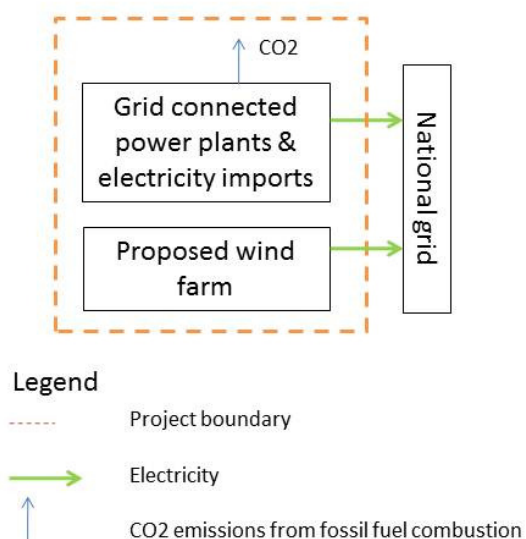
As per ACM0002 / Version 12.3.0, the spatial extent of the project boundary includes the project site and all the power plants connected physically to the electricity system. The project electricity system is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints.

According to the methodology ACM0002 / Version 12.3.0, a grid-connected wind power project like the proposed project is required to consider only the CO₂ emissions from fossil fuels fired power plants in baseline scenario.

Source		Gas	Included?	Justification / Explanation
Baseline	CO2 emission from the power plants generating electricity in the national grid	CO ₂	Yes	Major source of emissions.
		CH ₄	No	Excluded as per methodology
		N ₂ O	No	Excluded as per methodology
Project activity	The proposed project activity	CO ₂	No	Excluded as per the methodology.
		CH ₄	No	Excluded as per the methodology
		N ₂ O	No	Excluded as per the methodology

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

Figure 2: Project boundary



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

According to the ACM0002 / Version 12.3.0, 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 Version 02.2.1 of 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
Wind monitoring started	25/02/2010
EIA initiated	March 2010
Record of Decision received from the Department of Environmental Affairs	17/03/2011
Consultant appointed to develop CDM component	June 2011
PIN submitted to DNA	12/07/2011
Letter of no objection from DNA	11/08/2011
Prior consideration received by UNFCCC	28 th February 2012
Validation initiated	March 2012

The additionality of the proposed project is demonstrated and assessed by the approved “Tool for the Demonstration and Assessment of Additionality (version 06.0.0)”.

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

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

According to the Validation and Verification Manual (version 01): “103. The PDD shall identify credible alternatives to the proposed project activity in order to determine the most realistic baseline scenario, unless the approved methodology that is selected by the proposed CDM project activity prescribes the baseline scenario and no further analysis is required. (e.g., methodology ACM0002)”.

According to ACM0002 / Version 12.3.0, 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 Version 02.2.1 of the “Tool to calculate the emission factor for an electricity system”.

As such, there is no need to further analyze alternatives to the proposed project activity since the methodology ACM0002 / Version 12.3.0 prescribes the baseline scenario for the proposed project



activity. The baseline accounts for construction of other power sources due to calculating a Combined Margin for the grid emission factor. The project is evaluated on its own viability and does not exclude the expansion of grid with other options.

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

There is no need to further analyze alternatives to the proposed project activity since the methodology ACM0002 / Version 12.3.0 prescribes the baseline scenario for the proposed project activity.

The baseline scenario is consistent with mandatory laws and regulations

Step 3. Barrier Analysis

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

The project accords with the criteria in paragraph 6(b) of the additionality tool as it concerns a renewable energy project:

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

There are at the time of the starting date of the project (May 2012) no large scale, grid connected wind farms exporting electricity to the national grid⁶ 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: In terms of EB 63 annex 11 the “Applicable geographical area” covers the entire host country as a default, so the geographical area is South Africa.

Note: In terms of EB 63 annex 11, a proposed project activity is the First-of-its-kind in the applicable geographical area if:

⁶ As confirmed by SAWEA, there are only three installations of which the largest is a 5,2 MW wind farm. The total installed capacity from 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%. This statement from SAWEA will be provided to the validator. As confirmed by Eskom, Eskom has not entered into contracts with any Renewable Independent Power Producers, including wind parks, with installed capacity above 20 MW. This statement from EAC will be provided to the validator.



