CLEAN DEVELOPMENT MECHANISM
PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-PoA-DD) Version 01

CONTENTS

Annexes

NOTE:

This form is for the submission of a CDM PoA whose CPAs apply a large scale approved methodology.

At the time of requesting registration this form must be accompanied by a CDM-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-CPA-DD (using a real case).

SECTION A. General description of programme of activities (PoA)

A.1 Title of the programme of activities:

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Title: Grid-Connected Wind Power Programme in South Africa
Date: 11 October 2011
Version No: 01

A.2. Description of the programme of activities:

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a) General operating and implementing framework of PoA

The Programme of Activities (henceforth referred to as PoA) is a programme for the installation of grid-connected wind power plants by Independent Power Producers (IPPs) in South Africa. The objective of the PoA is to reduce greenhouse gas emissions by displacing grid electricity which is predominantly coal-based in South Africa. According to the South African Department of Energy, almost 90 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. Each CPA will generate electricity from wind which is a renewable resource and will feed onto the national electricity grid. All power plants under this PoA will be Greenfield installations.

The objective of the PoA is to encourage the development of wind projects by Independent Power Producers in South Africa. Entry into the electricity generation market is challenging given the structure of the electricity sector in 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[2]. Eskom is responsible for the production of over 95%[3] of South Africa's electricity and is also responsible for the transmission of electricity. This situation has left very little room for the development of IPPs. Prior to August 2009, there were no electricity regulations dealing with IPPs. This was changed only recently with the introduction of New Generation Capacity Regulations which were promulgated on the 5th of August 2009[4]. The regulatory framework for IPPs in South Africa is very new and there are a number of challenges in the application of the regulations going forward. The objective of the programme is to assist

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

[2] 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].

[3] Creamer Media. March 2010. *South Africa's Electricity Industry 2010*. Page 7. Available online from http://www.esco.org.za/pdf/new/Electricity_Overview%202010.pdf. [Accessed 16 November 2010].

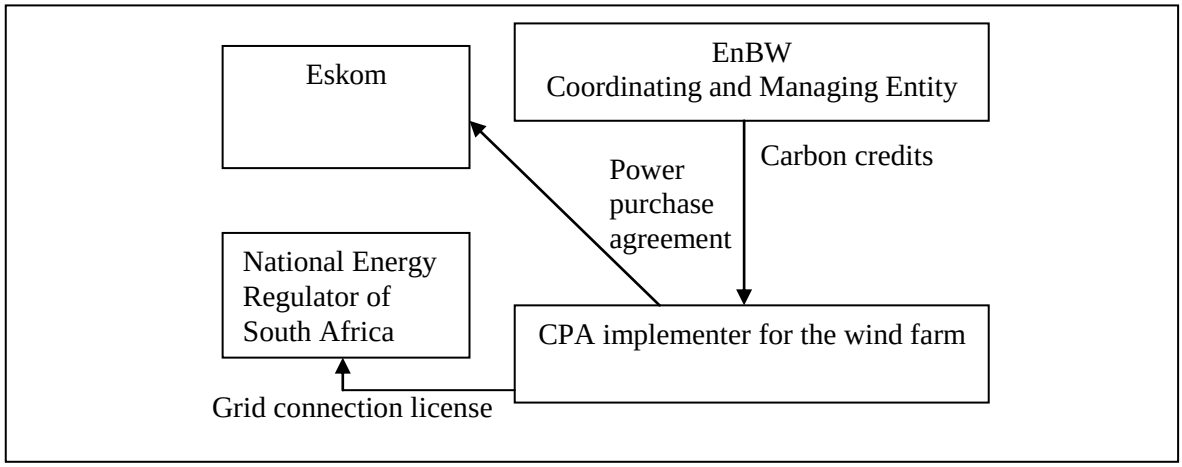
[4] Brodsky, S. Dewey & LeBoeuf. 17 August 2010. South Africa's REFIT programme – latest developments and the way forward. Page 8. Available online from http://www.sanea.org.za/CalendarOfEvents/2010/SANEALecturesJHB/Aug17/SANEA%20Lecture%20JHB%20-%2017%20August%202010%20(SA's%20REFIT%20Programme%20-%20Scott%20Brodsky).pdf. [Accessed 16 November 2010].

wind developers in overcoming these barriers through the revenue provided by the carbon credits.

The aim of the programme is to promote the installation of grid-connected wind power plants by Independent Power Producers (IPPs). EnBW Kraftwerke AG (EnBW) will promote and facilitate this activity as the Coordinating and Managing Entity (CME) for the PoA.

The CME will have an agreement with the CPA implementers of each of the CPAs. The agreement will set out the payment model required for the administration of the CPA as agreed upon by the CME and the CPA implementer. The carbon credits will be owned by the CPA implementer. The CME may of their own accord enter into an agreement with the CPA implementer to purchase the carbon credits from the project. However, this agreement will be separate to the PoA. The CME may also be a CPA implementer in CPAs under the PoA.

The proposed PoA structure is presented below:



b) Policy/measure or stated goal of the PoA

The objective of the PoA is to reduce greenhouse gas emissions through the installation of grid-connected wind power plants in South Africa. The PoA aims to assist Independent Power Producers (IPPs) to overcome the barriers associated with wind power projects in South Africa through the revenue from carbon credits under the CDM.

c) Confirmation that the proposed PoA is a voluntary action by the CME

The PoA is a voluntary action undertaken by EnBW who is the coordinating/managing entity for the PoA. There are now laws or regulations that mandate the development of wind power plants or their development under a POA in South Africa.

