PROGRAMME DESIGN DOCUMENT FORM FOR CDM PROGRAMMES OF ACTIVITIES (F-CDM-PoA-DD)
Version 02.0

PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

PART II. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

Title: Renewable Energy Carbon Programme for Africa (RECPA)
Version: Version 04
Date: 16/12/2012

A.2. Purpose and general description that the PoA seeks to promote

Policy/measure or stated goal of the PoA

The purpose of the Renewable Energy Carbon Programme for Africa (hereafter referred as the PoA) is to support the development and implementation of large-scale wind and solar photovoltaic (PV) renewable energy projects in South Africa. This measure will displace grid-connected fossil fuel-based electricity generation through the promotion of grid-connected renewable energy based electricity generation, thereby reducing greenhouse gas (GHG) emissions.

Historically, South Africa has relied and continues to rely heavily on electricity generation from coal-based power plants. Partly due to the low cost of coal, South Africa has been able to offer one of the lowest electricity prices in the world and this has made it difficult for renewable energy projects to enter the market.

Since 2009, the government of South Africa has introduced a number of policies and regulations that are trying to promote the development and implementation of renewable energy projects. In 2009, a Renewable Energy Feed-in Tariff (REFIT) programme was formulated by the National Energy Regulator of South Africa (NERSA), which introduced a number of Feed-in-Tariffs for renewable energy projects including initially wind and later also solar PV. The REFIT was never fully implemented and in November 2010, the Minister of Energy introduced the *Electricity Regulations on New Generation Capacity* which also established the IPP bid programme. The rules and procedures for the IPP Procurement Programme were subsequently published by the Department of Energy under the *Request for qualification and proposals for new generation capacity under the IPP Procurement Programme* in August 2011 and effectively replaced the REFIT programme. Under the IPP Procurement Programme, projects are required to submit a bid price which will be payable by the off-taker of the electricity to the project. The bid price or tariff should not exceed the cap as provided in the IPP Procurement Programme documentation.

Since the introduction of a Renewable Energy Feed-in Tariff programme in 2009, and the subsequent establishment of the IPP Procurement Programme, the interest in renewable energy projects has rapidly increased. However, considerable barriers remain, most importantly in relation to the uncertainties in the regulatory and permitting processes and relative inexperience with renewable energy technologies. Examples of uncertainties include:

- Substantial decrease in the REFIT for wind power from 1.25 ZAR/kWh in 2009 to a proposed 0.938 ZAR/kWh in 2011.

- The subsequent abandonment of the REFIT programme and establishment of the IPP Procurement Programme and bidding system. This marks a significant change in policy approach and has created further uncertainty for the development process of renewable energy projects.
- Changes in the connection requirements by Eskom, which requires higher investment on the side of the project.
- Uncertainties in the rezoning rules and new requirements in terms of mineral permits before construction can start.

Changes and uncertainties in national and sectoral policies like the ones mentioned above increase the development cost for renewable energy projects and also increase the risk perception by investors and financiers. The purposes of the proposed Programme of Activities is therefore to facilitate the access to carbon credits and as such create a source of revenue to achieve the financial viability for the projects. It is expected that the Programme of Activities will support and facilitate the development and implementation of renewable energy projects in South Africa.

The technologies included in the Programme of Activities are wind and solar PV. The programme focuses on greenfield renewable energy projects. Therefore, CO2 is the main and only type of GHG included in the PoA due to the substitution of fossil fuel based generated electricity in the baseline scenario. Since the PoA will involve the implementation of wind and solar PV power plants, the project activities will correspond to sectoral scope 1: Energy industries (renewable- / non-renewable sources) and applies the approved large-scale methodology ACM0002 (version 13.0.0).

The baseline scenario will be: *"*Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the *Tool to calculate the emission factor for an electricity system*".

As per 31 March 2011, the total installed capacity of grid-connected power plants in South Africa was 47,465 MW. Ninety-three per cent (93%) of the installed capacity is owned by Eskom, the national utility company. The remaining 7% is owned by municipalities and Independent Power Producers (IPPs), i.e. 4% and 3% respectively. As of 31 March 2011, there were only three grid-connected wind power plants with a total installed capacity of 10.16 MW.[1] This constitutes less than 0.02% of the total installed capacity and is negligible compared to the 85%, 6%, and 4% that coal, gas, and nuclear power plants contribute respectively.[2]

The Integrated Resource Plan 2010-2030, published by the Department of Energy (DOE) and the National Energy Regulator of South Africa (NERSA), predicts that by 2030 the power generation capacity of South Africa will double to 89,532MW to meet the rising energy demand. It is expected that wind and solar PV technologies will constitute 10.3% and 9.4% of the future capacity respectively, i.e. approximately 9,200 MW and 8,400 MW.

