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:

>>

Project Title: Grid Connected Wind Power Plant in Nelson Mandela Bay, South Africa
Version No: 01
Date of Document Completion: 24 November 2011

A.2. Description of the project activity:

>>

The objective of the MetroWind Van Stadens Wind Farm (henceforth referred to as 'the project') is to reduce greenhouse gas emissions through producing electricity from wind which is a renewable resource.

The project details are as follows:

- **The project scenario:** The project will involve the installation of 9.0 wind turbines in the Nelson Mandela Bay Metropolitan region of the Eastern Cape Province of South Africa. The electricity will be supplied onto the South African national electricity grid. The project will generate an estimated 80.0 Gigawatt hours (henceforth represented as GWh) of electricity per year with an installed capacity of 27.0 Megawatts (henceforth represented as MW).
- **The scenario existing prior to the start of the implementation of the project activity:** The land on which the wind turbines will be erected has been previously cleared for pastures, and is subject to low levels of grazing by cattle and antelope kept by the landowner. The landowner does not use the site for commercial agricultural purposes.
- **The baseline scenario:** The baseline scenario is similar to the scenario existing prior to the start of the implementation of the project activity. The baseline for the project is the South African national electricity grid and, as such, the baseline is calculated using the emission factor for the national grid. According to the South African Department of Energy, almost 90.0 percent (%) of South Africa's electricity is generated in coal-fired power stations[1]. Hence, grid electricity is predominantly coal-based and, as such, has an associated high greenhouse gas emission factor.
- **Current project development stage:** Currently, a permanent 60.0 metre wind measuring mast has been installed to gather data on wind velocities. The planned commissioning date for the power plant is 1 August 2013.
- **Reduction in greenhouse gas emissions:** The emission reductions result from the displacement of grid electricity through the supply of clean electricity generated using wind as a renewable resource.

The project was submitted under the South African Department of Energy's Independent Power Producer (IPP) Procurement Programme. The IPP Procurement Programme was designed to procure a target of 3 725 MW installed capacity of renewable energy and to start and stimulate the renewable energy industry in South Africa.

Under the IPP Procurement Programme, the responding developers (bidders) are required to bid a price which is payable by the purchaser of the electricity. The price must not exceed the cap allocated for each

[1] South African Department of Energy. 2010. Available online from: http://www.energy.gov.za/files/electricity_frame.html. Accessed 21 September 2010.

renewable energy technology. The first bid submission date to the Department of Energy was on the 4th of November 2011 and this project was successful in the first round of bids.

Contribution to sustainable development

The South African Designated National Authority (DNA) has defined sustainable development in terms of three core categories: environmental, economic and social. The project contributes to each of the three categories in the following manner:

Economic

The project will contribute to national economic development in the following ways:

- The project will contribute to national economic development through the sales of the Certified Emission Reductions (CERs) which will result in an inflow of foreign exchange.
- The success of this project in South Africa will encourage both local and international investment in the power generation sector.
- The project developers will be applying for the IPP Procurement Programme. The success of this project under the programme will promote investor confidence in the country and will encourage the growth of the renewable energy sector in South Africa.
- The Department of Energy congratulated MetroWind on achieving the highest score for South African ownership and local economic development for round one projects at the project meeting on 26 January 2012.

Social

The project will contribute to social development in South Africa in a number of ways:

- The project will result in the creation of temporary jobs in the construction phase of the project. A number of local people will be employed during construction for site security, manual labour, transportation of goods and other similar services. Excluding office and administration staff, it is estimated that a local team of permanent wind farm maintenance specialists (including trainees) would be employed by the project during the operations phase.
- The project will result in technology transfer to South Africa as there is not wind technology available locally. Thus, all wind technology will need to be imported. In addition, a team of locals will be trained to maintain the wind turbines which will ensure the transfer of skills to South Africa.
- MetroWind believes that the community surrounding the Van Stadens project site should share in and benefit from the value created by having a renewable energy asset in its midst. Indeed, symbiotic partnership with the community is seen as being essential to the long-term viability of the project: if the community is itself invested in the Van Stadens wind project, it will help to ensure that its operations are secure, sustainable, and successful. Therefore five percentage (5%) of the project company will be owned by the MetroWind Community Development Trust. Dividends, estimated at R1,600,000 annually from year 5 will be invested directly back into the local community.
- An extensive socio-economic development (SED) plan has been developed and MetroWind has pledged 1% of project revenues, estimated at R636,500 annually from year increasing at CPI, to fund this mechanism.

- MetroWind aims to promote economic development (ED) and reduce poverty by supporting the sustainable development of local black-owned enterprises, and has commits to contribute up to 0.6% of total project revenue to ED initiatives around the project site and metropolitan Port Elizabeth.:
- MetroWind's joint SED and ED commitment will focus on three primary social investment sectors: education, environmental conservation, and sustainable livelihoods. Just as important, MetroWind sees great developmental potential in the linkages between these sectors, and that the preservation of the community's environmental assets could yield important educational dividends; that the promotion of jobs skills should leverage the economic potential of the region's unparalleled natural assets; that the promotion of agricultural livelihoods should be done in an environmentally sustainable way; and that providing support to each of these sectors can lead to the development of successful local enterprises and the promotion of economic growth.

Environmental

The project developers conducted an Environmental Impact Assessment (EIA) for the project in accordance with the National Environmental Management Act (NEMA). A record of decision has been received for the EIA. The project conforms to the NEMA principles of sustainable development in the following ways:

- The project results in a reduction of greenhouse gas emissions by displacing coal-fired grid electricity with electricity generated from a renewable resource. This reduction in greenhouse gas emissions will play a role in assisting South Africa to achieve its emission reduction target of 34.0% below business-as-usual by 2020.
- The generation of electricity from wind power does not require the use of water. This is in direct contrast to the generation of electricity from coal.
- The project will make use of a renewable resource to generate electricity. The electricity will be fed onto the national electricity grid and displace coal-fired electricity. Apart from reducing greenhouse gas emissions, the project will displace the negative impacts of coal-mining and beneficiation as well as the adverse environmental impacts of combusting coal (particulate and sulphur emissions and water consumption and contamination). The success of the project will assist in encouraging the diversification of South Africa's energy mix and the use of renewable resources.

A.3. Project participants:

>>

Name of Party involved ((host) indicates host Party)	Private and/or public entity project participants	Indication if party involved wishes to be considered as a project participant
Germany	Private entity EnBW Kraftwerke AG	No
South Africa (host)	Private entity MetroWind (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.:

>>
Eastern Cape Province

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

>>
Nelson Mandela Bay Metropolitan

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

>>
The project is located on the western side of the Nelson Mandela Bay Metropolitan on a ridge east of the Van Stadens River mouth in the Eastern Cape. The site is approximately 35 km west of the Port Elizabeth Airport.

The geographical co-ordinates of the boundary of the project site are as follows:

Site Boundary Coordinates		
Corner	Geographic Coordinates	
	X	Y
A	25°15'58.57" E	33°56'42.40" S
B	25°15'53.16" E	33°57'35.65" S
C	25°15'26.49" E	33°57'49.98" S
D	25°15'57.69" E	33°57'51.92" S
E	25°14'52.78" E	33°57'5.06" S
F	25°14'45.08" E	33°56'51.89" S
G	25°14'24.38" E	33°56'57.94" S
H	25°14'21.41" E	33°56'42.61" S
I	25°14'28.70" E	33°56'24.95" S
J	25°14'41.03" E	33°56'40.25" S
K	25°15'24.69" E	33°56'30.79" S

The location of the project is depicted below:

Figure 1: Provincial Map of South Africa from One World Nations Online[2]

[2] One World Nations Online. 2011. Map of South Africa Provinces. Available online from http://www.nationsonline.org/maps/south_africa_prov_map2.jpg&imgrefurl. Accessed 05 December 2011.

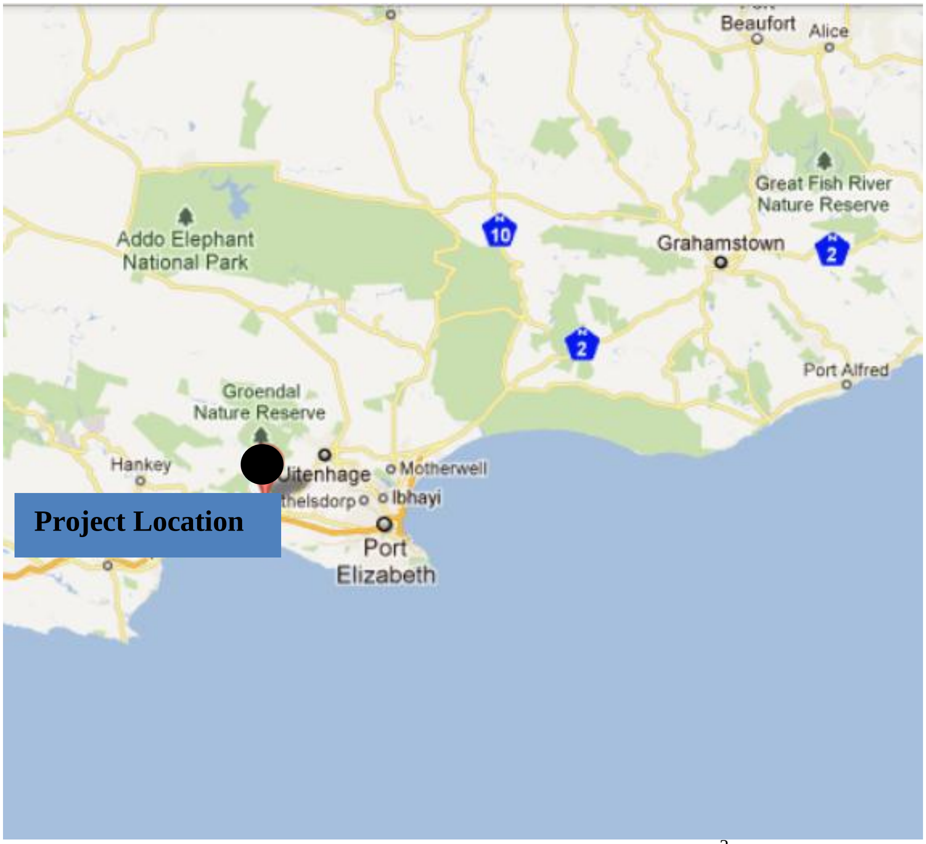


Figure 2: Map of Project from Google Maps[3]

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

>>

The project falls within sectoral scope 01.0.

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

>>

Description of the technology and measures implemented in the project activity

The project involves the installation of a wind farm in the Nelson Mandela Bay Metropolitan in the Eastern Cape. Electricity will be generated in 9.0 wind turbines on site. Each turbine will be accompanied by an electrical transformer. The turbines will be connected together via medium voltage electrical cables, which will be buried under the ground leading to a substation on site. A new substation will be constructed on site to connect the wind farm to the South African national electricity grid via existing transmission lines.

The equipment that will be installed in the project is as follows:

- Turbines

[3] Google Maps. 2011. Map of the Van Stadens. Available online from http://maps.google.co.za/maps/place?hl=en&num=100&safe=active&um=1&ie=UTF-8&q=Van+stadens+port+elizabeth&fb=1&gl=za&hq=Van+stadens&hnear=0x1e7b290045ffd62b:0x86fd2337cd894226,Port+Elizabeth&cid=5163910752811704 3. Accessed 05 December 2011.