Participation in the PoA is voluntary. A wind farm developer may choose whether or not to participate in the programme. If the developer decides to join the PoA, he has to sign an agreement with the CME.

d) Contribution to sustainable development

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

Economic

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

- The PoA 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 PoA in South Africa will encourage both local and international investment in the power generation sector and a diversification of energy supply.
- The PoA is applicable to renewable energy power plants that will generate electricity and supply the electricity to the national electricity grid. Independent power generation represents a significant growth area for South Africa. The success of this PoA in the South African independent power generation regulatory framework will encourage other project developers to undertake clean power generation. In addition, the success of this PoA will encourage overseas investors to invest in the development of South Africa's clean energy sector. Encouraging international investment in local projects will contribute significantly towards national economic development.
- The PoA will assist in meeting the renewable energy targets for South Africa. According to the White Paper on Renewable Energy, South Africa aims to diversify its power supply to include 10,000.0 GWh of electricity from renewable energy by 2013.
- South Africa committed to a greenhouse gas emission reduction target of 34.0% by 2020 and 42.0% by 2025 at the climate change conference in Copenhagen held in December 2009. This commitment was re-iterated in the Integrated Resource Plan (IRP) for 2010. The PoA will assist in achieving this target by increasing the renewable energy component of the national electricity mix. National Treasury is investigating implementing a carbon tax. In the long term, the growth of clean energy will reduce the carbon tax that the private sector may be required to pay for using grid electricity. This, in turn, will reduce the negative impact that the carbon tax may have on the economy.

Social

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

- The PoA will result in the creation of temporary jobs in the construction phase of each CPA. For each CPA, a number of people will be employed during construction for site security, manual labour, transportation of goods and other similar services. In addition, a number of permanent jobs will be created during the operation of the wind farms under this PoA.
- The PoA will result in technology transfer from developed countries to South Africa. In addition, a team will be trained to maintain the wind turbines which will ensure the transfer of skills to South Africa.

- The success of the PoA will encourage the growth of the renewable energy sector in South Africa which may result in the creation of 'green' jobs. The success of the PoA will also encourage the diversification of South Africa's energy mix and the growth of Independent Power Producers (IPPs) in South Africa.
- The PoA encourages the use of renewable resources as opposed to fossil fuels and assists towards sustainable energy use.

Environmental

The PoA conforms to the National Environmental Management Act (NEMA) principles of sustainable development in the following ways:

- The PoA 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 footprint of the turbines is relatively small and this will allow for daily activities to continue undisturbed. The placement of wind turbines and associated infrastructure will take existing site activities into account to limit disruption.
- Each CPA 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 PoA will assist in encouraging the diversification of South Africa's energy mix and the use of renewable resources.

A.3. Coordinating/managing entity and participants of POA:

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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
South Africa (host)	Private entity EnBW Kraftwerke AG	No

The coordinating or managing entity of the PoA will be EnBW Kraftwerke AG (EnBW). The CME may or may not be involved in one of the CPAs related to the PoA.

A.4. Technical description of the programme of activities:

A.4.1. Location of the programme of activities:

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A.4.1.1. Host Party(ies):

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The Republic of South Africa (South Africa)

A.4.1.2. Physical/ Geographical boundary:

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The boundary of a PoA is defined as the geographical area within which all the CPAs included under the PoA will be implemented. All the CPAs included under this PoA will be implemented within the geographical boundary of South Africa. Therefore the boundary of the PoA is defined as the geographical boundaries of South Africa.The PoA is located within the geographical boundaries of South Africa:

Figure 1: Provincial Map of South Africa from One World nations Online[5]

[5] One World Nations Online. 2010. Map of South Africa Provinces. Available online from http://www.nationsonline.org/oneworld/map/za_provinces_map.htm. Accessed 11 August 2011.

A.4.2. Description of a typical CDM programme activity (CPA):

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A.4.2.1. Technology or measures to be employed by the CPA:

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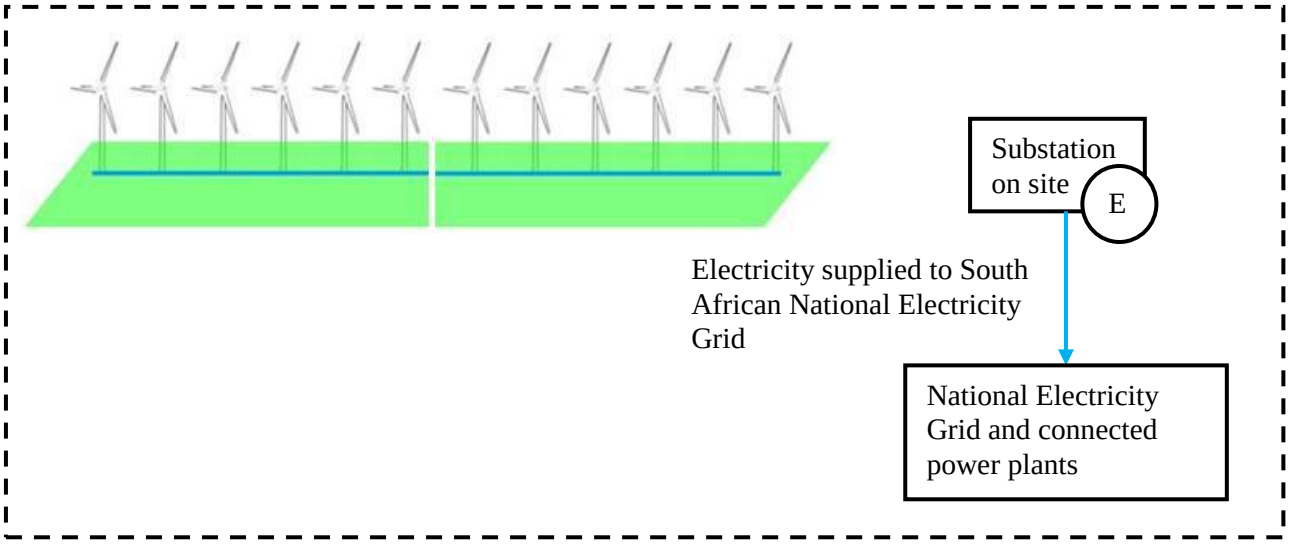
Each CPA will consist of a single, grid-connected wind farm. The wind farm will be located in South Africa and will feed onto the South African national electricity grid.