Further information regarding the existing and planned power plants is given in section B.4 of the generic CPA part below.

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

[1] All three wind power projects are considered demonstration projects. The first one, Klipheuwel Wind farm of 3.16 MW is owned by Eskom. The second project, the Darling National Demonstration Wind Farm of 5.2 MW, is owned by an Independent Power Producer (IPP). The third project is the Coega wind farm which only has one 1.8 MW wind turbine.

[2] 2012 01 19 Graphs Baseline

The establishment of the Programme of Activities will help renewable energy projects in South Africa in overcoming some of the key barriers faced by projects by enhancing the financial viability of the projects and facilitating access to capital. In addition, the PoA is expected to contribute to sustainable development in South Africa in various ways, including:

- The project is expected to support the national policy goal of achieving 10% penetration for wind and PV technologies as a share of total installed capacity in 2020, and 20% in 2030[3].
- The project is expected to provide local employment opportunities during the construction and operation phase.
- The project is expected to contribute to South Africa's fiscal revenues through payment of taxes, and attract foreign direct investment.
- The project will have a positive impact on the transfer of wind and solar PV technologies to South Africa, as well as know-how skills of local workers. The transfer of technology and know-how will be directly replicable to other future renewable energy projects.
- The project will reduce South Africa's CO2 footprint.

Framework for the implementation of the proposed PoA

Carbon Africa Limited (Carbon Africa) will act as the Coordinating/Managing Entity (CME) for the PoA. The CME will be responsible for:

1. Development of the PoA Design Document (CDM-PoA-DD) and the Component Project Activity (CPA) Design Documents (CDM-CPA-DD) for CPAs that are developed under the Programme of Activities;
2. Obtaining a Letter of Approval for the implementation of the PoA from the host country
3. Obtaining a Letter of Authorization of the coordination of the PoA from the host country;
4. Liaise with the Designated National Authority (DNA) on matters related to the implementation of the PoA and inclusion of CPAs
5. Carry out a quality check on CPAs to be included in the Programme of Activities to ensure that the CPA meets all the eligibility criteria as formulated in the PoA-DD;
6. Collect and compile monitoring records from all the CPA entities;
7. Coordinate monitoring activities and data management during the lifetime of the PoA;
8. Contract a DOE for validation and verification purposes
9. Prepare and submit monitoring reports and facilitate the verification of the same;
10. Act as the focal point with the CDM Executive Board for matters related to the PoA;
11. During the lifetime of the PoA, maintenance of all monitoring reports of all CPAs in accordance with record keeping systems outlined in the CDM-PoA-DD,

CPA entities will be responsible for the implementation of individual CPAs under the PoA and will be responsible for:

a) Implementation of the described CPA
b) Operate and maintain the CPA for the duration of the project;
c) Keep records of parameters as per the monitoring plan, provide hard and/or electronic records to the CME on a regular basis and provide the CME and DOE with required documents and access to sites as needed.
d) Make available staff for validation and verification where applicable.

The CME will enter into agreements with all CPA entities. The contractual agreements will summarize roles and responsibilities regarding the implementation of the individual project activities as a Component

[3] Integrated Resource Plan for Electricity 2010-2030, Department of Energy, Electricity Regulation Act No.4 of 2006, 6 May 2006

Project Activity (CPA). The agreements will ensure that the CME will have control of all records and information related to the implementation of individual CPAs and will be in a position to ensure that each CPA is being implemented according to the provisions as outlined in the PoA-DD. The agreement will also put in place measures that avoid double counting of the proposed CPA.

Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity

There are no policies, laws or mandatory requirements in South Africa, the host country, stipulating the implementation of renewable energy power plants. The proposed PoA is a voluntary action by the CME.

A.3. CMEs and participants of PoA

Carbon Africa Limited will act as the coordinating/managing entity.

Climate Corporation Emissions Trading GmbH will be a project participant.

A.4. Party(ies)

Name of Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
South Africa (host)	Carbon Africa Limited	No
South Africa (host)	Climate Corporation Emissions Trading GmbH	No

A.5. Physical/ Geographical boundary of the PoA

The geographical area within which Component Project Activity (CPAs) included in the PoA will be implemented is defined by the national boundaries of the Host Country, South Africa.