- Electrical transformer for each turbine
- Electrical connections
- The new substation

The electricity is generated by the turbines and electrical transformer attached to each turbine and then fed via the electrical connections and through the substation to the national electricity grid.

A site-related wind energy yield assessment was conducted for the wind farm by an independent third-party contractor. The basis of the calculations is measured wind data from one mast at the site (up to a height of 60.2 m). The yield was calculated at a hub height of 90m using data from June 2010 to September 2011. The energy yield assessment results are as follows (based on the Sinovel SL3000/113-HH90 wind turbines):

Parameter	**Value**
Number of wind turbines	9.0
Nominal power of the wind farm (MW)	27.0
Hub height (m)	90.0
Annual mean wind speed at hub height (m/s)	7.3
Net wind farm AEP	80 GWh
Net wind farm AEP P50 (capacity factor 33.8%)	80.0 GWh
Net wind farm AEP P90 1 year (capacity factor 26.8%)	63.4GWh
Net wind farm AEP P90 10 year (capacity factor 28.2%)	66.6 GWh
Net wind farm AEP P90 20 year (capacity factor 28.2%)	66.8 GWh

In order to calculate the emission reductions, the net wind farm AEP P50 was used. This corresponds to a plant load factor of 33.8%. This net wind farm AEP takes into account losses by subtracting them from the calculated energy yield.

The technical details of the proposed wind turbine type to be used in the project are as follows:

Parameter	**Value**
Rated power	3 MW
Cut-in wind speed	3 m/s
Rated wind speed	11.5 m/s
Cut-out wind speed	25 m/s
Rotor diameter	113.3 m
Swept area	10 039.7 m^2
Nominal revolutions of generator	1200/600 to 1400 rpm
Nominal revolutions of blades	14-18 rpm

Transfer of technology and know-how

South Africa has limited experience both in operating and manufacturing wind turbines. Currently, there are only two wind farms in operation in South Africa. These are the Darling and Klipheuwal wind farms.

Klipheuwal wind farm was erected by Eskom in 2002/3 as a research programme and has a total generating capacity of 3.2 MW[4]. The installed capacity of Darling wind farm is 5.2 MW. The wind farm was erected by private investors in 2007. The wind farm has been given the status of a national demonstration project. The electricity produced by the wind farm is sold to the City of Cape Town at a negotiated tariff[5].

These wind farms are all relatively small, having less than four wind turbines installed. In addition, the wind farms are demonstration projects. The project will consist of 9.0 turbines and will be a large scale commercial wind farm. The development of large-scale commercial wind farms such as this project will encourage the growth of the wind power industry in South Africa and result in technological transfer to South Africa.

The wind turbines will be sourced from overseas. This technology will be transferred to South Africa. The technology is environmentally sound and safe. The wind turbines do not have a large footprint and do not use water. The wind turbines are used for the generation of electricity from wind which is a renewable resource and, therefore, clean and environmentally safe and sound.

The project will result in the creation of a number of jobs during the construction and operations phase. People will be appointed to operate and maintain the wind turbines. The aim is to appoint local people who will be trained by the turbine manufacturers. This training will result in skills and know-how transfer to South Africa.

The scenario existing prior to the start of the implementation of the project activity

The project is located in the Nelson Mandela Bay Metropolitan in the Eastern Cape Province of South Africa. The project developers have received a record of decision for an Environmental Impact Assessment (EIA) conducted for the project in accordance with the National Environmental Management Act (NEMA).

The project will feed electricity on to the South African national electricity grid. Currently, the grid is predominantly coal-based. According to the South African Department of Energy, almost 90.0 percent (%) of South Africa's electricity is generated in coal-fired power stations[6].

---

[4] Eskom. Klipheuwal Fact Sheet. Available online from www.eskom.co.za/content/RW%200002Kliph**Wind**fRev3.doc. Accessed 23 September 2010.

[5] Darling Wind Power (Pty) Ltd. Available online from http://www.darlingwindfarm.co.za/aboutus.htm. Accessed 23 September 2010.

[6] South African Department of Energy. 2010. Available online from: http://www.energy.gov.za/files/electricity_frame.html. [Accessed 21 September 2010].

The project will generate renewable energy and displace grid electricity. As a result, the project will reduce greenhouse gas emissions (predominantly CO_2 emissions) associated with the use of fossil fuels to generate grid electricity.

The baseline scenario

The baseline for this project is the continuation of the existing scenario (business-as-usual). This would be the current fuel mix of the electricity generated and fed to the South African national electricity grid. According to the South African Department of Energy, almost 90.0 % of South Africa's electricity is generated in coal-fired power stations[7].

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

>>

Years	**Annual estimation of emission reductions in tonnes of CO_2 e**
1 August 2013 – 31 July 2014	74,400.0
1 August 2014 – 31 July 2015	74,400.0
1 August 2015 – 31 July 2016	74,400.0
1 August 2016 – 31 July 2017	74,400.0
1 August 2017 – 31 July 2018	74,400.0
1 August 2018 – 31 July 2019	74,400.0
1 August 2019 – 31 July 2020	74,400.0
Total estimated reductions (tonnes of CO_2 e)	520,800.0
Total number of crediting years	7 (renewable twice)
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	74,400.0

A.4.5. Public funding of the project activity:

>>

The project has not received any public funding from Annex 1 Parties.

[7] South African Department of Energy. 2010. Available online from: http://www.energy.gov.za/files/electricity_frame.html. [Accessed 21 September 2010].

SECTION B. Application of a baseline and monitoring methodology

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

>>
The approved baseline and monitoring methodology applied to the project activity is ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable resources." (Version 12.3.0)

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

- "Tool for the demonstration and assessment of additionality" (Version 06.0.0)
- "Combined tool to identify the baseline scenario and demonstrate additionality" (Version 3.0.1)
- "Tool to calculate the emission factor for an electricity system" (Version 02.2.1)

The project will not make use of the following methodological tool as set out in the selected methodology:

- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02.0) – no fossil fuels are combusted as part of this project activity.

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

>>
The proposed project activity meets each of the applicability criteria as set out under ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable resources" (Version 12.3.0). This is demonstrated below:

Applicability

Criteria	Project
This methodology is applicable to grid-connected renewable power generated project activities that a) Install a new power plant at the site where no renewable energy power plant was operated prior to the implementation of the project activity (Greenfield plant) b) Involve a capacity addition c) Involve a retrofit of an existing plant d) Involve a replacement of an existing plant	The project involves the installation of a grid-connected, renewable power plant on farm land. The project will be on a site where there is currently no renewable energy power plant. The plant will be greenfield.
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	The project is the installation of a wind power plant.
In case of capacity additions, retrofits or	The project is not a capacity addition, retrofit or

replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 10 to calculate the parameter $EG_{PJ,y}$): the existing plant started commercial operation prior to the start of a minimum historical reference of five years, used for the calculation of baseline emissions and defined in the baseline emissions section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	replacement. The project is a new (Greenfield) power plant.
In case of hydro power plants: • One of the following conditions must apply: o The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of 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 the project activity, as per the definitions given in the Project Emissions section, is greater than 4 W/m^2; or o The project activity results in new single or multiple reservoirs and the power density of each reservoir the power plant, as per the 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/m^2 all the following conditions must apply: o The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2; o Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity	The project is not a hydro power plant.

of the combined power plant; o Water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity; o Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than 4 W/m^2, is lower than 15MW; • Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m^2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.	
The methodology is not applicable to the following: • Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; • Biomass fired power plants; • A hydro power plant that results in the creation of a new single reservoirs or in the increase in an existing single reservoirs where the power density of the power plant is less than 4 W/m^2.	• The project does not involve switching from fossil fuels to renewable energy sources at the site of the project activity. The electricity generated from the new power plant will be fed into South Africa's national electricity grid. • The project does not involve the combustion of biomass for the purpose of generating electricity. • The project does not involve the installation of a hydro power plant.
In the case of retrofit, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	The project is not a retrofit, replacement or capacity addition.

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

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

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

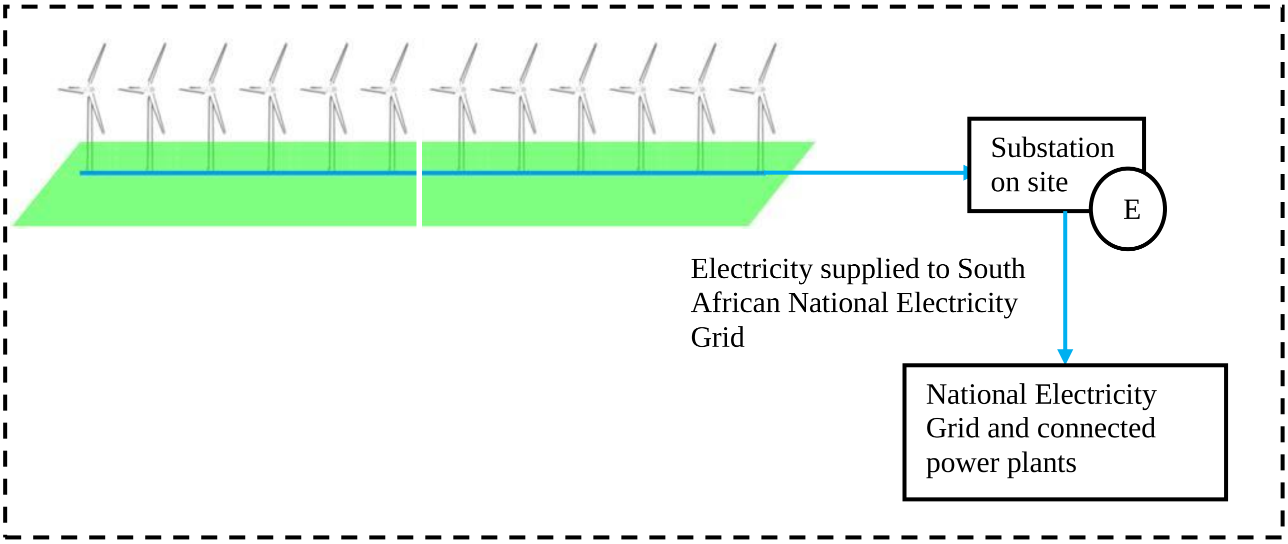
Hence, the project power plant equipment included in the boundary is:

- 9.0 wind turbines each with a rated capacity of 3.0 MW
- Electrical transformer for each turbine

- Electrical connections
- The new substation
- Underground cables

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

Source		Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source. The baseline emissions from the electricity generated in fossil fuel fired power plants is calculated in accordance with the latest version of the "Tool to calculate the emission factor for an electricity system"
		CH_4	No	Minor emission source so is negligible and therefore not considered.
		N_2O	No	Minor emission source so is negligible and therefore not considered.
Project activity	The proposed wind power project	CO_2	**No**	No GHG emissions from wind power projects.
		CH_4	**No**	Excluded according to methodology.
		N_2O	**No**	Excluded according to methodology.



Where (E) represents an electricity metering point

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

>>

The baseline methodology procedure in ACM0002 “Consolidated baseline methodology for grid-connected electricity generation from renewable resources” (Version 12.3.0) was followed to identify the baseline scenario.

The project activity is the installation of a new grid-connected renewable power plant. In this case, the methodology states that 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...*’ The baseline emissions are calculated using the grid emission factor for the South African national electricity grid as calculated using the “Tool to calculate the emission factor for an electricity system” (Version 02.2.1)

The calculations can be found in Annex 3. A summary of the results is presented in the table below.