In terms of the technology used in the wind farm, each wind farm typically consists of the following:

- Wind turbines connected to each other to generate electricity
- Electrical transformer for each turbine
- The substation (new or existing)
- Electrical cables
- New construction of transmission-/distribution-lines to connect the wind farm to the national electricity grid (if necessary)



The Plant Load Factor (PLF), the installed capacity, turbine size and number of turbines may differ for each CPA. Hence, there is no set parameters for the technology.

A.4.2.2. Eligibility criteria for inclusion of a CPA in the PoA:

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The following requirements must be met by each CPA linking onto this PoA:

No.	Eligibility Criteria	Verification procedure for eligibility criteria
1	The project must be the installation of a wind power plant which uses wind turbines to generate electricity.	CPA implementers must submit the wind assessment report conducted by an external third party to the CME.
2	The project must be uniquely identified by location using GPS coordinates to provide the	This will be verified through a site visit which will be conducted by the responsible person at

	boundary of the site. Each CPA must be uniquely identified by project title.	the CME prior to allowing the CPA into the PoA. The responsible person at the CME will compile a report which confirms the project location and the project title.
3	Each CPA must have a land lease agreement in place with the owners of the land where the wind farm will be developed.	A signed copy of the land lease agreement or title deed (in the case of the landowner being the project developer) must be given to the CME.
4	The project must be implemented on a greenfields site where no power plant existed prior to the implementation of the project.	This will be verified through a site visit which will be conducted by the responsible person at the CME prior to allowing the CPA into the PoA. The responsible person will compile a report which confirms that no wind farm existing on the project activity site.
5	At the time of inclusion into the PoA, each CPA must be able to provide the Plant Load Factor (PLF) as verified by an independent third party or as submitted to national government. Each CPA must also provide the number of turbines, the installed capacity of the project and the turbine specifications.	The report by the third party or as submitted to national government must be made available to the CME for verification of the PLF. The specifications of the proposed turbine must be given to the CME. The proposed site layout, number of turbines and installed capacity of the project must be given to the CME.
6	Each CPA must have completed the required environmental processes and received the required authorisation or Record of Decision. If the project does no require a basic assessment or environmental impact assessment then this must demonstrated to the CME.	A copy of the Record of Decision must be given to the CME. If the project does not require a basic assessment or environmental impact assessment then this must be demonstrated through a letter from an environmental consultant or from the Department of Environmental Affairs or via demonstrating that the project does not trigger any of the listed activities as per the The National Environmental Management Act 107 of 1998[6] (NEMA).
7	Each CPA must be connected to the national electricity grid.	The grid connection quotation of the responsible grid operator must be made available to the CME.
8	The technical life of the project must be recorded as carbon credits can only be claimed up to the end of the useful life of the turbines.	This will be as per manufacturer's specifications for the proposed turbines.
9	The proposed sources of funding for the project must be disclosed to the CME to ensure that the funding is not official development assistance.	The proposed sources of funding must be made available in the form of a feasibility assessment to the CME.
10	The CPA implementers are required to adhere to the monitoring requirements as set out by the coordinating and managing entity as a condition of inclusion in the PoA. Each CPA	The CPA implementer will sign an agreement with the CME during inclusion onto the PoA. This agreement will commit the CPA implementer to adhering to the monitoring

[6] More information on the national EIA law and process available at http://www.eiatoolkit.ewt.org.za/process/what.html

	will be monitored under this PoA.	requirements as set out by the CME under the CPA monitoring plan.
11	The start date of the CPA must be the earliest date on which significant capital is committed to the project. The CPA implementers are required to provide evidence to demonstrate the start date of the CPA to the coordinating and managing entity.	This is generally the date on which the order is placed for the wind turbines. The date on which it is anticipated that the order will be signed for the turbines must be indicated on the project plan submitted to the CME. The start date may be different dependent on the specific conditions in the CPA. The CPA implementer is responsible for motivating to the CME and providing evidence to demonstrate the start date of the project.
12	The start date of commercial operation of the CPA must be recorded. This must be provided to the coordinating and managing entity.	This is a requirement of the CPA before it starts generating carbon credits. Before being allowed onto the PoA, each CPA must submit a draft project plan which shows the anticipated start date of commercial operation.
13	Each CPA must meet all the applicability criteria as specified under the selected methodology for this PoA.	This will be demonstrated in the CPA design document.
14	Each CPA CPA implementer must have a signed agreement with the CME for inclusion into the PoA.	Signed copy of the agreement
15	Each CPA owner confims in the inclusion agreement that he will consider the Quality Management System (QMS) of the PoA in its valid version.	Signed copy of the agreement with the CME
16	Each CPA owner confims in the inclusion agreement his adherence to the UN Global Compact (www.unglobalcompact.org).	Signed copy of the agreement with the CME

The CME will be responsible for checking whether the above requirements are met for each CPA. The documentation collected must be sent to the DOE in order to demonstrate that the CPA is eligible for inclusion onto the PoA.

The requirements for the demonstration of additionality are provided Sections E.5.1 and E.5.2. CPA implementers must be able to demonstrate that the CPA is additional prior to inclusion onto the PoA.

The criteria above are in accordance with the '*standard for the development of eligibility criteria for the inclusion of a project activity as a CPA under the PoA*' (EB 63, Annex 3).

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

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(i) The proposed PoA is a voluntary coordinated action

The development of wind power plants by IPPs is not mandated by the South African Government. Participation under this PoA is voluntary. The objective of the PoA is to reduce greenhouse gas emissions through the installation of wind power plants which displace electricity from the national grid which is predominantly coal-based.

(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;

Additionality can be demonstrated at either a PoA level or at CPA level in accordance with paragraph 73 of EB 47, '*The Board, noting that in the context of programmes of activities that additionality is to be demonstrated either at the PoA level or at CPA level, requested the secretariat to prepare a guideline on the demonstration of additionality in the context of PoAs to be considered at a future meeting.*'

At EB 63, a '*standard for the demonstration of additionality of GHG emission reductions achieved by a Programme of Activities*' was approved. This standard states that for a PoA, additionality should be demonstrated by establishing that in the absence of CDM, none of the implemented CDM Project Activities (CPAs) would occur. This should be demonstrated in accordance with the methodology for large scale projects.