Figure 1: Map of South Africa

Approximate geographic coordinates of South African Northernmost, Westernmost, Southernmost and Easternmost mainland points are given in Table 1 below.

Table 1. Coordinates South Africa

Latitude	Longitude
-22.124689°	29.658050°
-28.634997°	16.457919°
-34.834261°	19.994058°
-26.858256°	32.891208°

In line with version 01.0 of the *CDM Project Standard* (EB 65, Annex 5) and the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 01.0, EB 65, Annex 3) the programme boundary might be amended post-registration to include additional host parties.

A.6. Technologies/measures

CPAs under the PoA will use renewable energy technologies to generate electricity. The following CPA types will be included in the PoA:

- Greenfield wind power plants/units in South Africa applying first-of-its-kind barrier
- Greenfield wind power plants/units in South Africa applying investment analysis
- Greenfield solar PV plants/units in South Africa applying first-of-its-kind barrier
- Greenfield solar PV plants/units in South Africa applying investment analysis

Each CPA will be given a unique name based on the location where the project will be implemented, the installed capacity of the CPA. The following standardized approach will be used:

- For wind power projects: [name of location] [installed capacity] Wind Power Project
- For solar PV project: [name of location] [installed capacity] Solar PV Project

Upon inclusion in the PoA, each CPA will receive a unique reference number. The geographical coordinates of the CPA will be provided in section A.7 of the CPA-DD.

The following table shows the typical information that a CPA will need to provide to clarify which technology type the CPA belongs to:

Table 2. Technology specifications for Wind and Solar CPAs

Greenfield wind power project	**Greenfield solar PV power project**
Installed capacity (MW)	Installed capacity (MW)
Wind turbine model certified to IEC 61400 standard	Solar module certified to IEC/EN 61215 and IEC/EN 61730 standards. In case of concentrated solar photovoltaic, IEC 62108.
Number of turbines	Number of modules
P50 forecast of average annual energy yield on an annual basis for the first 20 years of operation or the duration of the PPA.	Average annual energy yield on an annual basis for the first 20 years of operation or the duration of the PPA.
Plant load factor (%) and plant losses (%)	Plant load factor (%) and plant losses (%)
Equipment lifetime	Equipment lifetime
-	Inverter model and type
-	Number of inverters

In line with the guidelines set up by the Department of Energy of South Africa for Independent Power Producers, the maximum installed capacity for a single grid connection point for the wind power projects and for solar PV will be 140 MW and 75 MW respectively. Wind power projects will have a capacity factor ranging from 16.2 to 49.6% for the P50 scenario. For solar PV project this range will be from 0 to 35%

Further information regarding both CPA types is provided below.

Wind Power:

Wind energy originates from the sun. Solar radiation falls onto the earth and the temperature difference between the equator and the poles drives thermal currents - or winds - which circulate around the globe. The atmosphere is a big thermal machine continuously "producing" wind air mass flows between areas of low and high pressure. Up to now winds in up to about 200 m above ground level can be "harvested" by the wind turbines. Wind turbines can generate electricity at wind speeds of 3 m/s to 35 m/s. Some specially designed wind turbines can work even at lower or higher wind speeds. Quite a wide range of different designs exist for special purposes. Wind turbines are designed with a vertical or horizontal axis, one blade up to about 20 rotor blades, small capacity of some watt up to some megawatt, with or without gear box and with direct current or alternating current generator. A general design does not exist, although the three bladed horizontal upwind turbines are the most successful ones. This PoA will deploy the most common commercially deployed model, the horizontal axis one, although it may use a different number of blades depending on energy resources and economic issues. Generally, electricity is generated as the turning rotor spins a generator by means of the wind that passes through the blades. The higher amount of wind and a higher speed that moves the blades of the wind turbines, the more electricity the wind turbine will generate, therefore the more CO2 emission reductions will be achieved. Figure 2 represents the average wind speed in South Africa in m/s.