Emission Factor	**tCO_2/MWh**
Simple Operating Margin (OM)	0.96
Build Margin (BM)	0.81
Combined Margin (CM)	0.93

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

>>

Prior Consideration of the CDM

CDM has been a major driver behind the project and has been considered from early on in the development of the project. The EB decided that for project activities with a starting date on or after 2 August 2008, the PP must inform a Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of its intention to seek CDM status.

The start date for the project has not occurred as of yet. The start date is defined as the earliest date at which either the implementation or construction or real action of a project begins. This is generally the data on which the project participant has committed to expenditures related to the implementation or construction of the project. The project is still in development and orders have not been placed for equipment. The start date for the project will be the date on which the project and finance contracts are signed. This is anticipated to be 30 June 2012. The anticipated timeline for the project is as follows:

Activity	**Date**
Drafting of final EPC, O&M, Equipment Suppliers and other subcontracts	5 December 2011
Completion of legal, technical and insurance due diligence	15 March 2012
Performance and completion of detailed design	19 March 2012
Finalising EPC, O&M, Equipment Suppliers and other subcontracts	25 March 2012
Sign generation licence	30 April 2012
Approval of detailed design	16 April 2012
Final drafts of project and finance documentation due	16 April 2012
Finalising and signing of project and finance documentation	16 June 2012
Commercial Close	30 June 2012
Commissioning date	1 August 2013

This is subject to change.

However, CDM has been considered from the inception of the project. The project participants lodged prior consideration with the UNFCCC secretariat and the South African DNA before the start date of the project. The prior consideration form and emails are given below:

Document	**Date**	**Description**
Prior Consideration of the CDM Form	22/07/2011	Submission of notification of the commencement of the project activity to the UNFCCC with the intention to seek CDM status.
Email sent to DNA for prior consideration	02/08/2011	Submission of notification of the commencement of the project activity to the DNA with the intention to seek CDM status.
Email reply from DNA to acknowledge receipt of the prior	03/08/2011	Acknowledgement of the prior consideration from the DNA of

consideration form		South Africa.
Email reply from the UNFCCC secretariat to acknowledge receipt of the prior consideration form	16/08/2011	Acknowledgement of the prior consideration from the UNFCCC secretariat.
Letter of No Objection from DNA	01/02/2012	DNA confirmed Project does not show any conflict with Sustainable Development Criteria and DNA has no objection to continuing further development.

Demonstration of Additionality

The following steps are used to demonstrate the additionality of the project in accordance with the '*Tool for the assessment and demonstration of additionality*' (Version 06.0.0).

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

Define realistic and credible alternatives to the project activity consistent with the current national laws and regulations through the following sub-steps:

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

To provide the same output or services comparable with the proposed project activity, realistic and credible alternatives to the project that are available to the project participant would be the following:

a) The project activity not implemented as a CDM project and
b) The continuation of the current situation (the use of grid electricity)

These are the only alternatives available to the project participant which are in accordance with the additionality tool as alternatives must be related to the investor, technology and circumstance.

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

The alternatives listed above are in compliance with all mandatory laws and regulations.

Step 2: Investment Analysis

The purpose of this step is to determine whether the project activity is economically or financially attractive without the revenue from the sale of certified emission reductions (CERs). The investment analysis was conducted in the following steps:

Sub-step 2a: Determine appropriate analysis method

The "Tool for the demonstration and assessment of additionality" suggests three analysis methods. These are simple cost analysis (option I), investment comparison analysis (option II) and benchmark analysis (option III).

Given that the project will earn revenue from the sale of electricity and not only from the sale of the CERs, option I is not applicable.

The investment comparison analysis (option II) is only applicable to projects whose alternatives are similar investment projects. As the alternative to the project is the generation of power from the South African national grid as opposed to individual investment alternatives, option II is not appropriate.

In addition, according to the methodology (ACM0002), if more than one alternative is remaining and they include P1 and P2, a benchmark analysis should be applied as per Step 2b of the "Tool for the demonstration and assessment of additionality".

Therefore, the project will use a benchmark analysis method (option III).

Sub-step 2b: Option III. Apply benchmark analysis

Financial Indicator Selection

The project's Equity Internal Rate of Return (EIRR) has been selected as the most appropriate financial indicator. The EIRR is the most appropriate financial indicator for the decision-making context as a company taking equity in the projects would make a decision as to whether to invest in the project based on the project's EIRR.

Local commercial lending rates reflect the cost of debt available locally. From the investor's perspective, it would not be considered appropriate to use this as a financial performance metric, because it only reflects the cost of debt.

The Weighted Average Cost of Capital (WACC) is also a measure of the cost of capital and relies on the cost of debt in the industry. However, included in the weighted average cost of capital is an element of investors' requirements as to the returns that they would require in the particular industry considering the industry risk profile. Comparing the project's EIRR with the company's WACC for the project would give the company an indication of whether the contract is worth pursuing. If the EIRR for the project is greater than the company's WACC, then the company will be earning more from the project than the cost of the capital they are required to put in. However, this then becomes a company-specific benchmark.

When we compare the project's EIRR to the industry's EIRR, we are essentially asking if this project worth more than is available elsewhere in the industry. If the project's EIRR is greater than the EIRR for the industry, then the project is worth more than other projects in the industry.

Hence, EIRR is considered the most appropriate financial indicator for the project for comparative purposes.

Benchmark Selection

As the project could be developed by another entity than the project participant, the benchmark equity IRR of the project is based on "*parameters that are standard in the market and considering the specific characteristics of the project type*" in accordance with the "Tool for the demonstration and assessment of additionality."

In accordance with Guidance 12 of Annex 13 of EB 61, the benchmark must be appropriate to the type of IRR calculated. Required/expected returns on equity are appropriate benchmarks for an equity IRR. Benchmarks supplied by relevant national authorities are also appropriate if the DOE can validate that they are applicable to the project activity and the type of IRR calculation presented.

EB 62 Annex 5 provides a default value for expected return on equity for projects in the energy industry. For South Africa, this expected return on equity is 10.9%. Although this default value may reflect the risk associated with investing in conventional energy projects, it does not appear to accurately reflect the risk associated with investment in IPP renewable energy projects in South Africa.

An EIRR of 10.9% is not sufficiently attractive for investors to enter the South African renewable energy market. The investors will typically price in a risk perceived for a certain type of investment into their IRR expectation. The mark ups should include a premium for foreign exchange which is equal to or higher than the hedging cost for such risk and an inflation rate risk. A further premium will be expected for regulatory uncertainty due to a new, unproven IPP procurement programme. With the uncertainty in the regulatory environment for renewable energy projects in South Africa, an EIRR of 10.9% is not adequate to encourage investment.

According to the South African Photovoltaic Industry Association, the return expectations for South African infrastructure projects in the renewable energy sector is a nominal return on equity after tax of between 23 and 28% and a real return on equity of 20%.

The only publically available and objectively verifiable information for EIRR benchmarks in the renewable energy sector in South Africa was the Renewable Energy Feed-In Tariff (REFIT) guidelines.

The REFIT was introduced to promote the uptake of grid-connected renewable energy projects[8]. The REFIT is a policy instrument that guarantees prices for the supply of renewable energy onto the South African national electricity grid over a specified time period[9].

The REFIT guidelines were first released in May 2008[10]. After an extensive stakeholder and public consultation period, NERSA released the final guidelines on the 26 March 2009[11]. The progression of the REFIT has been captured below:

---

[8] Imbewu Sustainability Legal Specialists and The Renewable Energy and Energy Efficiency Partnership. 2009. *South African Policy and Regulation Review.* Available online from www.reeep-sa.org/projects/doc_download/56-south-africa-2009. [Accessed 16 November 2010].

[9] National Energy Regulator of South Africa. March 2009. South Africa Renewable Energy Feed-in Tariff. Available online from http://www.innovent.com.uy/site/content/legislacion/south_africa_renewable_energy_feed_in_tariff.pdf [Accessed 28 February 2011].

[10] National Energy Regulator of South Africa (NERSA). May 2008. Draft Guidelines South African Renewable Energy Feed-in Tariff. Available online from http://www.ameu.co.za/library/industry-documents/nersa/REFIT%20guidelines%20draft%20080515%20pdf.pdf. [Accessed 16 November 2010].

Date	Action Taken
July 2007[12]	The Renewable Energy Feed-in Tariff (REFIT) study of NERSA was commissioned[13].
May 2008[14]	Draft REFIT guidelines published for consultation[15]
26 March 2009[16]	Guidelines for the REFIT Phase I are approved. The guidelines establish the institutional framework, the role of the key players and the tariff conditions. The tariff for wind is disclosed in the guidelines.[17]
July 2009[18]	REFIT Phase II consultation paper was released by NERSA.[19] Phase II governs Concentrated Solar Power (CSP), Photovoltaic (PV), biomass and biogas.
3 September 2009[20]	NERSA public hearing on REFIT Phase II[21].

[11] Department of Public Enterprises. April 2009. Nersa Decision on Renewable Energy Feed in Tariff (REFIT). Available online from http://www.dpe.gov.za/news-3. [Accessed 16 November 2010].

[12] National Energy Regulator of South Africa (NERSA). July 2009. Renewable Energy Feed-in Tariff Phase II. Available online from http://www.nersa.org.za/Admin/Document/Editor/file/NERSA%20REFIT%20%20consultation%20paper%2002%20Dec%202008.pdf. [Accessed 16 November 2010].

[13] National Energy Regulator of South Africa (NERSA). July 2009. Renewable Energy Feed-in Tariff Phase II. Available online from http://www.nersa.org.za/Admin/Document/Editor/file/NERSA%20REFIT%20%20consultation%20paper%2002%20Dec%202008.pdf. [Accessed 16 November 2010].

[14] National Energy Regulator of South Africa (NERSA). May 2008. Draft Guidelines South African Renewable Energy Feed-in Tariff. Available online from http://www.ameu.co.za/library/industry-documents/nersa/REFIT%20guidelines%20draft%20080515%20pdf.pdf. [Accessed 16 November 2010].

[15] National Energy Regulator of South Africa (NERSA). May 2008. Draft Guidelines South African Renewable Energy Feed-in Tariff. Available online from http://www.ameu.co.za/library/industry-documents/nersa/REFIT%20guidelines%20draft%20080515%20pdf.pdf. [Accessed 16 November 2010].

[16] Department of Public Enterprises. April 2009. Nersa Decision on Renewable Energy Feed in Tariff (REFIT). Available online from http://www.dpe.gov.za/news-3. [Accessed 16 November 2010].

[17] National Energy Regulator of South Africa. March 2009. South Africa Renewable Energy Feed-in Tariff. Available online from http://www.innovent.com.uy/site/content/legislacion/south_africa_renewable_energy_feed_in_tariff.pdf [Accessed 28 February 2011].

[18] National Energy Regulator of South Africa (NERSA). July 2009. Renewable Energy Feed-in Tariff Phase II. Available online from http://www.nersa.org.za/Admin/Document/Editor/file/NERSA%20REFIT%20%20consultation%20paper%2002%20Dec%202008.pdf. [Accessed 16 November 2010].

[19] National Energy Regulator of South Africa (NERSA). July 2009. Renewable Energy Feed-in Tariff Phase II. Available online from http://www.nersa.org.za/Admin/Document/Editor/file/NERSA%20REFIT%20%20consultation%20paper%2002%20Dec%202008.pdf. [Accessed 16 November 2010].