Additionality for this PoA is demonstrated at CPA level. The CPA implementer for a CPA is required to demonstrate that it would not have been implemented in the absence of the CDM. This must be demonstrated by following the procedure as given in the selected methodology.

For this PoA, additionality must be demonstrated at CPA level in accordance with the 'Tool for the demonstration and assessment of additionality' (Version 06.0.0). The decision to demonstrate additionality at CPA level is based on the fact that the investment climate, economic parameters and the nature of the barriers to development may change over the crediting period of the PoA. Hence, it is more accurate and reflective of the real situation to demonstrate additionality at CPA level.

To demonstrate additionality for each CPA, the CPA implementer must decide whether to apply an investment analysis, barrier analysis or both as per the additionality tool. The application of this tool to the CPAs is addressed in Sections E.5.1 and E.5.2.

(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;

The PoA is not a mandatory policy or regulation and, as such, this is not applicable.

(iv) If mandatory a policy/regulation are enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

The PoA is not a mandatory policy or regulation and, as such, this is not applicable.

A.4.4. Operational, management and monitoring plan for the programme of activities:

A.4.4.1. Operational and management plan:

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The CME will maintain an electronic database with the following information (if applicable) for each CPA that seeks to be subscribed to the PoA:

- The title of the project
- The location of the project as given by the GPS coordinates for the project boundary
- The proposed project plan
- Copies of feasibility studies conducted on the project if available
- The current project financial model (may be used for additionality demonstration)
- Third party wind assessment report or document submitted to national government which contains the PLF
- Any documents pertaining to the environmental process which indicate that the environmental approval process is underway
- Grid connection quotation from Eskom or the responsible local grid operator
- Land lease agreement or copy of title deed for the project
- Proposed Shareholding of the project
- Technical specifications for the proposed wind turbines
- Proposed technical design of the plant (installed capacity, number of turbines and proposed turbine layout)
- Technical life of the turbines as provided by the manufacturer of the proposed turbines
- Proposed sources of funding
- CPA design document which has been completed in line with the design document template
- The agreement with the project developer to enable CPA inclusion

The CME will also conduct a site visit before allowing inclusion of the CPA onto the PoA. In addition, the CPA implementers will be required to sign an agreement with the CME in order for their project to be included onto the PoA. The CME will keep a copy of this agreement in the electronic filing system. This will assist in avoiding double counting and will ensure that the CPA implementer is aware that the CPA is being subscribed to the PoA.

Should the CPA implementer not have the required documents then it must be demonstrated why they are not applicable to the project and that the project still meets the eligibility criteria of the PoA.

If there are permanent changes to the project after it has been included onto the PoA, the CME must evaluate the impact of the change to the project and notify the DOE accordingly. In cases where there are permanent changes to the project after it has included onto the PoA, the DOE must be informed by the CME and assess whether or not the CPA still meets the eligibility criteria of the PoA. Only permanent changes that impact on the additionality of the CPA, the applicability of the selected methodology for the CPA and the eligibility of the CPA under the PoA should be assessed. If the CPA no longer meets the eligibility criteria of the PoA then it cannot generate carbon credits and must be removed with immediate effect from the PoA.

Prior to commercial operation of the wind farm, the CME will conduct an assessment of the project. This assessment will be to ensure that all eligibility criteria of the project has been met and there are no permanent changes to the the CPA that impact on additionality or the eligibility of the CPA under the PoA. The assessment will also ensure that all legal and regulatory requirements have been met by the CPA implementer prior to commercial production. This includes environmental approvals, generation license and power purchase agreement with Eskom or the responsible local grid operator. The CME will keep copies of these licenses, agreements and approvals in the electronic database. These approvals (if

required in the case of the CPA) must be recieved prior to commercial operation. Should the CPA not meet all of the legal and regulatory requirements of South Africa then it will not obtain carbon credits until all requirements are met.

The CME will appoint a responsible person to manage the PoA. This responsible person may or may not be an employee of the CME. The CME has the option to appoint a consultant to manage the PoA. The responsible person must have at least one year's history of involvement with CDM project development. The competency of this responsible person will be made available to the DOE in the form of a curriculum vitae. Should the responsible person change at any point throughout the crediting period of the PoA, a new person with the relevant experience must be appointed and the DOE must be informed of the change and be provided with the detailed curriculum vitae of the new person appointed.

The responsible person will be required to ensure that all human resources involved in the PoA are trained in the CDM and understand the structure of the PoA and their responsibility in terms of the CPAs and monitoring. The responsible person will be the main point of contact with the DOE.

In terms of the procedure for assessing if the CPA is eligible for inclusion in the PoA: the CME shall be responsible for gathering the information for the assessment and preparing a preliminary assessment. The information and the results of the assessment will be made available to the DOE. The DOE will evaluate whether the CPA is eligible for inclusion in the PoA. Should there be any changes to the CPA which impact on its eligibility, the DOE must be informed of these changes and the CPA shall be removed from the PoA if it is no longer eligible.

A.4.4.2. Monitoring plan:

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Monitoring will be conducted on an on-going basis for each CPA. The amount of electricity supplied to the grid (net electricity generated) by the CPA will be monitored using an online electricity meter. The data will be integrated hourly so hourly measurements will be available. The CPA implementer of the CPA is responsible for aggregating this information into a monthly value and submitting this to the CME.

CPA implementers are responsible for monitoring the net amount of electricity sypplied to the grid as per the monitoring plan for the CPA. All parameters included in Section E.7.1 will be monitored according to the procedures and monitoring framework delineated in Section E.7.2. The CME is responsible for ensuring that each CPA is being monitored in accordance with this monitoring plan.