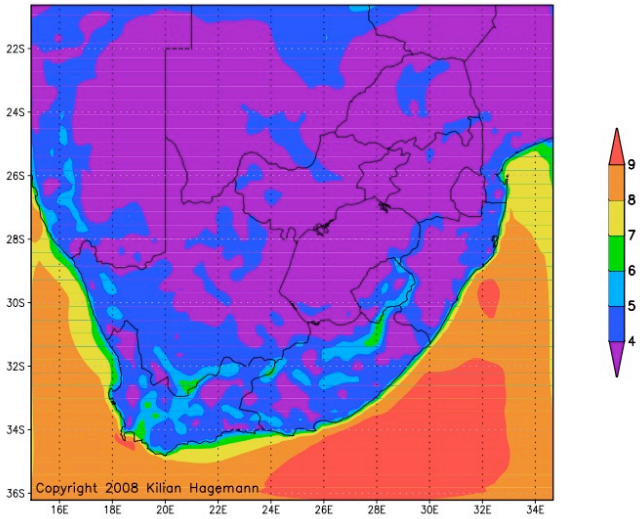


Figure 2. Average annual wind speeds at 10m above ground in m/s.[4]

Solar PV

Solar photovoltaic cells, also known as solar cells, are used to convert solar energy into electrical energy. The solar cells are the basic elements of a solar module. When semiconductor materials are exposed to sunlight, electrons excite from the valence band to the conduction band creating charged particles called holes. By doping the silicon, i.e. adding tiny amounts of other materials like boron or phosphor to the crystalline structure, p- or n- type semiconductors are formed respectively. By bringing them together, a p-n junction serves for creating an electric field within the semiconductor, which is able to separate electrons and holes and which creates a direct current (DC) coming out from the solar cells through the contacts. Solar modules are composed of solar cells in series and parallel in order to obtain a desired final power, current, and voltage. The output current of a solar cell directly relates to the incoming irradiation: The higher the irradiation, the more electron-hole pairs are produced and therefore the current increases and more electricity is produced. There are several slightly different technologies using solar PV cells, solar crystalline modules with 36 to 72 cells being the most widely used (see Figure 3). Variations such as concentrated solar photovoltaic (CPV), although less widely used, are also accepted in this PoA as in essence, the technology principles are the same. Concentrated solar photovoltaic (see Figure 4) technologies concentrate the solar rays with Fresnel Lenses above the photovoltaic cells, resulting in much smaller photovoltaic cells for similar relative efficiencies. The CPV technology is ideal for locations with high amount of direct solar radiation, and common PV technology for places with more diffuse radiation.

[4] Mesoscale wind atlas of South Africa. Kilian Hagemann. University of Cape Town. November 2008

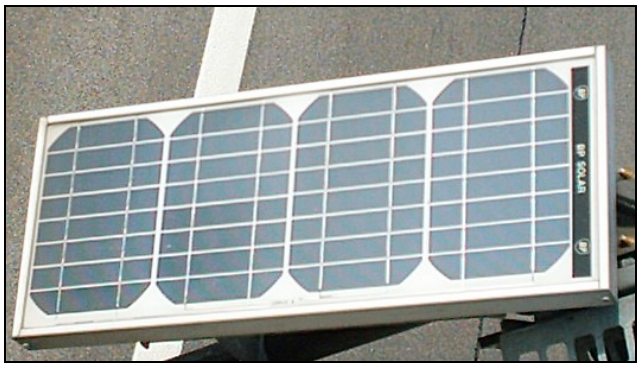


Figure 3. Photovoltaic module

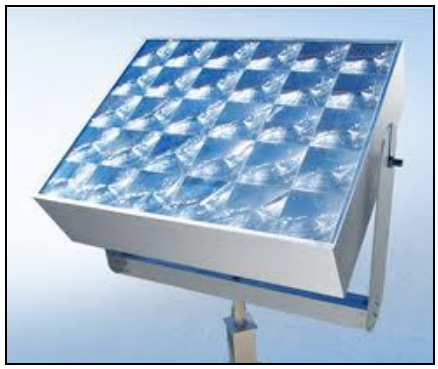


Figure 4. Concentrated solar photovoltaic

In addition to the photovoltaic modules, some solar PV plants may or may not decide to install their PV modules in 1-axis or 2-axis sun-trackers. Those trackers allow the PV modules to track the direction of the sun through the day, maximizing the sun energy collected and electricity generated by facing the modules as perpendicular to the sunrays as possible, therefore increasing the amount of CO2 emission reductions.

As with the wind energy, the solar irradiation also varies from site to site. Figure 5.