[20] National Energy Regulator of South Africa (NERSA). August 2009. *Notice of the Energy Regulator Public Hearing on the Renewable Energy Feed-in Tariff (REFIT) Phase II.* Available online from

29 October 2009[22]	NERSA approves REFIT Phase II[23].
February 2010[24]	Regulatory Rules on selection criteria for renewable energy projects under the REFIT Programme are published for comment[25]
March 2011	Consultation paper released by NERSA on the revised REFIT[26].

The REFIT was designed by NERSA to achieve a real return on equity (ROE) after tax of 17%. This can be seen as the benchmark for the renewable energy industry in South Africa.

Although the REFIT has been replaced by the IPP Procurement Programme as the incentive programme for grid-connected renewable energy, the REFIT remains the only publically available and independent Government benchmark for renewable energy. Hence, the appropriate benchmark for this project is an EIRR of 17%.

Sub-step 2c: Calculation and comparison of financial indicators

The basic parameters for calculation of the financial indicator are as follows:

Parameter	**Value**	**Unit**	**Source**
[redacted]	[redacted]	[redacted]	[redacted]

---

www.sessa.org.za/component/docman/doc_download./82-public-hearing-announcement-refit-phase-2. [Accessed 16 November 2010].

[21] National Energy Regulator of South Africa (NERSA). August 2009. *Notice of the Energy Regulator Public Hearing on the Renewable Energy Feed-in Tariff (REFIT) Phase II.* Available online from www.sessa.org.za/component/docman/doc_download./82-public-hearing-announcement-refit-phase-2. [Accessed 16 November 2010].

[22] Edkins, M., Marquard, A. And Winkler, H. Energy Research Centre. University of Cape Town. June 2010. *Assessing the effectiveness of national solar and wind energy policies in South Africa*. Available online from http://www.erc.uct.ac.za/Research/publications/10Edkinesetal-Solar_and_wind_policies.pdf. [Accessed 16 November 2010].

[23] Edkins, M., Marquard, A. And Winkler, H. Energy Research Centre. University of Cape Town. June 2010. *Assessing the effectiveness of national solar and wind energy policies in South Africa*. Available online from http://www.erc.uct.ac.za/Research/publications/10Edkinesetal-Solar_and_wind_policies.pdf. [Accessed 16 November 2010].

[24] National Energy Regulator of South Africa (NERSA). February 2010. *Rules on selection criteria for renewable energy projects under the REFIT programme.* Available online from http://www.nersa.org.za/Admin/Document/Editor/file/Electricity/Legislation/Regulatory%20Rules/RULES%20FOR%20SELECTION%20CRITERIA%2019%20Feb10.pdf. [Accessed 16 November 2010].

[25] National Energy Regulator of South Africa (NERSA). February 2010. *Rules on selection criteria for renewable energy projects under the REFIT programme.* Available online from http://www.nersa.org.za/Admin/Document/Editor/file/Electricity/Legislation/Regulatory%20Rules/RULES%20FOR%20SELECTION%20CRITERIA%2019%20Feb10.pdf. [Accessed 16 November 2010].

[26] National Energy Regulator of South Africa (NERSA). March 2011. *Review of Renewable Energy Feed-In Tariffs*. Available online from http://www.nersa.org.za/Admin/Document/Editor/file/Electricity/Consultation/Documents/Review%20of%20Renewable%20Energy%20Feed-In%20Tariffs%20Consultation%20Paper.pdf. [Accessed March 2011]

[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]		[redacted]
[redacted]	[redacted]		[redacted]

The ROE after tax for this project was calculated to be 8.39%. Hence, the project is not financially attractive.

Sub-step 2d: Sensitivity analysis

A sensitivity analysis was conducted on the following parameters:

- Capital expenditure and construction costs
- O&M costs
- Net power generation

The likelihood of these parameters varying is very low as:

- a contract containing the capital expenditure and construction costs is in place
- a contract is in place for operation and maintenance and costs associated with it
- a wind assessment report has been received from a third party

These parameters were varied by +/- 10%. The results are as follows:

Parameter	**+10%**	**-10%**
Capital expenditure and construction costs	4.04%	12.30%
O&M costs	7.69%	9.11%
Net power generation	14.78%	2.85%
Benchmark	17%	
Project IRR	8.39%.	

The ROE after tax for the project is below the benchmark.

Step 3: Barrier Analysis

The 'Tool for the demonstration and assessment of additionality' states that project participants may choose to apply Step 2 (Investment Analysis) or Step 3 (Barrier Analysis).

Step 4: Common Practice Analysis

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

The geographical scope considered for the common practise analysis is South Africa as the project activity is based in South Africa and will be connected to the South African grid. The following wind farms are currently operational in South Africa:

- Electrawinds: Electrawinds has erected a turbine in Port Elizabeth with a rated capacity of 1.8 MW. This is their first project outside of Europe.

- Klipheuwel Wind Farm is a demonstration project which is partially government owned through the parastatal Eskom. Annually, since all turbines have been operating, total production has been just more than 4GWh.[27] The Klipheuwel wind farm is government owned and not an IPP. The Klipheuwel wind farm is intended as a demonstration wind farm and not a commercial wind farm.

- The Darling Wind Farm is the first commercial wind energy facility in South Africa[28]. Annually, average total production is 13.2 GWh since operation[29]. Financial assistance from the Danish government through Danida, a loan from the Development Bank of Southern Africa and investment by the Central Energy Fund assisted in the development of the project.[30] The Darling wind Farm Company (DWP) signed a 20 year PPA with the City of Cape Town as well as a power wheeling agreement with Eskom[31].

Electrawinds' project currently consists of one turbine with a rated capacity of 1.8MW. This is not similar in scale to this project and so can be ignored.

Below is a table of comparison between the Klipheuwal Wind Farm, the Darling Wind Farm and this project:

	Klipheuwel Wind Farm[32]	**Darling Wind Farm**[33]	**The Project**
Financing	Public funding: Eskom	Public funding: • Central Energy Fund • Danish Government • Development	Privately funded

[27] South African Department of Energy. *Wind Power*. Available online from: http://www.energy.gov.za/files/renewables_frame.html. Please select wind power tab on the left hand side of the webpage in order to access data [Accessed 16 November 2010].

[28] Benton, S. South Africa.info. 6 November 2006. *Green light for SA's wind farm*. Available online from http://www.southafrica.info/about/sustainable/windfarm-darling.htm. [Accessed 16 November 2010].

[29] Wind Farms. Available online from http://www.energy.gov.za/files/esources/renewables/r_wind.html. [Accessed 18 January 2011].

[30] South African Department of Energy. *Wind Power*. Available from http://www.energy.gov.za/files/renewables_frame.html. Please select wind power tab on the left hand side of the webpage in order to access data [Accessed 16 November 2010].

[31] Otto, A. South African Wind Energy Programme (SAWEP). 13 May 2008. Renewable Energy City Summit. Available online from http://www.eskom.co.za/content/Potential%20contribution%20by%20wind%20energy%20in%20SA.pdf . [Accessed 16 November 2010]. (The stated link occasionally does not work. If this is the case please google South African Wind Energy Programme. 13 May 208. Renewable Energy City Summit. Click on this first link which appears on the search page.)

[32] South African Department of Energy. *Wind Power*. Available online from: http://www.energy.gov.za/files/renewables_frame.html. Please select wind power tab on the left hand side of the webpage in order to access data [Accessed 16 November 2010].

[33] Darling Wind Power (Pty) Ltd. Available online from http://www.darlingwindfarm.co.za/aboutus.htm. Accessed 23 September 2010.

		Bank of South Africa and	
Number of turbines	3	4	9.0
Total Capacity	3.2 MW	5.2 MW	27.0 MW
Total Annual Production	4 GWh	13.2 GWh	80 GWh
Load Factor	20%-30%	28%	33.8%
Year of Operation	The first unit started generating on 16 August 2002 and the last on 20 February 2003.	May 2008	1 August 2013
Electricity off taker	Eskom	City of Cape Town	Eskom under the IPP Procurement Programme

The project is not similar to the Klipheuwel and Darling Wind Farms. The project is a large, commercial wind farm which is privately owned. No public funding will be used for the project.

According to the 'Tool for the demonstration and assessment of additionality,' projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Under this definition, the Klipheuwel and Darling Wind Farms are not similar to the project as the scale; access to financing and regulatory framework is substantially different.

None of these wind farms are similar as they are not of similar scale and do not take place in the same regulatory framework. None of the projects are commercial wind farms of similar scale to this wind farm which have been developed under the IPP Procurement Programme.

Sub-step 4b: Discuss any similar Options that are occurring:

There are no similar projects identified in Sub-step 4a above. Hence, this sub-step is not applicable. As a result, the project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>
The calculation of the emission reductions is done in accordance with ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable resources" (version 12.01). The calculation methodology is set out below:

Project emissions
According to the methodology, for most renewable energy power generation activities, $PE_y = 0$. This is the case for this project activity as it is neither a hydro nor a geothermal power plant. In addition, it does not involve the combustion of fossil fuels as with geothermal and some solar plants. The project emissions are equal to zero as the baseline emissions are calculated based on net electricity supplied to the national grid. This net electricity takes into account the electricity used by the wind farm.

Baseline emissions

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. All electricity generation would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$$ (Equation 6)

Where:

BE_y	Baseline emissions in year y (tCO_2/yr)
$EG_{PJ,y}$	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EF_{grid,CM,y}$	Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the “Tool to calculate the emission factor for an electricity system.” (tCO_2/MWh)

The methodology for the calculation of the grid emission factor is presented in Annex 3. The net quantity of electricity generation that is fed onto the grid as a result of the implementation of the project activity ($EG_{PJ,y}$) is calculated as follows:

$EG_{PJ,y}$ is equivalent to $EG_{facility,y}$ as the project activity is the installation of a new grid-connected renewable energy power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (Greenfields project). In other words,

$$EG_{PJ,y} = EG_{facility,y}$$ (Equation 7)

Where:

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

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y$$ (Equation 11)

Where:

ER_y	Emission reductions in year y (tCO_2/yr)
BE_y	Baseline emissions in year y (tCO_2/yr)
PE_y	Project emissions in year y (tCO_2/yr)

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

Data / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO_2/MWh
Description:	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.”
Source of data used:	Calculation using version 02.2.1 of the “Tool to calculate the emission factor

	for an electricity system" as set out in Annex 3
Value applied:	0.93
Justification of the choice of data or description of measurement methods and procedures actually applied :	The emission factor of the grid is calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" in accordance with the methodology applied to the project (ACM002).
Any comment:	The baseline will be updated as the start of the second and third crediting period. Should the baseline scenario still be the grid then the grid emission factor must be updated for the second and third crediting period. The new data available will be used to revise the baseline emissions.

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

>>

The data used to calculate the emission reductions and the source of the data is as follows:

Parameter	Value	Unit	Source
$EG_{facility,y}$	80 000.0	MWh/yr	Wind data

The grid emission factor is presented in Annex 3.

The ex-ante calculation of the emission reductions is presented below:

Project emissions

There are no project emissions as a result of the installation of the wind farm.