The appropriate meter must be installed to measure net electricity. The meter specifications must be sent to the CME and approved prior to installation of the meter. The CME will ensure that the meter is in compliance with the requirements as set out under the monitoring table for the net electricity generation. In addition, the meter which measures net electricity consumption must be calibrated in accordance with manufacturer's specifications. The calibration certificates must be sent to the CME.

The CME is also responsible for updating the grid emission factor at the end of each crediting period for each CPA. The updating of the grid emission factor falls to the responsible person appointed by the CME.

The CME will calculate the emission reductions achieved by each CPA on a monthly basis using the data received from the CPA implementer. On an annual basis, the CME will draft a monitoring report which includes details of the calculation emission reductions, the net electricity generated and the calibration of

the elecitricty meter. The monitoring report will also take note of any exceptions in the monitoring and how the exceptions have been dealt with in order to ensure conservative estimation of emission reductions.

Verification does not involve sampling and the CME will be responsible for the verification of each CPA. The CPAs may be verified in a group. The emission reductions for that year will be verified for each operational CPA. The monitoring reports will be made available for use during verification.

A.4.5. Public funding of the programme of activities:

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The proposed PoA will not receive any public funds resulting from official development assistance from Parties included in Annex I to the Convention.

SECTION B. Duration of the programme of activities

B.1. Starting date of the programme of activities:

>>

1 January 2013

B.2. Length of the programme of activities:

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28 years

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

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1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at CPA level X

The environmental analysis is performed at CPA level. The justification for this is that the impacts of each wind farm will be dependent on location. Major impacts of wind farms are on local flora and fauna, local communities, visibility and noise which are also localised. Under The National Environmental Management Act 107 of 1998[7] (NEMA), each project may be required to conduct a Basic Assessment or an Environmental Impact Assessment. Again , this will be on CPA level.

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

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The projects will use wind energy to generate electricity. The electricity will feed onto the national electricity grid and displace electricity generated predominantly from coal. This has a number of environmental benefits. Some of the benefits are listed below:

[7] More information on the national EIA law and process available at http://www.eiatoolkit.ewt.org.za/process/what.html

- The projects result 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 footprint of the turbines is relatively small and this will allow for daily activities to continue undisturbed. The placement of wind turbines and associated infrastructure will take existing site activities into account to limit disruption.
- The projects 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 projects 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 projects will assist in encouraging the diversification of South Africa's energy mix and the use of renewable resources.

The projects do not result in any transboundary impacts.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

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Each CPA must adhere to all of South Africa's laws and regulations with regards to environmental impacts. In South Africa, projects require a basic assessment or environmental impact assessment if they trigger one of the listed activities in The National Environmental Management Act 107 of 1998[8] (NEMA). NEMA governs the requirements for an environmental impact assessment. The Listing Notices specify measures which cannot be started without environmental authorisation from the competent authority. In general, a basic assessment must be conducted if the facility or infrastructure will generate electricity where the output is more than 10 MW but less than 20 MW or the output is 10 MW or less but the total extent of the facility covers an area in excess of 1 hectare (NEMA listing notice 1). An environmental impact assessment is required if the facility or infrastructure will generate electricity where the output is 20MW or more (NEMA listing notice 2).

The project may trigger other listing notices than the two mentioned above. If the project triggers one of the listed activities then it must undergo a basic assessment or environmental impact assessment, as required. The Record of Decision should be received for the basic assessment or environmental impact assessment prior to commercial production of electricity.

SECTION D. Stakeholders' comments

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D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

[8] More information on the national EIA law and process available at http://www.eiatoolkit.ewt.org.za/process/what.html

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at CPA level X

Stakeholder consultation must be done at CPA level as the impacts of a wind farm are localised and the stakeholders (or interested and affected parties) will differ depending on the location of the wind farm. The local community needs to be consulted for each wind farm and, as a result, it is necessary to conduct stakeholder consultation at CPA level.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

>>

Stakeholder comments are invited at CPA level for all projects included onto this PoA. The stakeholder engagement process for the CPAs can be aligned with the public participation should the project require an Environmental Impact Assessment or Basic Assessment. The public participation process will suffice for the stakeholder engagement process required for CDM. In the public participation process, mention must be made of the fact that the project is attempting to secure CDM status.

If the project does not require an Environmental Impact Assessment or Basic Assessment then there must be a separate stakeholder consultation process for the CDM application. This process must involve the following:

1. Drafting an article on the project. This article must make mention of the environmental impacts of the project and the fact that the project is applying for carbon credits under the CDM. The article must invite comments from the public on the project. Contact details must be included in the article so that people can leave comments. This should include the name of the person responsible for the project, the telephone number and the email address.
2. The article must be published in one local newspaper in English and the local language.
3. The article must be placed in the town hall or municipal office nearest to the project site.
4. All comments must be recorded when received and all contact details of the person giving comments must be recorded.
5. All comments must be responded to and addressed. The person giving comments must be contacted with the response.

D.3. Summary of the comments received:

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This will be done at CPA level.

D.4. Report on how due account was taken of any comments received:

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This will be done at CPA level.

SECTION E. Application of a baseline and monitoring methodology

E.1. Title and reference of the approved baseline and monitoring methodology applied to each CPA included in the PoA:

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The approved baseline and monitoring methodology applied to the PoA is ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable resources." (Version 12.2.0)

The PoA 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 2.2.1)

The PoA 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.

E.2. Justification of the choice of the methodology and why it is applicable to each CPA:

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The PoA is for the development of wind power projects which generate electricity for sale feed onto the national electricity grid. The selected methodology is for projects which use renewable enegy to generate electricity which is fed onto the grid.

Each CPA must meet each of the applicability criteria as set out under ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable resources" (Version 12.2.0). This is demonstrated below:

Criteria	CPA
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	Each CPA involves the installation of a greenfields grid-connected wind power plant. The power plant is installed at a site where no renewable energy power plant was operated prior to the implementation of the project activity.
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.	Each CPA involves the installation of a wind power plant.
In case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use Option 2: on page 10 to calculate the parameter $EG_{PJ,y}$): the existing plant started commercial operation prior to the start of a minimum historical reference of five years, used for the	The CPAs do not involve capacity additions, retrofits or replacements. Each CPA is a new (Greenfields) power plant.