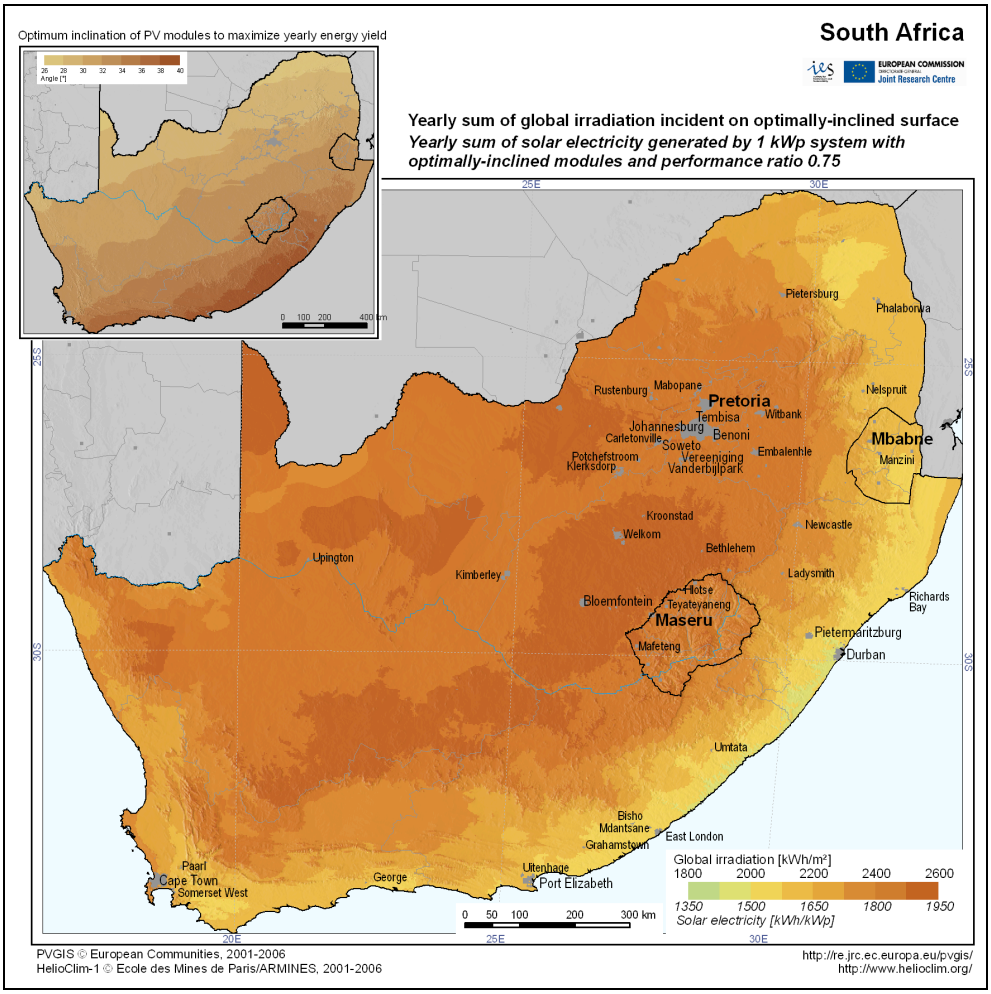


Figure 5. Yearly sum of global irradiation incident on optimally-inclined surface

Common features for both wind and solar PV power plants

In addition to the wind turbines or the solar photovoltaic modules, the project activities will require additional equipment for the collection of the electricity generated and connection to the South African electricity grid. An electrical network connecting all the solar modules or wind turbines will be installed to collect the electricity, and where applicable, inverters transformers and distribution centers in order to change the voltage of the electricity, and minimize the electrical losses. Electricity will be transformed to the required connection voltage at the terminal substation before the Delivery Point with the national electricity grid. The installation of a metering system is also required for CDM purposes and for electricity sales. This facility metering system is normally installed at the terminal substation just before the Delivery Point with the South African electricity grid. Another meter, the system metering system, is installed by Eskom for back up meter readings The following diagram shows a typical equipment layout of a CPA:

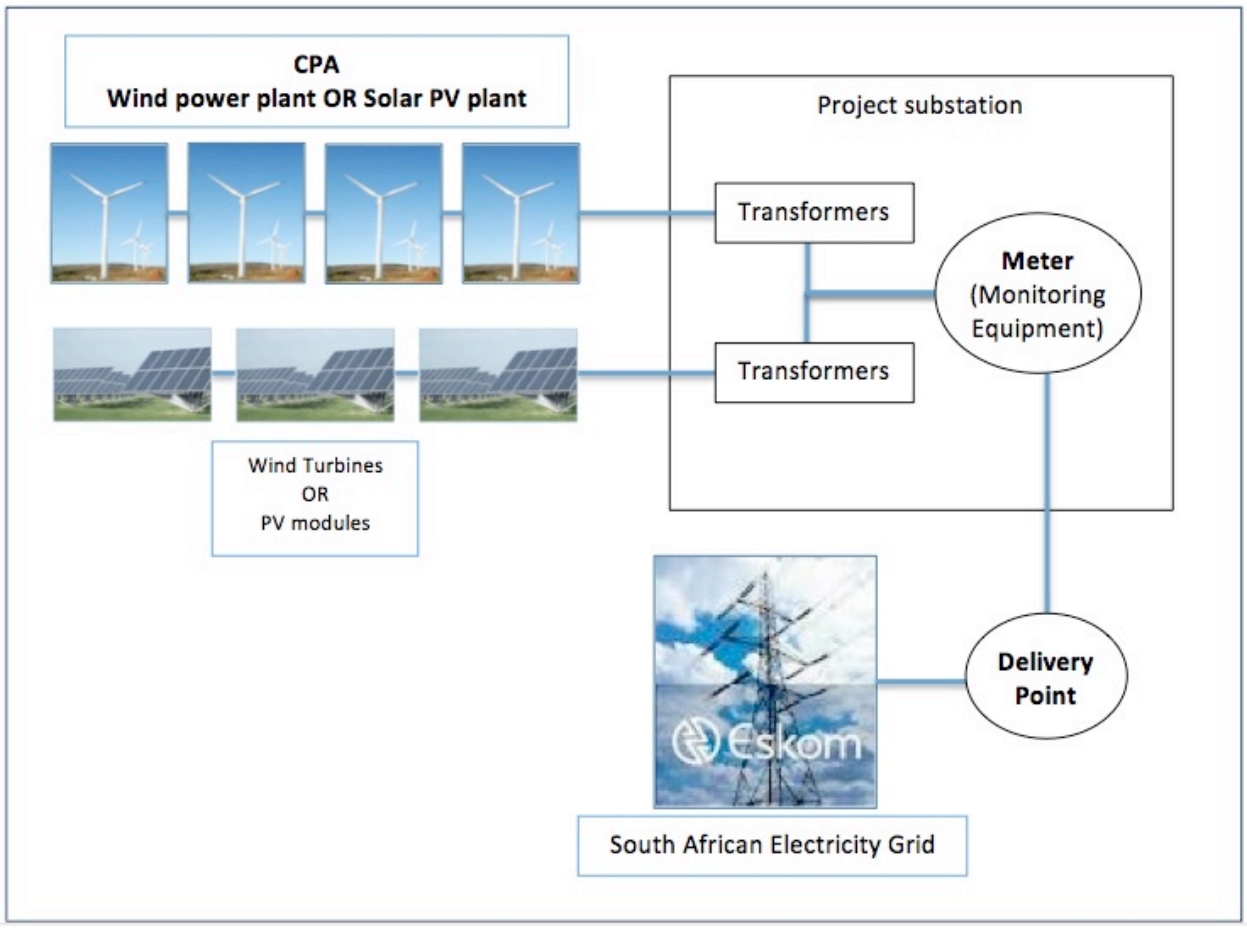


Figure 6. Equipment diagram for a generic CPA, for both technology types wind and solar PV

In line with the above description and information, the following technical information will be provided by specific CPAs that will be included in the PoA:

- The installed capacity
- Number and model of turbines (wind) or solar modules (solar PV) and inverters
- Technical specifications of the equipment that will be installed and relevant industry standards
- Lifetime of the installed equipment
- Plant load factor, including the relevant losses internal consumption, and net electricity supply to the grid
- Details about the electricity collection and transmission infrastructure (e.g. number of transformers)

- Details about the metering system

CPAs will involve transfer of environmentally safe and sound technology through the introduction of state- of-the-art wind turbine technology and solar photovoltaic technology. Transfer of know-how will take place through the training of local engineers and other technical staff by the Operations and Maintenance contractor with the support of the equipment manufacturer. The equipment manufacturer, as well as assuring performance standards for the projects, will also provide oversight of the maintenance and operation of the equipment during the lifetime of a typical CPA.

A.7. Public funding of PoA

There is no public funding involved in this Programme of Activities.