Baseline emissions

The baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad \text{(Equation 6)}$$

Year	BE_y	$EG_{PJ,y}$	$EF_{grid,CM,y}$
1 August 2013 – 31 July 2014	74 400.0	80 000.0	0.93
1 August 2014 – 31 July 2015	74 400.0	80 000.0	0.93
1 August 2015 – 31 July 2016	74 400.0	80 000.0	0.93
1 August 2016 – 31 July 2017	74 400.0	80 000.0	0.93
1 August 2017 – 31 July 2018	74 400.0	80 000.0	0.93
1 August 2018 – 31 July 2019	74 400.0	80 000.0	0.93
1 August 2019 – 31 July 2020	74 400.0	80 000.0	0.93

The net quantity of electricity generation that is fed onto the grid as a result of the implementation of the project activity ($EG_{PJ,y}$) is calculated as follows:

$$EG_{PJ,y} = EG_{facility,y} \quad \text{(Equation 7)}$$

Year	$EG_{PJ,y}$	$EG_{facility,y}$
1 August 2013 – 31 July 2014	80 000.0	80 000.0
1 August 2014 – 31 July 2015	80 000.0	80 000.0

1 August 2015 – 31 July 2016	80 000.0	80 000.0
1 August 2016 – 31 July 2017	80 000.0	80 000.0
1 August 2017 – 31 July 2018	80 000.0	80 000.0
1 August 2018 – 31 July 2019	80 000.0	80 000.0
1 August 2019 – 31 July 2020	80 000.0	80 000.0

Emission reductions
Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \text{(Equation 11)}$$

Year	**ER_y**	**BE_y**	**PE_y**
1 August 2013 – 31 July 2014	74 400.0	74 400.0	0.0
1 August 2014 – 31 July 2015	74 400.0	74 400.0	0.0
1 August 2015 – 31 July 2016	74 400.0	74 400.0	0.0
1 August 2016 – 31 July 2017	74 400.0	74 400.0	0.0
1 August 2017 – 31 July 2018	74 400.0	74 400.0	0.0
1 August 2018 – 31 July 2019	74 400.0	74 400.0	0.0
1 August 2019 – 31 July 2020	74 400.0	74 400.0	0.0

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

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 overall emission reductions (tonnes of CO_2 e)**
1 August 2013 – 31 July 2014	0.0	74 400.0	0.0	74 400.0
1 August 2014 – 31 July 2015	0.0	74 400.0	0.0	74 400.0
1 August 2015 – 31 July 2016	0.0	74 400.0	0.0	74 400.0
1 August 2016 – 31 July 2017	0.0	74 400.0	0.0	74 400.0
1 August 2017 – 31 July 2018	0.0	74 400.0	0.0	74 400.0
1 August 2018 – 31 July 2019	0.0	74 400.0	0.0	74 400.0
1 August 2019 – 31 July 2020	0.0	74 400.0	0.0	74 400.0
Total (tonnes of CO_2 e)	**0.0**	**520 800.0**	**0.0**	**520 800.0**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$EG_{facility,y}$**
Data unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant to the grid in year y
Source of data to be used:	The source of the data that will be actually used for the proposed project activity will be data recorded from measurements taken by an electricity meter. The electricity meter will measure both the electricity produced and the electricity consumed by the wind farm. The net electricity will be calculated by subtracting the electricity consumed by the wind farm from the electricity produced by the wind farm. Another source for this data is the receipts for electricity sold to the grid from the national electricity distributor. However, the metered data is preferred. The receipts for electricity sold to the grid will be used for cross-checking purposes.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	80,000.0
Description of measurement methods and procedures to be applied:	The electricity generated and used by the wind farm is measured using an online electricity meter. The net electricity supplied to the grid is calculated by subtracting the amount of electricity used by the wind farm from the amount of electricity generated by the wind farm .The data is measured continuously and integrated hourly. The hourly data is used to calculate the net electricity supplied to the grid each hour in a spreadsheet. This hourly data is summed each month to obtain a monthly value. The monthly values are summed to obtain an annual value. The data collected by the online meter will be stored both on and off site for the entire crediting period. The data will be sent via a GSM network to the internet where it can be accessed by authorised users. Any changes to the data or data manipulation will be logged by the system so as to maintain an audit trail. Only authorised users will be given access to the database. The people responsible for the measurement and calibration of the meter will be the operations manager for the wind farm. The accuracy of the meter is set in accordance with the regulations of the National Energy Regulator of South Africa (NERSA). NERSA has published an industry standard with which all electricity generation projects that supply onto the national electricity grid must comply. The accuracy of the meter shall be in accordance with the minimum requirements of NRS 057. In accordance with this standard, the electricity meter will be at least a “Class 0.2” which means it will be accurate to at least 0.2%.

	The online electricity meter will be calibrated in accordance with manufacturer's specifications. The electricity meter must at all times have a valid calibration certificate. A month before the current calibration certificate is due to expire, the operations manager must contact the manufacturer to provide calibration services and issue a new calibration certificate. The data that is collected both on and off site is archived for at least two years after the end of the crediting period.
QA/QC procedures to be applied:	Cross check measurement results with records for sold electricity. The data collected using the online meter will be aggregated monthly. The monthly values will be checked against purchase records from the authority responsible for transmission and distribution of electricity from the South African national electricity grid. This is provided that the receipts are received monthly from Eskom otherwise this check cannot be performed. If there is a significant difference (greater than 2%) then the difference must be clarified and justified in the annual monitoring report. The most conservative value will be used if there is any doubt as to which is more accurate. A second check that will be performed is to check the metered values with the design installed capacity, operating hours and plant load factor. Should there be a significant difference (±5%) then this difference must be justified and the lowest value applied to the ex-post calculation of the emission reductions.
Any comment:	

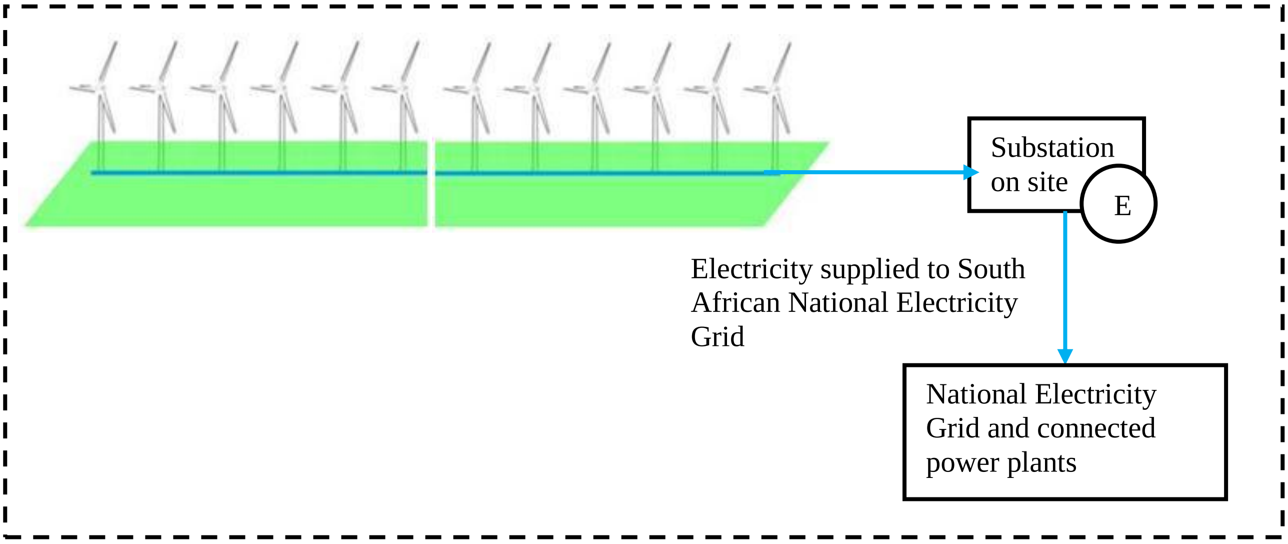
B.7.2. Description of the monitoring plan:

>>

The monitoring plan for the project

The only parameter that requires monitoring is the quantity of net electricity generation supplied by the project plant to the grid in year y. The monitoring plan describes the procedure to monitor and record the electricity supplied to the national electricity grid.

The electricity will be metered at the substation on site. The metering point is depicted below:



Where E represents an electricity metering point

The electricity meter will measure the electricity generated and used by the wind farm. The net electricity supplied to the grid will be calculated by subtracting the electricity used by the wind farm from the electricity generated by the wind farm.

The data is measured continuously and integrated hourly. The hourly data is used to calculate the net electricity supplied to the grid each hour in a spreadsheet. This hourly data is summed each month to obtain a monthly value. The monthly values are summed to obtain an annual value.

The data collected by the online meter will be stored both on and off site for the entire crediting period. The data will be sent via a GSM network to the internet where it can be accessed by authorised users. Any changes to the data or data manipulation will be logged by the system so as to maintain an audit trail. Only authorised users will be given access to the database.

The people responsible for the measurement and calibration of the meter will be the operations manager for the wind farm.

The accuracy of the meter is set in accordance with the regulations of the National Energy Regulator of South Africa (NERSA). NERSA has published an industry standard with which all electricity generation projects that supply onto the national electricity grid must comply. The accuracy of the meter shall be in accordance with the minimum requirements of NRS 057. In accordance with this standard, the electricity meter will be at least a "Class 0.2" which means it will be accurate to at least 0.2%.

The online electricity meter will be calibrated in accordance with manufacturer's specifications. The electricity meter must at all times have a valid calibration certificate. A month before the current calibration certificate is due to expire, the operations manager must contact the manufacturer to provide calibration services and issue a new calibration certificate.

The data that is collected both on and off site is archived for at least two years after the end of the crediting period.

Cross check measurement results with records for sold electricity. The data collected using the online meter will be aggregated monthly. The monthly values will be checked against purchase records from the authority responsible for transmission and distribution of electricity from the South African national electricity grid. This is provided that the receipts are received monthly from Eskom otherwise this check cannot be performed. If there is a significant difference (greater than 2%) then the difference must be clarified and justified in the annual monitoring report. The most conservative value will be used if there is any doubt as to which is more accurate.

A second check that will be performed is to check the metered values with the design installed capacity, operating hours and plant load factor. Should there be a significant difference (±5%) then this difference must be justified and the lowest value applied to the ex-post calculation of the emission reductions.

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: 29/11/2011

Responsible person/s:

Peter Oldacre
Deloitte & Touche
South Africa
+27 (082) 920 4984
poldacre@deloitte.co.za

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

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

The anticipated starting date for the project is the date of placement of the order for the wind turbines in 7 May 2012 which is the date on which the project and finance contracts are signed as per the project plan.

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

>>

The operational lifetime of the project is anticipated to exceed the crediting period of the project. The service life of the wind turbines is 20 year and 0 months. However, it is anticipated that the turbines will continue to operate beyond the service life.

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

C.2.1. Renewable crediting period:

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

>>

01/08/2013 but not prior to project registration

C.2.1.2. Length of the first crediting period:

>>

7 years and 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

Not applicable

C.2.2.2. Length:

>>

Not applicable

SECTION D. Environmental impacts

>>

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

>>

The project will have a number of positive impacts on the environment. These include:

- The project results in a reduction of greenhouse gas emissions by displacing coal-fired grid electricity with electricity generated from a renewable resource. This reduction in greenhouse gas emissions will play a role in assisting South Africa to achieve its emission reduction target of 34% below business-as-usual by 2020.
- The generation of electricity from wind power does not require the use of water. This is in direct contrast to the generation of electricity from coal.
- The project will make use of a renewable resource to generate electricity. The electricity will be fed onto the national electricity grid and displace coal-fired electricity. Apart from reducing greenhouse gas emissions, the project will displace the negative impacts of coal-mining and beneficiation as well as the adverse environmental impacts of combusting coal (particulate and

sulphur emissions and water consumption and contamination). The success of the project will assist in encouraging the diversification of South Africa's energy mix and the use of renewable resources.