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.	
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 of the combined power plant; o Water flow between multiple	Each CPA is not a hydro power plant.

reservoirs is not used by any other hydropower unit which is not a part of the project activity; ○ 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.	• Each CPA does not involve switching from fossil fuels to renewable energy sources. The electricity generated from the new power plants will be fed into South Africa's national electricity grid. • Each CPA does not involve the combustion of biomass for the purpose of generating electricity. • Each CPA 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".	Each CPA is not a retrofit, replacement or capacity addition.

Hence, the CPAs must adhere to all the applicability criteria listed above in order to be included onto the PoA.

E.3. Description of the sources and gases included in the CPA boundary

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For each CPA, 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.

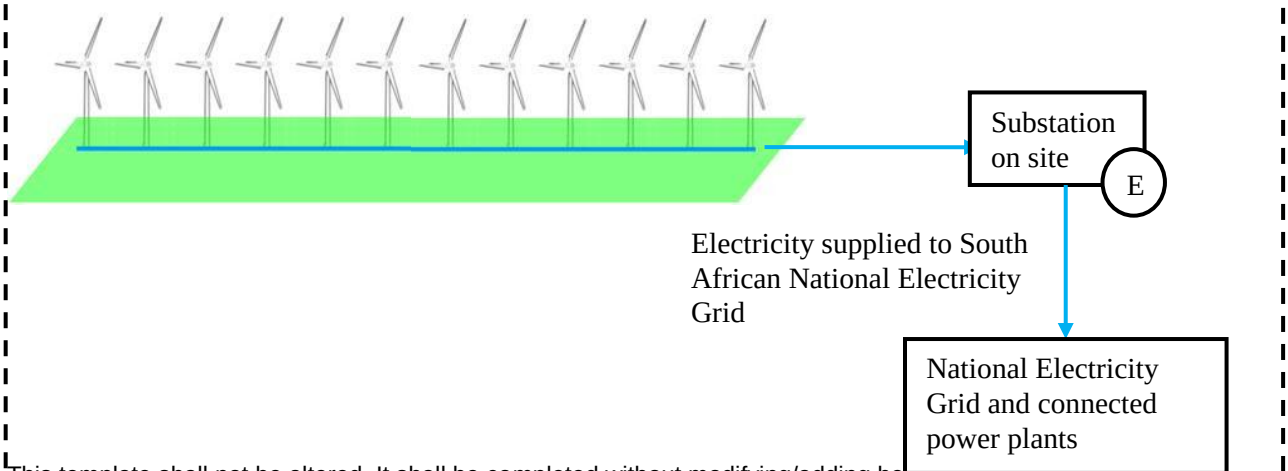
Typically, the project power plant equipment included in the boundary is:

- Wind turbines
- Electrical transformer for each turbine

- The substation
- Electrical cables
- New construction of transmission-/distribution-lines to connect the wind farm to the national electricity grid (if necessary)

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 as the baseline emissions are calculated as the net amount of electricity sent to the national electricity grid.
		CH_4	No	Excluded according to methodology.
		N_2O	No	Excluded according to methodology.



Where (E) represents an electricity metering point

The wind turbines in the diagram are representative of the number of turbines that will be installed in each CPA. Each CPA may differ in installed capacity and number of turbines.

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

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The baseline methodology procedure is ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable resources" (Version 12.2.0) 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 2.2.1).

Hence, the baseline is the national electricity grid of South Africa.The baseline emissions are calculated as the net amount of electricity supplied to the national grid multiplied by the grid emission factor. The calculation of the grid emission factor is given in Annex 3.

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the CPA being included as registered PoA (assessment and demonstration of additionality of CPA): >>

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E.5.1. Assessment and demonstration of additionality for a typical CPA:

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Additionality is demonstrated using the "Tool for the demonstration and assessment of additionality." A stepwise approach is used to demonstrate additionality:

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

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

The alternatives available to the CPA implementers must include the following:

P1: The project activity not implemented as a CDM project; and

P2: The continuation of the current situation.

Other alternatives may be included if the CPA implementer is involved in the development of power plants using alternative energy sources such as fossil fuels or other renewable energy sources. This is in accordance with the alternatives mentioned in the selected methodology. The alternatives are to be described in each CPA-DD.

The alternatives must deliver outputs or services with comparable quality, properties and application area to the CDM programme activity. Hence, the alternatives must generate the same amount of electricity for sale onto the national electricity grid.

All alternatives must be realistic and credible. For example, a coal-fired power station or hydropower may not be an alternative for an independent power producer investing in wind energy or for a sugar factory owner investing in a co-generation, but may be an alternative for a public utility. Alternatives are, therefore, related to technology and circumstances as well as to the investor.

Outcome of Step 1a: Identified realistic and credible alternative scenarios to the project activity

Sub-step 1b: Consistency with mandatory laws and regulations
The CPA implementer must demonstrate that the alternatives listed in Sub-step 1a are in compliance with all applicable mandatory legal and regulatory requirements.

If an alternative does not comply with all mandatory applicable legislation and regulations, then show that, based on an examination of current practice in the country or region in which the law or regulation applies, those applicable legal or regulatory requirements are systematically not enforced and that noncompliance with those requirements is widespread in the country. If this cannot be shown, then eliminate the alternative from further consideration.

If the proposed project activity is the only alternative amongst the ones considered by the CPA implementers that is in compliance with mandatory regulations with which there is general compliance, then the proposed CDM project activity is not additional.

Outcome of Step 1b: Identified realistic and credible alternative scenarios to the project activity that are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

The project developer shall proceed to Step 2 (Investment analysis). Step 3 is not a requirement under this PoA.

Step 2: Investment analysis
According to the relevant Tool it has to be determined whether the proposed project activity is not:

a) The most economically or financially attractive; or

b) Economically or financially feasible without the revenue from the sale of certified emission reductions (CERs).