“(a) The project is the first in the applicable geographical area (as the default it is South Africa) that applies a technology that is different from any other technologies able to deliver the same output and that have started commercial operation in the applicable geographical area before the start date of the project; and: (b) Project participants selected a crediting period for the project activity that is a maximum of 10 years with no option of renewal.”

Here:

“4. Different technologies are technologies that deliver the same output and differ by at least one of the following:

- (a) Energy source / fuel
- (b) Feed stock
- (c) Size of the installation (power capacity)
 - i. Micro (as defined in paragraph 24 of Decision 2/ CMP.5 and paragraph 39 of Decision 3/CMP.6
 - ii. Small (as defined in paragraph 28 of Decision 1/CMP.2
 - iii. Large”

In terms of the definitions in EB63 annex 11, wind power plant will thus be a first of its kind if no other wind power plants of comparable scale (here large scale, equal or larger than 15 MW) have reached commercial operation within the borders of South Africa at the time of the starting date of the project activity.

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 is payable 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 is awarded with “preferred bidder status”, the developer is required to double the initial payment within two weeks. This amount 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 16,8 million or about € 1,5 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 the developer chooses to pay the preferred bidder bond and thus commits itself to reaching financial close within 6-7 months thereafter. At this point the developer is committed to the project. Thus, if the earliest date is chosen in terms of the definition of Starting Date, the preferred bidder bond payment date is the Starting Date.

The current installed capacity of wind energy in South Africa is extremely low and is made up by the Darling Demonstration Wind Farm (5.2MW), the Klipheuwel Wind Energy Demonstration Facility (3.2MW) and the single turbine installed at Kouga (1.8 MW), which are the only grid connected wind



farms in the country. Given a total installed capacity of just over 10 MW of wind energy in South Africa, the development of wind farms in South Africa is clearly not business as usual.

In accordance with the guidance in the Additionality Tool version 6, a project for the present purposes is considered similar if it comprises + or – 50% in installed capacity in the geographical area.

As stated above, there is no grid connected wind power plants of comparable scale exporting power into the South African grid, and the project activity is thus additional as first of its kind.

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

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

Step 4: Common practice analysis

Since the project has demonstrated to be first-of-its kind (according to Sub-step 3a), step 4 of the additionality tool is not necessary.

Describe how the CDM alleviates the barriers identified

As per Paragraph 39 of the additionality tool, a proposed project activity that was identified as the First-of-its-kind project activity does not have to described how the CDM alleviates the barriers identified.

Conclusion

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:

$$BE_y = EG_{PJ,y} * EF_{GRID,CN,y}$$
 Equation 1

Where:



BE_y	=	Baseline emissions in year y (tCO ₂)
$EF_{grid,CM,y}$	=	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)

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:

$$EG_{PJ,y} = EG_{Facility,y} \quad \text{Equation 2}$$

Where

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

Project emissions

Since the project is the generation of electricity from wind energy, project emissions are zero, as per methodology.

$$PE_y = 0$$

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 (EF_y) 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:

$$ER_y = BE_y - PE_y$$

Equation 3

Where:

ER_y = Emission reductions in year y (t CO₂e)

BE_y = Baseline emissions in year y (t CO₂)

PE_y = Project emissions in year y (t CO₂e)

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

(Copy this table for each data and parameter)

Data / Parameter:	$FC_{i,y}$
Data unit:	Ton or litres
Description:	Amount of fossil fuel type i consumed in the project electricity system in year y
Source of data used:	Eskom published data
Value applied:	Refer to Annex 3 for detailed information
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, Version 02.2.1” (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 (<i>ex ante</i> option); (ii) BM: Once <i>ex ante</i> as there is only one crediting period.
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:	<ul style="list-style-type: none"> • For coal, Eskom Holdings Limited Integrated Report 2011, page 324 • For kerosene, IPCC default figures where Eskom does not publish data. • 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.