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

Historically, South Africa has relied heavily on coal-based electricity generation. By 2011 installed capacity of coal power plants amounted to 85%, followed by gas power plants (6%), nuclear (4%) and pumped storage hydro power plants (3%). Currently, there are only three wind power plants connected to the grid. The 3.16 MW Klipheuwel Wind Farm which is owned by Eskom, the 5.2 MW Darling Wind Farm which is an IPP owned by private investors and the Coega wind farm which only includes one 1.8 MW turbine. Both wind farms have been developed as demonstration projects and are very small compared to the 47,465 MW of installed capacity. Currently, there are also no operational solar PV power projects that supply electricity to the grid. Other energy sources like hydro, biogas, etc. are negligible.

In order to promote the use of renewable energy, the government of South Africa introduced a Feed-in-Tariff policy in 2009. The same year some of the feed-in-tariffs were already changed and in 2011, a proposal was tabled which proposed a material decrease in the level of some of renewable energy feed-in-tariffs. The latter proposal never got approved because the government of South Africa abandoned the Feed-in-Tariff policy and adopted the Renewable Energy Independent Power Producer (IPP) Procurement Programme. Under the Programme, bidders are required to specify a tariff for the electricity produced. The tariff should not exceed the applicable tariff cap set out in the procurement documentation.

The first renewable energy projects are currently going through the procurement programme and it is too early to evaluate the success of the programme. However, it is clear that renewable projects in South Africa still face many barriers, including regulatory, institutional and financial. In this context, it will be demonstrated for each CPA under the PoA that the CPA is not financially viable without the sale of the certified emission reductions.

B.2. Eligibility criteria for inclusion of a CPA in the PoA

The PoA will focus on four CPA types:

1. Greenfield wind power plants/units in South Africa applying first-of-its-kind barrier
2. Greenfield wind power plants/units in South Africa applying investment analysis
3. Greenfield solar PV plants/units in South Africa applying first-of-its-kind barrier
4. Greenfield solar PV plants/units in South Africa applying investment analysis

The following eligibility criteria have been formulated for each type of CPA based on the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple technologies for Programme of Activities* (version 01.0, EB 65, Annex 3) and on the provisions in ACM0002 (version 13.0.0).

The technical and economic parameters as provided in ACM0002 (version 13.0.0) have been included in the formulation of the eligibility criteria as follows:

a) Technical and economic parameters that are technology specific (e.g. ranges of load factors, sizes of installation, wind speed) have been included as eligibility criteria that specify the technology/measure including the level and type of service, performance specifications including compliance with testing/certifications (para 14c of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple technologies for Programme of Activities*).
b) Parameters reflecting the investment climate have been included as conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality (para 14f of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple technologies for Programme of Activities*).
c) Ranges of costs (capital investment, operating and maintenance costs, etc.) and revenues (income from electricity sale, subsidies/fiscal incentives, ODA) have been included as conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality (para 14f of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple technologies for Programme of Activities*).

For the inclusion of a CPA, CPA implementing entities will be required to provide supporting evidences and information to confirm that all eligibility criteria are met. The following types of documentation will be accepted as being objective and credible:

- Documentation that has been prepared by an experienced third party
- Documentation that has been approved or issued by South African governmental authorities
- Documentation that carries an official signature from the CPA implementing entity, CME or project participant[5]
- Documentation that has been submitted to or received from financing institutions like banks and equity providers
- Documentation submitted for official purposes such as documents submitted to South African authorities as part of the *Request for qualifications and proposals for new generation capacity under the IPP procurement programme*

The eligibility criteria for the demonstration of additionality for each CPA type were derived from the *Tool for the demonstration and assessment of additionality* (version 07.0.0)

[5] As documentation with an official signature from the CPA implementing entity, CME or project participant may not be sufficiently objective on its own for some cases, so those will only be valid for the following criteria:

- Double counting. Criteria 2.1 to 2.4. The nature of these criteria can only be evidenced by signed confirmations from the CME and the CPA implementing entity. However, the veracity of those are easily demonstrable by the DOE.
- Investment decision date. Criterion 5.3. The investment decision is taken by the project developer and therefore its proof is normally based on Board Resolution or Board Minutes. However, this decision can be backed up by independent third party studies such as energy resource assessments.
- Stakeholder consultation. Criterion 6.2. When the stakeholder consultation is hold strictly for CDM purposes, the consultation and its reports are normally taken by the CME and therefore it must be accepted. Signed participation lists and pictures should support those reports.
- ODA diversion. Criteria 7.1. When there is no use public funding by the project developer, its non-existence can only be evidence by a signed confirmation by the project developer.
- The agreement between the CME and the CPA for participation in the PoA is a legally binding document and therefore it can be used for confirmation purposes.