To determine this, the following sub-steps must be applied:

Please note that the latest version of the Guidelines on the assessment of investment analysis which are available on the UNFCCC website, shall be taken into account when applying step 2.

Sub-step 2a: Determine appropriate analysis method
Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis (Sub-step 2b).

A simple cost analysis cannot be applied as the CDM project activity and the alternatives identified in Step 1 generate financial or economic benefits from the sale of electricity other than CDM related income. An investment comparison analysis can only be used if the baseline scenario leaves the CPA implementer no other choice than to make an investment to supply the same products or services. In the CPAs, the choice of the developer is to invest or not to invest. The project developer can decide not to invest. As such, an investment comparison analysis is not an appropriate analysis method. Therefore a benchmark analysis must be used by each CPA. According to the guidelines, '*The benchmark approach is therefore suited to circumstances where the baseline does not require investment or is outside the direct control of the project developer, i.e. cases where the choice of the developer is to invest or not to invest.'* In the CPAs, the choice of the developer is to invest or not to invest in this project. Hence, a benchmark analysis (Option III) is considered the acceptable approach.

Sub-step 2b: Apply benchmark analysis (Option III)
Each CPA must identify the financial/economic indicator most suitable for the project type and decision context. This should be justified in the CPA design document. Since the decision making context may change throughout the duration of the PoA, there is no pre-set financial indicator.

Discount rates and benchmarks shall be derived from:

a) Government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data;

b) Estimates of the cost of financing and required return on capital (e.g. commercial lending rates and guarantees required for the country and the type of project activity concerned), based on bankers views and private equity investors/funds' required return on comparable projects; or

c) Government/official approved benchmark where such benchmarks are used for investment decisions.

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%. CPAs may use this default benchmark. If this benchmark is not used then the CPA implementer is required to justify why this default is not applicable to the project.

Each CPA must describe the benchmark and justify the appropriateness of the selection in the CPA design document. An appropriate benchmark shall be determined in accordance with the requirements of the "Tool for the demonstration and assessment of additionality" and the "Guidelines on the assessment of investment analysis." If the default benchmark is not used in the design document then the CPA implementer must justify why the default benchmark is not appropriate for the project.

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

CPA implementers are required to calculate the suitable financial indicator for the proposed CDM project activity. All relevant costs and revenues must be accounted for as per the "Tool for the demonstration and assessment of additionality" and the "Guidelines on the assessment of investment analysis." The investment analysis must be presented in a transparent manner with all relevant assumptions in the CPA design document. The project financial model must be given to the CME.

If the CDM project activity has a less favourable indicator than the benchmark, then the CDM project activity cannot be considered as financially attractive. CPA implementers must then apply sub-step 2d.

Sub-step 2d: Sensitivity analysis
The CPA implementers are required to conduct a sensitivity analysis on the financial model to ensure that the conclusion regarding the attractiveness of the project is within reasonable variations in the critical assumptions. For each CPA, the following parameters shall be varied by +-10%:

- Electricity generation
- Capital investments
- Operating and maintenance cost

The results of the sensitivity analysis must be presented in the design document in a transparent manner.

Outcome of Step 2: If the project financial indicator is still less favourable than the benchmark then the project cannot be considered as financially attractive. CPA implementers can then proceed to Step 4.

Step 4: Common practice analysis
CPA implementers must conduct an analysis of the extent to which wind power plants have already diffused in the relevant sector or region by applying the following sub-steps:

Sub-step 4a: Analyze other activities similar to the proposed project activity
CPA implementers must provide an analysis of any other activities that are operational and that are similar to the proposed project activity. Projects are considered similar if they are wind power plants in South Africa of similar scale (+/-50% output) and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc. Other CDM project activities are not to be included in this analysis. On the basis of that analysis, CPA implementers must describe whether and to which extent similar activities have already diffused in the relevant region.

Sub-step 4b: Discuss any similar Options that are occurring
If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity is financially unattractive. Therefore, if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is financially/economically unattractive or subject to barriers. This can be done by comparing the proposed project activity to the other similar activities, and pointing out and explaining essential distinctions between them that explain why the similar activities enjoyed certain benefits that rendered it financially/economically attractive (e.g., subsidies or other financial flows) and which the proposed project activity cannot use or did not face the barriers to which the proposed project activity is subject. If necessary data/information of some similar projects are not accessible for PPs to conduct this analysis, such projects can be excluded from this analysis. In case similar projects are not accessible, the PDD should include justification about non-accessibility of data/information.

Outcome of Step 4: If similar activities cannot be observed or similar activities are observed but essential distinctions between the project activity and similar activities can reasonably be explained then the proposed project is additional.

E.5.2. Key criteria and data for assessing additionality of a CPA:

>>

The CPA implementers are required to complete the additionality assessment and present it in the CPA design document along with the financial model used for the investment analysis. All statements and values must be supported by credible documentation. The CME will conduct a review of the additionality assessment to understand whether the project is additional or not.

The key assessment criteria for Step 2 are as follows:

- The appropriateness of the financial indicator
- The appropriateness of the selected benchmark
- The values used in the financial model and the documentation supporting the selection of these values
- The calculation of the financial indicator
- The results of the sensitivity analysis

The key assessment criteria for Step 4 are as follows:

- The number of similar activities listed in the design document
- The differences between the similar activies and the project activity
- The documentation supporting the common practice assessment
- The extent to which wind power plants of similar output have been diffused in South Africa

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical CPA:

>>

The calculation of the emission reductions is done in accordance with ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable resources" (version 12.2.0). 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.

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:

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

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,

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

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:

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

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)

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a CPA:

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$EG_{facility,y}$ is calculated using the Plant Load Factor (PLF) multiplied by 8,760 hours per year multiplied by the installed capacity. The PLF must be obtained from an independent third party assessment or from a document submitted to national government. In addition, the grid emission factor presented in Annex 3 must be applied to each CPA. The CME is responsible for keeping the grid emission factor up-to-date and applying it to the calculation of the emission reductions.