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Value applied:	Eskom: Coal (GJ/ton) 2008/9 – 19.1 2009/10 – 19.22 2010/11 – 19.5 Other Kerosene –42.4GJ/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, Version 02.2.1”. 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:	Information is used to calculate the combined margin emission factor

Data / Parameter:	EG_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: 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 for detailed information
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, Version 02.2.1”. 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:	Information is used to calculate the combined margin emission factor

Data / Parameter:	$EF_{GRID,CM}$
Data unit:	tCO_2 / MWh
Description:	Emission factor of the national electrical grid
Source of data used:	Calculated based on the Eskom information and IPCC information where applicable
Value applied:	0.9569
Justification of the choice of data or description of measurement methods and procedures actually applied :	The $EF_{grid,y}$ is calculated according to the ‘Tool to calculate the emission factor for an electricity system, Version 02.2.1. The Simple OM method is used to calculate the Operating margin (using the ex-ante option); with the Build Margin also calculated ex-ante based on the most recent information.
Any comment:	None

Data / Parameter:	$EF_{CO_2,i,y}$
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Data unit:	tCO ₂ /GJ
Description:	CO ₂ emission factor of fossil fuel type <i>i</i> in year <i>y</i>
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 conservativeness, it is assumed that Eskom uses kerosene at Ankerlig and Gourikwa and not diesel.
Value applied:	Other Bituminous Coal: 2008/9 to 2011: 89.5 (t CO ₂ /TJ) Other Kerosene 2008/9 to 2011: 70.8tCO 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 will be used. Refer to '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:	EF _{grid,OMsimple,y}
Data unit:	tCO ₂ /MWh
Description:	Simple operating margin CO ₂ emission factor in year <i>y</i>
Source of data used:	Calculated from the information published by Eskom, the national utility in South Africa. The years 2008/98, 2009/10 and 20010/11 were used to determine the factor.
Value applied:	0.9257
Justification of the choice of data or description of measurement methods and procedures actually applied :	The three most recent years prior to the project implementation were used to calculate the simple operating margin.
Any comment:	As per the to calculate the grid emission factor, Version 02.2.1.

Data / Parameter:	EF _{grid,BM,y}
Data unit:	tCO ₂ /MWh
Description:	Build margin CO ₂ emission factor in year <i>y</i>
Source of data used:	Calculated from the information published by Eskom, the national utility in



	South Africa. As per the “Tool to calculate the emission factor for an electricity system”, (Version 02.2.1), the build margin emissions factor is the generation-weighted average emission factor (tCO ₂ /MWh) of all power units <i>m</i> during the most recent year <i>y</i> for which power generation data is available.
Value applied:	1.0503
Justification of the choice of data or description of measurement methods and procedures actually applied :	The build margin is calculated according to the “Tool to calculate the emission factor for an electricity system”, (Version 02.2.1).
Any comment:	As per the Tool to calculate the grid emission factor, Version 02.2.1.

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 <i>y</i> (MWh)
EF _{grid,CM,y}	=	Combined margin CO ₂ emission factor for grid connected power generation in year <i>y</i> calculated using the latest version of the “Tool to calculate the emission factor for an electricity system” (tCO ₂ /MWh)

(a) Greenfield renewable energy power plants

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

**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 (tons of CO ₂ e)	Estimation of baseline emissions (tons of CO ₂ e)	Estimation of leakage (tons of CO ₂ e)	Estimation of emission reductions (tons of CO ₂ e)
1/1/2015	0	280,754	0	280,754
2016	0	280,754	0	280,754
2017	0	280,754	0	280,754
2018	0	280,754	0	280,754
2019	0	280,754	0	280,754
2020	0	280,754	0	280,754
2021	0	280,754	0	280,754
2022	0	280,754	0	280,754
2023	0	280,754	0	280,754
31/12/2024	0	280,754	0	280,754
Total (tons of CO₂ e)	0	2,807,540	0	2,807,540

B.7. Application of the monitoring methodology and description of the monitoring plan:**B.7.1 Data and parameters monitored:**

(Copy this table for each data and parameter)

Data / Parameter:	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:	Measured at the project activity site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	293,400
Description of measurement methods and procedures to be	The net electricity supplied to the grid from the project will be continuously measured using energy meters and recorded at least monthly. The precision of the energy meters is class 0.5s or better.



applied:	
QA/QC procedures to be applied:	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.
Any comment:	Data will be archived electronically for at least two years after the end of the last crediting period.