The Final Environmental Impact Report identified a number of potential negative environmental impacts for the project. These impacts are as follows:

- **Noise Impacts:** There could be an increase in noise during the construction phase of the project. During the operational phase of the project, there could be aerodynamic noise generated by the blades of the turbines. In addition, noise could be caused by the turbine generators during operation. A specialist Noise Impact Assessment has been conducted as part of the EIA.
- **Ecological Impacts (Avifauna and Bats):** There is potential for the proposed wind farm to result in impacts on birds and bats through collisions with the turbine blades or internal injuries sustained through decompression near the moving blades. An avifauna specialist study has therefore been carried out as part of the EIA to investigate the potential impact on birds and bats.
- **Visual Impacts:** Wind turbines are by their very nature highly visible structures, usually clearly visible for many kilometres. Bearing in mind that visual impacts are highly subjective, concern has been expressed, particularly by residents in the area of the Bushy Park site, that this may reduce the quality of their views, and could reduce the values of properties in the area. A visual impact specialist study has therefore been conducted as part of the EIA to assess potential impacts.
- **Ecological Impacts (Terrestrial Ecology):** The site selection process has taken care to avoid endangered and critically endangered ecological areas. It is also anticipated that the micro-siting of turbines, access roads, and associated infrastructure on each of the sites can be mostly accommodated in areas that have already been transformed. However, should the development be approved, it is possible that limited quantities of protected indigenous vegetation may need to be removed. Due to the relatively small footprint of the wind farm, and the care that has been taken in the site selection process, these terrestrial ecological impacts have been addressed through clear guidelines in the Draft Environmental Management Programme.

These impacts have been assessed in more depth in the Environmental Impact Assessment report and the Environmental Management Plan.

There are no transboundary impacts anticipated as a result of this project.

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 project requires an Environmental Impact Assessment (EIA) in accordance with the South African National Environmental Management Act No. 107 of 1998 (NEMA). The project received a record of decision for the EIA on the 28th of March 2011.

SECTION E. Stakeholders' comments

>>

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

>>

The stakeholder consultation process was aligned with the public participation required as part of the Environmental Impact Assessment (EIA) application process. The following process was followed to identify stakeholders or Interested and Affected Parties (I&APs) and to invite comment:

- A database of key stakeholders was compiled. Key stakeholders in this case were identified as neighbouring landowners, authorities (local and provincial), non-governmental organisations and other key stakeholders;
- Advertising of the EIA process in the EP Herald and Die Burger on 16th of March 2009;
- Placement of on-site posters – on at the main entrance to each site;
- Distribution of Background Information Document (BID) to potential and registered I&APs and stakeholders;
- Presentation on the project to the local Municipality's corporate EIA task team committee to gain input from the various departments on the way forward with the EIA;
- Recording of all issues raised in response to the BID;
- Presentation of a Draft Scoping Report and distribution of this report to public venues for review by I&APs and distribution of an executive summary to all I&APs registered for this project;
- Hosting of public meetings on the 1st and 4th of June 2009 to present the findings of the Scoping Study and obtain further comment;
- Hosting of aviation safety focus group meeting on the 10th of July 2009;
- Compilation of issues raised in response to the Draft Scoping Report and integration of these comments into the Final Scoping Report;
- Distribution of Final Scoping Report to public venues for review by I&APs and distribution of executive summary to all registered I&APs;
- Submission of Final Scoping Report and the Plan of Study for the EIA to the Department of Environmental Affairs (DEA) for consideration and approval on 31st of July 2009;
- Notification from DEA on 27th of October of approval of Plan of Study for the EIA with additional comments;
- Appointment of specialists and completion of specialist study reports;
- Compilation of a Draft Environmental Impact Report, specialist studies and a Draft Environmental Management Plan including comments raised in response to the Final Scoping Report;
- Submission of Draft Environmental Impact Report to DEA on the 10th of May 2010 and distribution to public venues for review by I&APs. Distribution of executive summary to all I&APs registered for this project;
- Hosting of a public meeting on the 27th of May 2010 to present findings and invite comment;
- Presentation to the local Municipality's corporate EIA task team committee to gain input;
- Compilation of issues raised in response to the Draft Environmental Impact Report and integration of these comments into the Final Environmental Impact Report;
- Submission of report to the DEA for a decision and distribution of the executive summary, as well as responses to issues raised, to registered I&APs.

E.2. Summary of the comments received:

>>

The comments and response report is made available in the EIA report. Below are a number of comments and questions relating to the wind farm:

1. The Driftsands and Bushy Park sites are close to PE Rader Site and could interfere with the Primary Radar. The effect on the radar from the Van Stadens site would have to be determined.

2. The radar minima head for the Vectory would have to be redesigned.

3. The circuit altitude to the south of the airfield may be recalculated.

4. The Bushy Park site could affect the minimum safety altitude for the instrument landing system (ILS) for runway 08 and also the minima for the VOR letdown for the runway 08. The rotating blades (of a wind turbine) have a modulation effect of the radiated signal from the Navigational facility and could possibly interfere with voice (speech).

5. (The wind turbines) are a hazard to any aircraft, as flight paths do not start at the airport.

6. Objects to the wind farm on the coastline as it is too close to the airport.

7. Expressed concern that there are aircraft flying over the Driftsands area daily.

8. The area (Driftsands) is in the flight path of aircraft.

9. The area is in the direct flight path of the airport.

10. Recommend that the wind farm should be as far from the airport as possible.

The rest of the comments can be found in the Final Environmental Impact Report. The concerns mentioned above have been addressed through specialist studies during the compilation of the Environmental Impact Assessment (EIA) report.

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

>>

The response that was provided to questions 1 through 9 listed above was as follows:

1. At a meeting held with the South African Civil Aviation Authority (SACAA) on 25 May 2009, it was agreed to hold a focus group meeting for all aviation stakeholders to further identify the potential aviation risks that should be investigated as part of the EIA. Based on the outcomes of this focus group meeting, an aviation safety specialist study was conducted as part of the EIA.

The response to question 10 was that the recommendation that the wind farm be as far was possible from the airport was noted and taken into consideration.

The rest of the responses to the comments can be found in the Final Environmental Impact Report

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	EnBW Kraftwerke AG
Street/P.O.Box:	Durlacher Allee 93
Building:	
City:	Karlsruhe
State/Region:	
Postcode/ZIP:	76131
Country:	Germany
Telephone:	+49 721 63 23105
FAX:	+49 721 63 23119
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	Mr
Last name:	Stein
Middle name:	
First name:	Tilo
Department:	
Mobile:	+49 175 299 89 67
Direct FAX:	+49 721 63 23119
Direct tel:	+49 721 63 23105
Personal e-mail:	

Organization:	MetroWind (Pty) Ltd
Street/P.O.Box:	14 Rose Street Central
Building:	Fernlea Building
City:	Port Elizabeth
State/Region:	
Postcode/ZIP:	
Country:	South Africa
Telephone:	+27 41 505 8000
FAX:	27 41 585 3437
E-Mail:	info@africoast.com
URL:	www.africoast.com
Represented by:	Donald McGillivray
Title:	Mr
Salutation:	
Last name:	McGillivray
Middle name:	
First name:	Donald

Department:	
Mobile:	+27 (0)83 777 0084
Direct FAX:	+27 (0)41 - 505 8000
Direct tel:	+27 (0)41 - 585 3437
Personal e-mail:	donald@africoast.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

Application of the "Tool to calculate the emission factor for an electricity system" Version 02.2.1

The methodological tool to calculate the emission factor for an electricity system determines the CO_2 emission factor for the displacement of electricity generated by power plants in an electricity system, by calculating the "operating margin" (OM) and "build margin" (BM) as well as the "combined margin" (CM). The operating margin refers to existing power plants whose electricity generation would be affected by the proposed CDM project activity. The build margin reflects the power units whose construction would be affected by the proposed CDM project activity. The tool follows six steps in order to calculate the operating margin, build margin and the combined margin:

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.

Step 1: Identify the relevant electricity systems

The connected electricity system is defined as the South African national electricity grid. The project feeds electricity onto the national electricity grid of South Africa. The DNA has not published a delineation of the electricity system for South Africa.

The South African electricity sector is a monopoly with Eskom (the national utility) dominating both the generation and distribution of electricity in the country[34]. Eskom generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customers as well as to redistributors.

The regional generation and consumption of Eskom transmission grids are interlinked and no distinction can be made between provincial or sectoral generation and consumption. For example: Cape Town, although located close to a nuclear power station, receives electricity via the transmission line from coal-fired power stations in Mpumalanga. The whole SA transmission system is taken as a homogenous mix of electricity supply by all generators.

[34] Edkins, M., Marquard, A. And Winkler, H. Energy Research Centre. University of Cape Town. June 2010. *Assessing the effectiveness of national solar and wind energy policies in South Africa*. Available online from http://www.erc.uct.ac.za/Research/publications/10Edkinesetal-Solar_and_wind_policies.pdf. [Accessed 16 November 2010].

Eskom is responsible for the production of over 95%[35] of South Africa's electricity and is also responsible for the transmission of electricity. Eskom owns and operates the following electricity generation plants:

Table 1: Eskom power plants

Plant Name	Installed Capacity (MW)	Commissioning date	Reinstallation or commissioning date	Fuel type
Arnot	1980	1971	1971	Coal
Duvha	3450	1980	1980	Coal
Hendrina	1895	1970	1970	Coal
Kendal	3840	1988	1988	Coal
Kriel	2850	1976	1976	Coal
Lethabo	3558	1985	1985	Coal
Matimba	3690	1987	1987	Coal
Majuba	3843	1996	1996	Coal
Matla	3450	1979	1979	Coal
Tutuka	3510	1985	1985	Coal
Koeberg	1800	1984	1984	Nuclear
Acacia	171	1976	1976	Gas
Port Rex	171	1976	1976	Gas
Colley Wobbles	42	1985	1985	Hydro
First Falls	6	1979	1979	Hydro
Gariep	360	1971	1971	Hydro
Ncora	2	1983	1983	Hydro
Second Falls	11	1979	1979	Hydro
Van Der Kloof	240	1977	1977	Hydro
Drakensberg	1000	1981	1981	Pumped storage
Palmiet	400	1988	1988	Pumped storage
Camden	1600	1966	2005	Coal
Grootvlei	1200	1969	1969	Coal
Komati	1000	1961	1961	Coal

The information in the table above was obtained from the Eskom website (www.eskom.co.za). In order to find the information, CDM must be typed into the search function. The first result must be opened and the link to the CDM calculation table must be opened.

The pumped storage plants can be excluded as they are not electricity generation plants, but only a means of electricity storage.