The template for 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 farms as the baseline emissions are calculated on the net amount of electricity supplied to the national electricity grid.

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	353 571	380 184	0.93
2	353 571	380 184	0.93
3	353 571	380 184	0.93
4	353 571	380 184	0.93
5	353 571	380 184	0.93
6	353 571	380 184	0.93
7	353 571	380 184	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	380 184	380 184
2	380 184	380 184
3	380 184	380 184
4	380 184	380 184
5	380 184	380 184
6	380 184	380 184
7	380 184	380 184

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	353 571	353 571	0.0
2	353 571	353 571	0.0
3	353 571	353 571	0.0
4	353 571	353 571	0.0
5	353 571	353 571	0.0
6	353 571	353 571	0.0
7	353 571	353 571	0.0

E.6.3. Data and parameters that are to be reported in CDM-CPA-DD form:

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 2.2.1 of the "Tool to calculate the emission factor for an electricity system" as set out in Annex 3 The grid emission factor will be kept up-to-date by the coordinating and managing entity of the PoA. The CME will provide each CPA with the grid emission factor that must be applied to calculate the emission reductions.
Value applied:	0.93
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Ex-ante option selected so grid emission factor will only be updated at the end of each crediting period which is 7 years for each CPA. The CME is responsible for updating the grid emission factor at the end of each crediting period of each CPA.

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

E.7.1. Data and parameters to be monitored by each CPA:

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	
Description of measurement methods and procedures to be applied:	The electricity generated and used by the wind farm is measured using an 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 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 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 or the responsible local grid operator 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:	

E.7.2. Description of the monitoring plan for a CPA:

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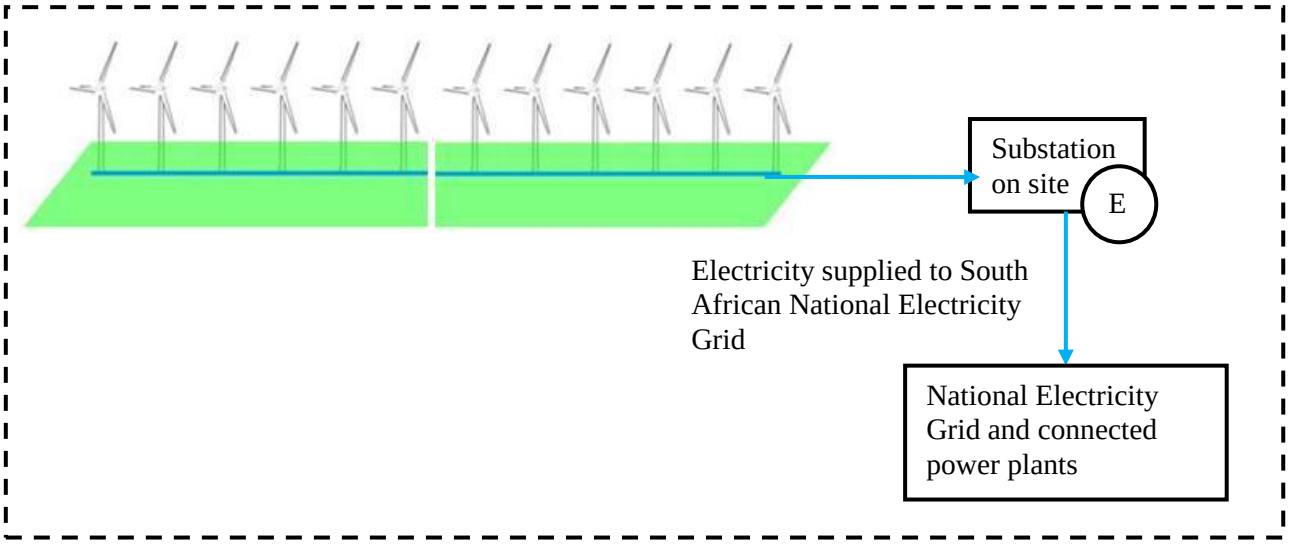
The monitoring plan for each CPA

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 meter will be stored both on and off site for the entire crediting period. 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.

E.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: 11/11/2011

Responsible person/s:

Peter Oldacre
Deloitte
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 CPA implementers.

Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

Organization:	EnBW Kraftwerke AG
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The proposed PoA will not receive any public funds resulting from official development assistance from Parties included in Annex I to the Convention.

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[9]. 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.

Eskom is responsible for the production of over 95%[10] of South Africa's electricity and is also responsible for the transmission of electricity. Eskom owns and operates the following electricity generation plants:

[9] 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].

[10] Creamer Media. March 2010. *South Africa's Electricity Industry 2010*. Page 7. Available online from http://www.esco.org.za/pdf/new/Electricity_Overview%202010.pdf. [Accessed 16 November 2010].

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 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[11]

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

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
Orlando	176		Currently not operational	Kerosene
Lydenburg				Hydro
Ceres				Hydro
Piet Retief				Hydro
Steenbras				Pumped storage
Tongaat Hulett Amatikulu				Bagasse coal
Tongaat Hulett				Bagasse coal

- Project Design Document: New Energies Commercial Solar Water Heating Programme in South Africa – information obtained from The National Energy Regulator of South Africa
- 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.
- The South African Department of Minerals and Energy. Energy Security Master Plan – Electricity. 2007-2025.
- ECON commissioned by the World Bank. 2007. Costing Power Infrastructure Investment Needs in Africa.
- Bethlehem Hydro website
- Darling Wind Farm Website

Darnell				
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[12]. This means that over 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 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

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

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

Simple OM

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.

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

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 than 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.[13]

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

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, CPA implementers 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
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[14]. 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		
Tongaat Hulett Amatikulu		
Tongaat Hulett Darnell		
Tongaat Hulett Felixton		
Tongaat Hulett Maidstone Mill		
Transvaal Suiker Ltd		
Mittal		

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

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

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

$EF_{grid,BM,y}$	= 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

Not Applicable