B.7.2. Description of the monitoring plan:

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

1. Management Structure and Responsibility

The Project Owner is responsible for daily monitoring and reporting. A staff (monitoring team) will be dedicated to execute the monitoring tasks. A 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.

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

Project Activity Diagram Westcoast 1 Wind Farm - Overview Energy Metering

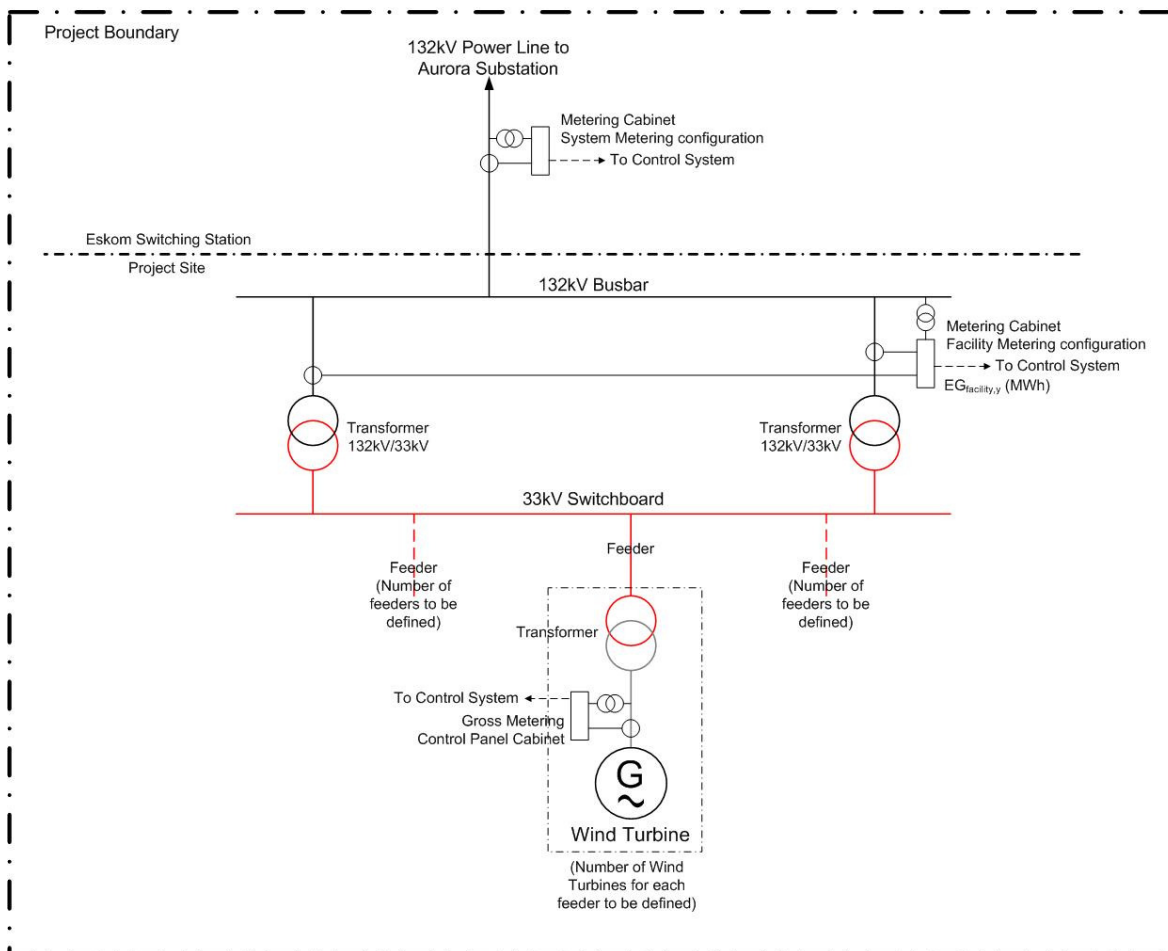


Figure: Layout of installation of monitoring equipment (single line diagram)

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 spreadsheet applications to gather, aggregate, calculate, control and (internally) report the CDM relevant data.