The remaining 5% of the electricity supplied onto the national electricity grid is generated by a combination of municipal power plants and Independent Power Producers (IPPs). There is no central database with a list of the power plants connected to the grid. There is also a lack of publically available information on the amount of electricity generated by each plant and supplied to the grid and the amount

[35] South African Department of Energy. 2010. Available online from: http://www.energy.gov.za/files/electricity_frame.html. Accessed 21 September 2010.

of fuel used to generate the electricity. A literature review or search was done to understand the non-Eskom generation. The following information was obtained:

Table 2: Information available on non-Eskom power plants[36]

Plant Name	Installed Capacity (MW)	Commissioning date	Reinstallation or commissioning date	Fuel type
Athlone	180	1960s	Currently not operational	Coal
Kroonstad	30		Currently not operational	Coal
Swartkops	240		Currently not operational	Coal
Bloemfontein	103	1967	Currently not operational	Coal
Orlando	300		Currently not operational	Coal
Rooiwal	300	1963	206 MW net maximum capacity	Coal
Pretoria West	170	1952	100 MW net maximum capacity	Coal
Roggebaai	50	1981		Kerosene
Athlone	40	1972	Currently not operational	Kerosene
Port Elizabeth	24		Currently not operational	Kerosene
Johannesburg				Kerosene
Pretoria West	24		Currently not operational	Kerosene

[36] This information was obtained from a number of different sources which are referenced below:

- Project Design Document: New Energies Commercial Solar Water Heating Programme in South Africa – information obtained from http://www.pwc.co.za/en_ZA/za/assets/pdf/pwc-new-energiespoapddforpwc.pdf [Accessed 9 March 2012]
- Orvika Rosnes and Haakon Vennemo Econ Pöyry, in association with Norplan and Power Planning Associates. March 2009. Powering Up: Costing Power Infrastructure Spending Needs in Sub-Saharan Africa. http://www.infrastructureafrica.org/system/files/BP5_Power_spending_country_annex%20new_0.pdf [9 March 2012]
- The South African Department of Minerals and Energy. Energy Security Master Plan – Electricity. 2007-2025. Accessed online :zaf.mofat.go.kr/webmodule/common/download.jsp?.. [9 March 2012]
- ECON commissioned by the World Bank. 2007. Costing Power Infrastructure Investment Needs in Africa. http://www.econ.no/stream_file.asp?iEntityId=3703 [9 March 2012]
- Bethlehem Hydro website http://www.bethlehemhydro.co.za/index.html [9 March 2012]
- Darling Wind Farm Website http://www.darlingwindfarm.co.za/aboutus.htm [9 March 2012]

Orlando	176		Currently not operational	Kerosene
Lydenburg				Hydro
Ceres				Hydro
Piet Retief				Hydro
Steenbras				Pumped storage
Tongaat Hulett Amatikulu				Bagasse coal
Tongaat Hulett Darnell				Bagasse coal
Tongaat Hulett Felixton				Bagasse coal
Tongaat Hulett Maidstone Mill				Bagasse coal
Transvaal Suiker Ltd				Bagasse coal
Mittal Vanderbijlpark	100			
Kelvin		1965		Coal
Sasol Syn Fuels	282			Coal
Sasol Chem Industries	11		Capacity addition in 2008 to increase generation from 11 MW to 42 MW	Coal
Friedenheim				Hydro
Bethlehem Hydro	7	2009		Hydro
Darling Wind Farm	5.2	2008		Wind
Coega Wind Farm	1.8	2010		Wind
Newcastle cogeneration	18	2011		Gas

Steenbras can be excluded as it is not a power plant, but rather a pumped storage facility which stores power and does not generate power.

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

Option 1 was selected for the purposes of the calculation of the emission factor for this project. Hence, only grid power plants are included in the calculation. This is reflective of the baseline for the CPAs where electricity is sourced from the national grid.

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

In accordance with the tool, the calculation of the operating margin emission factor ($EF_{grid,OM,y}$) must be based on one of the following methods:

- Simple OM; or
- Simple adjusted OM; or
- Dispatch data analysis OM; or
- Average OM.

Of these four methods anyone can be used, however the simple OM method can only be used if low-cost/must-run resources constitute less than 50 % of total grid generation in average of the five most recent years. The Tool states that *''Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants."*

The following Eskom-owned power plants are low-cost/must-run power plants:

- Koeberg (nuclear power plant)
- Colley Wobbles (hydro power plant)
- First Falls (hydro power plant)
- Gariep (hydro power plant)
- Ncora (hydro power plant)
- Second Falls (hydro power plant)
- Van Der Kloof (hydro power plant)

The total grid generation over 5 years is calculated in the table below. Please note that the information is obtained from the Eskom website. In order to find the information, CDM must be typed into the search function. The first result must be opened and the link to the CDM calculation table must be opened. In addition, since Eskom generates 95% of the electricity on the grid, we calculated the total grid electricity generation as the electricity generated by Eskom power plants divided by 95%. The non-Eskom generation was treated as low-cost/must-run in order to conservatively estimate the percentage of electricity on the grid generated by low-cost/must-run power plants. This was done as information was not available in a central database in the public domain on non-Eskom generation.

Table 3: Generation of Eskom power plants for 5 years and calculation of percentage of the grid that is low-cost/must-run resources

	Generation (MWh)				
Plant Name	**2006-2007**	**2007-2008**	**2008-2009**	**2009-2010**	**2010-2011**
Arnot	15 938 102	11 905 060	11 987 281	13 227 864	12 194 878
Duvha	31 550 562	23 622 732	21 769 489	22 581 228	20 267 508
Hendrina	16 083 288	13 756 351	12 296 687	12 143 292	11 938 206
Kendal	34 164 855	26 517 420	23 841 401	23 307 031	25 648 258
Kriel	22 468 695	17 762 398	18 156 686	15 906 816	18 204 910
Lethabo	32 052 833	25 701 723	23 580 232	25 522 698	25 500 366
Matimba	34 983 880	29 021 742	26 256 068	27 964 141	28 163 040
Majuba	22 828 565	23 680 971	22 676 924	22 340 081	24 632 585
Matla	30 864 194	24 549 833	21 863 400	21 954 536	21 504 422
Tutuka	23 389 829	20 980 242	21 504 122	19 847 894	19 067 501
Koeberg	-	-	-	-	-
Acacia	-	-	-	-	992
Port Rex	-	-	-	-	5 507

Colley Wobbles	-	-	-	-	-
First Falls	-	-	-	-	-
Gariep	-	-	-	-	-
Ncora	-	-	-	-	-
Second Falls	-	-	-	-	-
Van Der Kloof	-	-	-	-	-
Drakensberg	-	-	-	-	-
Palmiet	-	-	-	-	-
Camden	2 815 982	5 171 057	6 509 079	7 472 070	7 490 836
Grootvlei	-	237 138	1 249 556	2 656 230	3 546 952
Komati	-	-	-	1 016 023	2 060 141
Total (Eskom)	267 140 785	222 906 667	211 690 925	215 939 904	220 226 102
Total Grid	281 200 826	234 638 597	222 832 553	227 305 162	231 816 949
Total (non-Eskom)	14 060 041	11 731 930	11 141 628	11 365 258	11 590 847
Total low-cost/must-run electricity	14 060 041	11 731 930	11 141 628	11 365 258	11 590 847
Total low-cost/must-run electricity as a percentage of the total grid electricity	5%	5%	5%	5%	5%

Hence, at the most, the electricity grid consists of 5% low-cost/must-run resources. This makes sense as a result of the fact that, according to the South African Department of Energy, almost 90.0 percent (%) of South Africa's electricity is generated in coal-fired power stations[37]. This means that almost 90.0% of the total electricity on the grid is not generated from low-cost/must-run power plants. Hence, the simple operating margin was used to calculate the operating margin.

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

- Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
-
- Ex post option: The year in which the project activity displaces grid electricity, required emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the

[37] South African Department of Energy. 2010. Available online from: http://www.energy.gov.za/files/electricity_frame.html. Accessed 21 September 2010.

previous year (y-2) may be used. The same data vintage (y, y-1, or y-2) should be used throughout all crediting periods.

The ex-ante option was selected. Hence the operating margin was calculated based on data from the following three years:

- 2008-2009
- 2009-2010
- 2010-2011
-

This is the latest available data in the public domain. This data is only available for Eskom power plants. There is no central database of non-Eskom generation. We were unable to find the electricity generation and fuel consumption for all non-Eskom power plants. As such, we treated the non-Eskom generation as electricity imports with an emission factor of 0 tCO2e per MWh in order to be conservative in the calculation of the grid emission factor.

In addition, since Eskom generates 95% of the electricity on the grid, we calculated the total grid electricity generation as the electricity generated by Eskom power plants divided by 95%. The non-Eskom generation is calculated as the total grid electricity generation minus the Eskom generation.

The information used to calculate the operating margin is as follows:

Table 4: The generation and fuel consumption of Eskom's coal power plants

	Generation (MWh)			Fuel Consumption (tons of coal)		
Plant Name	**2008-2009**	**2009-2010**	**2010-2011**	**2008-2009**	**2009-2010**	**2010-2011**
Arnot	11 987 281	13 227 864	12 194 878	6 395 805	6 794 134	6 525 670
Duvha	21 769 489	22 581 228	20 267 508	11 393 553	11 744 606	10 639 393
Hendrina	12 296 687	12 143 292	11 938 206	7 122 918	6 905 917	7 139 198
Kendal	23 841 401	23 307 031	25 648 258	15 356 595	13 866 514	15 174 501
Kriel	18 156 686	15 906 816	18 204 910	9 420 764	8 504 715	9 527 185
Lethabo	23 580 232	25 522 698	25 500 366	16 715 323	18 170 227	17 774 699
Matimba	26 256 068	27 964 141	28 163 040	13 991 453	14 637 481	14 596 842
Majuba	22 676 924	22 340 081	24 632 585	12 554 406	12 261 833	13 020 512
Matla	21 863 400	21 954 536	21 504 422	12 689 387	12 438 391	12 155 421
Tutuka	21 504 122	19 847 894	19 067 501	11 231 583	10 602 839	10 191 709
Camden	6 509 079	7 472 070	7 490 836	3 876 211	4 732 163	4 629 763
Grootvlei	1 249 556	2 656 230	3 546 952	674 538	1 637 371	2 132 979
Komati	-	1 016 023	2 060 141	-	664 497	1 271 010

Table 5: The generation and fuel consumption of Eskom's kerosene power plants

	Generation (MWh)			Fuel Consumption (litres kerosene)		
Plant Name	**2008-2009**	**2009-2010**	**2010-2011**	**2008-2009**	**2009-2010**	**2010-2011**
Acacia	-	-	992	-	-	444 957

Port Rex	-	-	5 507	-	-	281 941

Table 6: The generation and fuel consumption of non-Eskom power plants

	Generation (MWh)			**Fuel Consumption**		
Plant Name	**2008-2009**	**2009-2010**	**2010-2011**	**2008-2009**	**2009-2010**	**2010-2011**
Non-Eskom	11 141 628	11 365 258	11 590 847	-	-	-

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

<u>Simple OM</u>

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

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{\sum_{m} EG_{m,y}} \qquad \textbf{(1 and 2)}$$

Where:

$EF_{grid,OMsimple,y}$	= Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,m,y}$	= Amount of fossil fuel type *i* consumed by power plant/unit m in year y (mass or volume unit)
$NCV_{i,y}$	= Net calorific value (energy content) fossil fuel type *i* in year y (GJ/mass or volume)
$EF_{CO2,i,y}$	= CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ)
$EG_{m,y}$	= Net electricity generated and delivered to the grid by power plant/unit m in year y (MWh)
m	= All power plants/units serving the grid in year y except low-cost/must-run power plants/units
i	= All fossil fuel types combusted in power plant/unit m in year y
y	= Three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation.