5. Data storage and safeguarding

Data will be archived in electronic spreadsheets. For data security, a backup of the electronic spreadsheets will be stored every month at two different physical locations (one of them not being the project site). The data will be kept at least 2 years after the end of the last crediting period or the last issuance of CERs for this project activity, whichever occurs later. The Project Owner will also collect and keep electricity sales receipts from the Grid Operator for the purpose of cross-checking with the main metering data.

All physical documents such as invoices, paper-based maps, drawings, diagrams and other relevant monitoring documents will be collected and stored in a central place, together with this monitoring plan.

6. Training

Operational Staff involved in the CDM monitoring will be given proper training. The training will be organised and supervised by the 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 January 2012

CiskaTerblanche / Matsen Jorritsma
CDM Africa / BGP Engineers
Tel.: 0031-413-243-800
Fax: 0031-413-243-801
E-mail: Ciska@cdmafrica.com / mj@bgp.nl

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 of the project is 6 June 2012.⁷

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

20 Years 0 months⁸

C.2. Choice of the crediting period and related information:**C.2.1. Renewable crediting period:****C.2.1.1. Starting date of the first crediting period:**

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

01/01/2015

C.2.2.2. Length:

10 Years 0 months

⁷ The reasoning appears in section B.5 above with the discussion of First-of-Kind additionality. The preferred bidder bond was paid on 6 June 2012.

⁸ As per manufacturer details, see also Technical brochure “V90-1.8/2.0 MW, Maximum output at medium-wind and low-wind sites” page 12, available through: <http://www.vestas.com/en/media/brochures.aspx>

**SECTION D. Environmental impacts**

>>

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

The environmental impact assessment for this project was carried out by Savannah Environmental (Proprietary) Limited and the final report was published in November 2010. The following table provides text copied from the EIA final report.

The findings of the specialist studies undertaken within this EIA to assess both the benefits and potential negative impacts anticipated as a result of the proposed project conclude that:

» There are **no environmental fatal flaws** that should prevent the proposed wind energy facility and associated infrastructure from proceeding on the identified site, provided that the recommended mitigation and management measures are implemented, and given due consideration of the recommendations regarding the re-location of turbines highlighted in this report during the process of finalizing the wind energy facility layout.

- From the holistic environmental perspective, power line alternative 2 is recommended as the preferred alternative

» Based on the findings of the Social Impact Assessment, none of the landowners who stand to be directly affected by the proposed wind energy facility are opposed to the development. In order to enhance the local employment and business opportunities the mitigation measures listed in the report should be implemented. The mitigation measures listed in the report to address the potential negative impacts during the construction phase, specifically the presence of construction workers, should also be implemented.

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

No transboundary impacts have been 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:

>>None of the environmental impacts were considered significant. The final impact assessment report is available with a summary of all the identified impacts. "Proposed West Coast One Wind Energy Facility and associated infrastructure on site near Vredenburg", Western Cape Province, (DEA Ref No: 12/12/20/1581).

**SECTION E. Stakeholders' comments**

>>The Environmental Impact Assessment (EIA) for the proposed West Coast 1 Wind Energy 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). No environmental fatal flaws were identified to be associated with the proposed West Coast 1 wind energy facility. A number of issues requiring mitigation have been highlighted. Environmental specifications for the management of potential impacts are detailed within the draft Environmental Management Plan (EMP) included within the Draft Scoping Report.

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

>>The Draft EIA Report was made available for public review at the following public places in the project area from 22 September 2010 – 22 October 2010:

- » Vredenburg Library
- » St. Helena Bay Library
- » Paternoster Library

The report was also made available on www.savannahSA.com

PUBLIC MEETING

In order to facilitate comments on the findings of the draft EIA report and provide feedback of the findings of the studies undertaken, a public feedback meeting was held. All interested and affected parties were invited to attend the public feedback meeting held on 29 September 2010 at the Paternoster Library, from 18:30 – 20:30⁹.

E.2. Summary of the comments received:

The full list of comments and responses appear in Annex F to the Final Environmental Impact Assessment Report which will be made available to the validators.

Most relevant comments are:

- The question was asked whether cabling would be overhead or below ground¹⁰
- A request was made for a training centre to the public on alternative energy and climate change¹¹
- In the context of an expressed passion for renewable energy it was inquired whether the project will cause a drop in local electricity prices.¹²

⁹ Savannah Environmental (Pty) Ltd. Proposed Moyeng Energy West Coast One Wind Energy Facility Environmental Impact Assessment. Public Meeting. Notes of the Public Meeting..

¹⁰West Coast One Full Environmental Impact Report, Appendix F, Comment 41, Annex F, page 9

¹¹West Coast One Full Environmental Impact Report, Appendix F, Comment 35, Annex F, page 22



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

The comments and responses were logged at the public meeting.

Response to question 1: It was explained that the onsite cables will be below ground to the substation and overhead from there to the Eskom grid connection

Response to question 2: The request was noted

Response to question 3: It was explained that the power would be sold to Eskom and would not impact local electricity prices however there were likely to be other economic benefits emanating from the project

¹²West Coast One Full Environmental Impact Report, Appendix F, Comment 59, Annex, p 30

**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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



Annex 3

Determination of the grid emission factor

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. The baseline emission factor (EF_y) is calculated as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors:

The following seven 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-ante.
- STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electric power system

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 South African grid is connected by transmission lines to grids in neighboring countries Mozambique, Botswana, Namibia and Zimbabwe.

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)

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

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

Motivation for using Option (c): Simple Operating Margin

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.

	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.

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.

Table 6: Electricity generation information for the power plants in the grid used in the operating margin

Power plant	Type of fossil fuel	Electricity generated (D)	Electricity generated (D)	Electricity generated (D)	Total MWh
		MWh	MWh	MWh	
		2008/9	2009/10	2010/11	
Arnot	Coal	11,987,281	13,227,864	12,194,878	37,410,023
Duvha	Coal	21,769,489	22,581,228	20,267,508	64,618,225
Hendrina	Coal	12,296,687	12,143,292	11,938,206	36,378,185
Kendal	Coal	23,841,401	23,307,031	25,648,258	72,796,690
Kriel	Coal	18,156,686	15,906,816	18,204,910	52,268,412
Lethabo	Coal	23,580,232	25,522,698	25,500,366	74,603,296
Matimba	Coal	26,256,068	27,964,141	28,163,040	82,383,249



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Majuba	Coal	22,676,924	22,340,081	24,632,585	69,649,590
Matla	Coal	21,863,400	21,954,536	21,504,422	65,322,358
Tutuka	Coal	21,504,122	19,847,894	19,067,501	60,419,517
Ankerlig*	Kerosene	143,000*	49,000 *	190,501 *	382,501
Gourikwa*					-
Acacia					992
Port Rex					5,507
Camden	Coal	6,509,079	7,472,070	7,490,836	21,471,985
Grootvlei	Coal	1,249,556	2,656,230	3,546,952	7,452,738
Komati	Coal	-	1,016,023	2,060,141	3,076,164

648,239,432

Total excluding imported
electricity MWh

Source: *FuelConsumptionElectricityGen.xls* published by Eskom.

Website short cut access is: <http://www.eskom.co.za/c/article/236/cdm-calculations/>

*The source information for Ankerlig and Gourikwa: (Source: For generation of electricity for all four gas turbine stations: Eskom Annual Integrated Report 2011, page 13, Appendix 60.

Please note:

The electricity generation and fuel consumption figures published for the single cycle gas turbines that operate on kerosene are not given for each power plant separately. From the spreadsheet published by Eskom "*FuelConsumptionElectricityGen.xls*", it seems that Acacia and Port Rex were not in operation in 2008/2009 and 2009/2010. In order to apply the emission factor calculations in the GEF spreadsheet, the total electricity generation and fuel consumption figures reported for gas fired power stations (published in Eskom Annual Integrated Report 2011, page 13, Appendix 60) are allocated to Ankerlig and Gourikwa for these years according to their design capacities.

The electricity generation and fuel consumption figures for Acacia and Port Rex are provided for 2010/2011. These figures are deducted from the total figures provided in the Eskom Integrated Report



2011 in order to determine the fuel consumption and electricity generation for Ankerlig and Gourikwa.