The emission factors and calorific values for kerosene and coal were from the IPCC 2006 Guidelines. The emission factors and the calorific values were taken as the default values at the lower limit of the uncertainty at a 95% confidence interval. This was considered a more conservative approach then using the calorific values and emission factors as reported in Eskom's annual reports. In addition, specific values can only be used if data is collected from power plant operators and regional values can only be used if values are reliable and documented in regional energy statistics. This is not the case in South Africa. Hence, IPCC default values were considered more conservative. The following IPCC default values were used:

Table 7: The emission factors and calorific values of the fuels used by Eskom

Fuel Type	**NCV (GJ/ton)**	**EF_{CO2} (tCO_2/GJ)**
Coal (other bituminous coal)	19.9	0.0895
Kerosene	42	0.0697

The density of Kerosene was required in order to convert from litres of Kerosene into tons of Kerosene. The density of Kerosene was 810 kg/m^3.[38]

The simple operating margin was calculated to be the following for each year:

Table 8: Summary of the operating margin per year for the South African national electricity grid

Year	**OM simple**	**Generation (MWh)**	**Weighting (%)**
2008-2009	0.97	222 832 553	33
2009-2010	0.96	227 305 162	33
2010-2011	0.96	231 816 949	34

The operating margin was calculated to be **0.96 tCO_2/MWh**.

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

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

- Option 1: For the first crediting period, the build margin emission factor must be calculated *ex ante* based on the most recent information available on the units already built for sample group *m* at the time of the CDM-PDD submission to the DOE for validation.
-
- Option 2: For the first crediting period, the build margin emission factor shall be updated annually, *ex post*, including those units built up to the year of registration of the project activity.

Option 1 has been selected which does not require monitoring of the build margin during the crediting period.

The following information was used to determine which power plants must be included in the build margin:

Eskom Power Plants:

Table 9: Commissioning dates of Eskom power plants

Plant Name	**Commissioning date**	**Reinstallation or commissioning date**
Arnot	1971	1971
Duvha	1980	1980
Hendrina	1970	1970
Kendal	1988	1988
Kriel	1976	1976

[38] The Physics Hypertextbook. Available online from http://physics.info/density/. Accessed 11 November 2011.

Lethabo	December 1985	1985
Matimba	1987	1987
Majuba	1996	1996
Matla	1979	1979
Tutuka	June 1985	1985
Koeberg	1984	1984
Acacia	1976	1976
Port Rex	1976	1976
Colley Wobbles	January 1985	1985
First Falls	1979	1979
Gariep	1971	1971
Ncora	1983	1983
Second Falls	1979	1979
Van Der Kloof	1977	1977
Camden	1966	2005
Grootvlei	1969	1969
Komati	1961	1961

The Camden power plant was mothballed in 1988 and 1990 up until 2005. Eskom recommissioned the station in 2005. There was no capacity expansion[39]. Hence, Camden can still be included in the calculation of the build margin as there were no capacity additions that need to be excluded.

Non-Eskom Power Plants:

Table 10: Commissioning dates of non-Eskom power plants

Plant Name	**Commissioning date**	**Reinstallation or commissioning date**
Athlone	1960s	Currently not operational
Kroonstad		Currently not operational
Swartkops		Currently not operational
Bloemfontein	1967	Currently not operational
Orlando		Currently not operational
Rooiwal	1963	206 MW net maximum capacity
Pretoria West	1952	100 MW net maximum capacity
Roggebaai	1981	
Athlone	1972	Currently not operational
Port Elizabeth		Currently not operational
Johannesburg		
Pretoria West		Currently not operational
Orlando		Currently not operational
Lydenburg		
Ceres		
Piet Retief		

[39] Eskom Camden Power Plant. Available online from http://www.eskom.co.za/c/article/9/camden-power-station/. Accessed 11 November 2011.

Tongaat Hulett Amatikulu		
Tongaat Hulett Darnell		
Tongaat Hulett Felixton		
Tongaat Hulett Maidstone Mill		
Transvaal Suiker Ltd		
Mittal Vanderbijlpark		
Kelvin	1965	
Sasol Syn Fuels		
Sasol Chem Industries		Capacity addition in 2008 to increase generation from 11 MW to 42 MW
Friedenheim		
Bethlehem Hydro	2009	
Darling Wind Farm	2008	
Coega Wind Farm	2010	
Newcastle cogeneration	2011	

The power plants to be included in the build margin were identified as follows:

a) The set of five power units that started to supply electricity to the grid most recently from the Eskom power plants are:

- Majuba (1996)
- Kendal (1988)
- Matimba (1987)
- Lethabo (December 1985)
- Tutuka (June 1985)

The annual electricity generation of the above 5 plants is as follows:

Table 11: The generation of the 5 most recently built Eskom power plants

Year	**Generation (MWh)**
2010-2011	123 011 750

However, there are a number of non-Eskom power plants that have been constructed after the above dates. These include Bethlehem Hydro, Newcastle cogeneration, Darling Wind Farm and Coega Wind Farm. Bethlehem Hydro can be excluded as it registered as a CDM project. However, we could not obtain commissioning dates or electricity generation information for each plant. Hence, we assumed that the all the non-Eskom generation was constructed after the Eskom power plants and included all non-Eskom generation. The annual generation of the non-Eskom power plants is as follows:

Table 12: The generation of the non-Eskom power plants excluding Bethlehem Hydro

Year	**Generation (excl Bethlehem Hydro) (MWh)**
2010-2011	11 529 527

The electricity generation of Bethlehem Hydro was calculated by taking the installed capacity of the power plant and multiplying it by 8760 hours per year.

b) The annual generation of the national electricity grid is as follows:

Table 13: The total generation of the national electricity grid

Year	**Generation (MWh)**
2010-2011	231 816 949

The set of Eskom power plants that started to supply electricity to the grid most recently and comprise 20% of the total annual generation of the grid are as follows:

Table 14: The five most recently built power plants and their percentage contribution to the grid

Plant Name	**Generation (MWh)**	**Percentage of total generation**
Majuba (1)	24 632 585	11%
Kendal (2)	25 648 258	11%
Matimba (3)	28 163 040	12%
Lethabo (4)	25 500 366	11%
Tutuka (5)	19 067 501	8%

In all cases, the first two power plants (Majuba and Kendal) supply 20% or more of the total annual generation of the grid. Hence, the generation of Majuba and Kendal are provided below:

Table 15: The generation of Majuba and Kendal which are the most recently built Eskom power plants

Plant Name	Generation (MWh)
Majuba (1)	24 632 585
Kendal (2)	25 648 258
Total	**50 280 843**

If we say that all non-Eskom generation was constructed after the Eskom power plants then we have the following results:

Table 16: The generation of the non-Eskom and Eskom power plants and their contribution to the total gird generation

Plant Name	Generation (MWh)	Percentage of total generation
Non-Eskom	11 529 527	5%
Majuba (1)	24 632 585	11%
Kendal (2)	25 648 258	11%
Matimba (3)	28 163 040	12%
Lethabo (4)	25 500 366	11%
Tutuka (5)	19 067 501	8%

In this case, the non-Eskom generation and Majuba and Kendal supply 20% or more of the total annual generation of the grid. Hence, the generation of non-Eskom and Majuba and Kendal are provided below:

Table 17: The generation of the non-Eskom power plants and the Eskom power plants which make up more than 20% of the national grid

Plant Name	Generation (excl Bethlehem Hydro) (MWh)
Non-Eskom	11 529 527
Majuba (1)	24 632 585
Kendal (2)	25 648 258
Total	**61 810 370**

c) The largest annual generation is provided by the five most recently built Eskom power plants. However, we cannot ignore the fact that some non-Eskom power plants have been constructed more recently than the Eskom power plants based on the information we could find. As such, we calculated two build margins. The first build margin emission factor is calculated using the five most recently built Eskom power plants. The second build margin is calculated using the non-Eskom generation, Majuba and Kendal. The lowest build margin is selected for the calculation of the combined margin.

d) Since all of the Eskom power plants selected started to supply electricity to the national grid more than ten years ago, we would need to exclude the Eskom power plants and include Bethlehem Hydro which is registered as a CDM project. Since Bethlehem Hydro only constitutes 0.03% of the total annual generation of the grid, we needed to proceed to the next step.

e) We included power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprised 20% of the total annual generation of the grid. This means that the new set consists of Bethlehem Hydro, Majuba and Kendal as follows:

Table 18: The generation of Bethlehem Hydro which is registered as a CDM project and the two most recently built Eskom power plants

Plant Name	Generation (MWh)	Percentage of total generation
Bethlehem Hydro	61 320	0.03%
Majuba	24 632 585	11%
Kendal	25 648 258	11%

If we include non-Eskom generation and Bethlehem Hydro along with Eskom power plants until the new set comprises 20% of the total annual generation of the grid then we get the following:

Table 19: The generation of Bethlehem Hydro, non-Eskom power plants and the two most recently built Eskom power plants

Plant Name	Generation (MWh)	Percentage of total generation
Bethlehem Hydro	61 320	0.03%
Non-Eskom	11 529 527	5%
Majuba	24 632 585	11%
Kendal	25 648 258	11%

f) The following power plants were included in the calculation of the first build margin:

Table 20: The power plants that make up the first build margin

Plant Name	Generation (MWh)	Percentage of total generation
Bethlehem Hydro	61 320	0.03%
Majuba	24 632 585	11%
Kendal	25 648 258	11%

The following power plants were included in the calculation of the second build margin:

Table 21: The power plants that make up the second build margin

Plant Name	Generation (MWh)	Percentage of total generation
Bethlehem Hydro	61 320	0.03%
Non-Eskom	11 529 527	5%
Majuba	24 632 585	11%
Kendal	25 648 258	11%

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:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(12)}$$

$EF_{grid,BM,y}$ = 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/GJ)

m = Power units included in the build margin

y = Most recent historical year for which power generation is available

The CO_2 emission factor of each power unit m ($EL_{EL,m,y}$) should be determined as per the guidance in step 4(a) for the simple OM, using options A1, A2, A3, using for y the most recent historical year for which power generation data is available and using for m the power units included in the build margin.

If for a power unit *m* data on fuel consumption and electricity generation is available the emission factor ($FE_{EL,m,y}$) should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{\sum_m EG_{m,y}} \quad \textbf{(2)}$$

$EF_{EL,m,y}$ = 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) fossil fuel type *i* in year y (GJ/mass or volume)
$EF_{CO2,i,y}$	= CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ)
$EG_{m,y}$	= Net electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	= All power plants/units serving the grid in year y except low-cost/must-run power plants/units
i	= All fossil fuel types combusted in power plant/unit m in year y
y	= either three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2.

The first build margin was calculated to be 1 tCO_2e/MWh and the second build margin was calculated to be 0.81 tCO_2e/MWh. The emission factors for Bethlehem Hydro and for the non-Eskom generation were assumed to be 0 tCO_2e/MWh in order to be conservative. Hence, the second build margin was used in order to be conservative. The build margin is 0.81 tCO_2e/MWh.

The build margin is conservative as all non-Eskom generation has been included with an emission factor of zero. This was done in order to be conservative and as a result of the lack of information on the non-Eskom power plants. Some of the non-Eskom power plants would have been constructed prior to the Eskom power plants. Excluding these power plants which are assigned an emission factor of zero would increase the build margin. Hence, we have been conservative due to lack of information and to ensure that we do not over-estimate the grid emission factor.

Step 6: Calculate the combined margin emissions factor

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \qquad \textbf{(13)}$$

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

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

- Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.

- All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

The combined margin emission factor for the South African grid for wind and solar projects was calculated to be 0.93 tCO_2/MWh. For all other projects, the combined margin emission factor was calculated to be 0.89 tCO_2/MWh.

Annex 4

MONITORING INFORMATION

- - - - -