Therefore the figures for Ankerlig and Gourikwa are reflected as follows in the GEF spreadsheet:

Name of Power Unit/country	Net Electricity Generation (MWh) <i>Source: Appendix 61_FuelConsumptionElectricityGen.xls published by Eskom.</i> Website short cut access is: http://www.eskom.co.za/c/article/236/cdm-calculations/		
	<u>2008-2009</u>	<u>2009-2010</u>	<u>2010-2011</u>
Ankerlig <i>(Source: For generation of electricity for all four gas turbine stations: Eskom Annual Integrated Report 2011, page 13, Appendix 60. For Kerosene (diesel) consumption: Eskom Holdings Limited Integrated Report 2011, page 152, Appendix 62)</i>	91,805	31,458	122,300
Gourikwa	51,195	17,542	68,201
Acacia	0.0	0.0	992
Port Rex	0.0	0.0	5,507

The following table shows the electricity imported from neighbouring countries and also confirms the electricity that was purchased from private generators (Local IPP and co-generation).



Electricity purchased by Eskom **2011** **2010** **2009** **2008** **2007**

Foreign purchases (GWh)	13,613	13,754	12,189	11,510	11,483
Local independent Power Producers and co-generation (GWh)	1,833	0	0	0	0

Source: Eskom Holdings Limited Integrated Report 2011, page 13

Step 4: Calculate the simple operating margin emission factor

The simple OM emission factor ($EF_{grid,OMsimple,y}$) is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants.

Option A1 - Calculation based on average efficiency and electricity generation of each plant

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

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

Equation 1



Where:

- $EF_{grid,OMsimple,y}$ = Simple operating margin CO₂ emission factor in year y (tCO₂/MWh)
 $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
 $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/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 $EF_{EL,m,y}$

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_{m,y}}$$

Equation 2

Where:

- $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/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)
 $EF_{CO_2,i,y}$ = CO₂ emission factor of fossil fuel type i in year y (tCO₂ /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 sources 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

The simple operating margin is calculated as 0.9257

Step 5 Calculate the build margin (BM) emission factor

Data Vintage – Option 1 is selected (ex-ante)



Option 1: For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation.

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

SET _{5-units}		
Plant Name	Fuel type	Commission year
Komati***	Coal	2009
Grootvlei**	Coal	2008
Gourikwa	Other Kerosene	2007
Ankerlig	Other Kerosene	2007
Camden*	Coal	2005

Source of information:

***Re-commissioned power plant**, Eskom Holdings Limited Integrated Report 2011, page 148

****Re-commissioned power plant**, Eskom Annual Report 2010, page 126,

http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf

*****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_{≥20%}).

(b) SET_{≥20%} consist of the following power stations indicated in the table below.



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No.	Name of power unit	Year commissioned	Fuel Type Energy Source	Net Electricity Generation (MWh/y) of	CO2 Emission Factor (t-CO ₂ /MWh) of the latest	CO2 Emissions (t-CO ₂)
SET _{≥20%}						
26	Komati **Commissioning information source: Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2009	Other Bituminous Coal	2 060 141	2.1776	4 486 265.9
25	Grootvlei * Commissioning information source: Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2008	Other Bituminous Coal	3 546 952	1.3979	4 958 140.8
13	Gourikwa (electricity production and kerosene consumption included in figures for Ankerlig)	2007	Other Kerosene	0	0.8494	0.0
12	Ankerlig (Source: For generation of electricity for all four gas turbine stations: Eskom Annual Integrated Report 2011, page 13. For Kerosene (diesel) consumption: Eskom Holdings Limited Integrated Report 2011, page 152.)	2007	Other Kerosene	190 501	0.8494	161 806.8
24	Camden *** Commissioning information source: Eskom Holdings Limited Integrated Report 2011, page 148	2005	Other Bituminous Coal	7 490 836	1.0786	8 079 616.7
8	Majuba	1996	Other Bituminous Coal	24 632 585	0.9202	22 665 781.8
4	Kendal	1988	Other Bituminous Coal	25 648 258	1.0299	26 415 392.0

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

AEG SET_{5-units} = 13,288,430 MWh (see grid emission spreadsheet, sheet BM-D)

AEG SET_{>20%} = 63,569,273 MWh (see grid emission spreadsheet, sheet BM-D)

SET_{sample} is equal to SET_{≥20%} because SET_{≥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 which started to supply 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.



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No.	Name of power unit	Year commissioned	Fuel Type Energy Source	Net Electricity Generation (MWh/y) of	CO2 Emission Factor (t-CO ₂ /MWh) of the latest	CO2 Emissions (t-CO ₂)
SET _{sample-CDM}						
26	Komati **Commissioning information source: Eskom Annual Report 2010, page 127. http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2009	Other Bituminous Coal	2 060 141	2.1776	4 486 265.9
28	Bethlehem Hydro (Source: http://cdm.unfccc.int/Projects/DB/SGS-UKL1245061289.99, CDM PDD, page 12)	2009	Hydro	34 031	0.0000	0.0
25	Grootvlei * Commissioning information source: Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2008	Other Bituminous Coal	3 546 952	1.3979	4 958 140.8
13	Gourikwa (electricity production and kerosene consumption included in figures for Ankerlig)	2007	Other Kerosene	0	-	
12	Ankerlig (Source: For generation of electricity for all four gas turbine stations: Eskom Annual Integrated Report 2011, page 13. For Kerosene (diesel) consumption: Eskom Holdings Limited Integrated Report 2011, page 152.)	2007	Other Kerosene	190 501	0.8494	161 806.8
24	Camden *** Commissioning information source: Eskom Holdings Limited Integrated Report 2011, page 148	2005	Other Bituminous Coal	7 490 836	1.0786	8 079 616.7

$AEG_{SET \text{ sample CDM}} < 0.2 \times AEG_{total}$. 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.



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No.	Name of power unit	Year commissioned	Fuel Type Energy Source	Net Electricity Generation (MWh/y) of	CO2 Emission Factor (t-CO ₂ /MWh) of the latest	CO2 Emissions (t-CO ₂)
SETsample-CDM						
26	Komati **Commissioning information source: Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2009	Other Bituminous Coal	2 060 141	2.1776	4 486 265.9
28	Bethlehem Hydro (Source: http://cdm.unfccc.int/Projects/DB/SGS-UKL1245061289.99 , CDM PDD, page 12)	2009	Hydro	34 031	0.0000	0.0
25	Grootvlei * Commissioning information source: Eskom Annual Report 2010, page 126 http://financialresults.co.za/2010/eskom_ar2010/downloads/eskom_ar2010.pdf	2008	Other Bituminous Coal	3 546 952	1.3979	4 958 140.8
13	Gourikwa (electricity production and kerosene consumption included in figures for Ankerlig)	2007	Other Kerosene	0	-	
12	Ankerlig (Source: For generation of electricity for all four gas turbine stations: Eskom Annual Integrated Report 2011, page 13. For Kerosene (diesel) consumption: Eskom Holdings Limited Integrated Report 2011, page 152.)	2007	Other Kerosene	190 501	0.8494	161 806.8
24	Camden *** Commissioning information source: Eskom Holdings Limited Integrated Report 2011, page 148	2005	Other Bituminous Coal	7 490 836	1.0786	8 079 616.7
8	Majuba	1996	Other Bituminous Coal	24 632 585	0.9202	22 665 781.8
4	Kendal	1988	Other Bituminous Coal	25 648 258	1.0299	26 415 392.0

The build margin emissions factor is the generation-weighted average emission factor (tCO₂/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 CO₂ emission factor in year y (tCO₂/MWh)
 $EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
 $EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/MWh)
 M = Power units included in the build margin
 Y = Most recent historical year for which power generation data is available

The emission factor for each power unit is calculated applying Option A1, if the electricity generation and fuel consumption information for the generating units are publicly available.

Determination of $EF_{EL,m,y}$ according to Option A1:

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

The BM is calculated as 1.0503 tCO₂/MWh (refer to GEF spreadsheet, Sheet BM)

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:

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

Equation 4

Where:

- $EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)
 $EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y (tCO₂/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 $0.9569 \text{ tCO}_2/\text{MWh}$



Annex 4

MONITORING INFORMATION

Not applicable