It is the understanding of the CME that those specific evidences for the eligibility criteria do not go against any of the CDM rules on third party evidence.

CPA TYPE I: GREENFIELD WIND POWER PLANTS/UNITS IN SOUTH AFRICA APPLYING FIRST-OF-ITS-KIND BARRIER

14 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

CPAs included in the Programme of Activities will be located in South Africa.

Eligibility criteria 1: The geographic boundary of the CPA is located in South Africa. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in South Africa (an EIA license for a proposed CPA issued by the South African authorities would automatically imply that the CPA is located in South Africa).

14 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a wind power project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:
1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website[6] that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C and the CME management manual. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C and the CME management manual. The check by the CME will be presented in a signed confirmation letter from the CME.

Eligibility criteria 2.1: The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

[6] http://cdm.unfccc.int/

Eligibility criteria 2.2: The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

Eligibility criteria 2.3: The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

Eligibility criteria 2.4: The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in South Africa. This will be evidenced by a signed confirmation letter from the CME.

14 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;

Eligibility criteria 3.1: The CPA involves the implementation of a wind power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

Eligibility criteria 3.2: The turbine technology shall be certified to IEC 61400 standard in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme*. This will be evidenced by the IEC 61400 certificate. If at the time of the inclusion of the CPA, the IEC 61400 certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria according to ACM0002 version 13.0.0:

Eligibility criteria 3.3: The installed capacity of the CPA will be minimal 1 MW and not more than 140MW per grid connection point. This is in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* which requires that "Projects must have a minimum installed capacity of 1 MW and, in order to limit congestion on the grid connections to the Transmission or Distribution System, have a maximum installed capacity of 140 MW for a single grid connection point assuming that the connection point can facilitate such capacity". The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

Eligibility criteria 3.4: The CPA will have a net load factor between 16.2% and 49.6% based on the P50 forecast. Net load factors are a function of wind speeds, the type of wind turbine and losses in the system. The range is based on projects that have been registered under the CDM (or are in the pipeline) and, therefore, provides a realistic range of circumstances under which a wind projects can be developed. The P50 forecast is in line with the requirement in Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme,* para 2.6.1.5

Eligibility criteria 3.5: The CPA will have an average wind speed between 5-11 m/s at hub height based on 12 months of measurement data reported by an independent third party. This wind speed is considered as representative of the South Africa's context when compared to available studies[7][8] and it is generally considered that project below that range are not commercially viable as per industry standards.

[7] Mesoscale wind atlas of South Africa. Kilian Hagemann. University of Cape Town. November 2008
[8] First verified numerical wind atlas for South Africa, DTU Wind Energy, Technical University of Denmark

14 d. Conditions to check the start date of the CPA through documentary evidence;

According to the *Clean Development Mechanism Project Standard* (version 01.0), the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date on which the PoA-DD is first published for global stakeholder consultation. The proposed PoA was first published for global stakeholder consultation on 02/06/2012. Furthermore, for the purpose of this PoA, the start date of the CPA will be when the agreement with the turbine supplier will be signed because this is the date on which real action towards the implementation of the CPA occurs. If an earlier contract such as the lending agreement is signed before the contract with the turbine supplier, this one will determine the start date of the CPA. If, at the time of inclusion, the CPA has not yet signed an agreement with the turbine supplier, the start date of the CPA will by definition be after 02/06/2012 and therefore, the CPA will have met the requirement of having a start date which is not prior to the commencement of the validation of the proposed PoA.

Eligibility criteria 4: The start of the CPA occurs after 02/06/2012. This will be evidenced by the EPC contract, contract with the turbine supplier or other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 02/06/2012.

14 e Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs

Eligibility criteria 5: The CPA has confirmed its compliance with the applicability of ACM0002, version 13.0.0 in section D.2 of the F-CDM-CPA-DD.

14 f The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of* activities, PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies.

ACM0002, version 13.0.0 requires that: "The additionality of a project activity shall be demonstrated and assessed using the latest version of the *Tool for the demonstration and assessment of additionality"*.

In addition, ACM0002 further stipulates that: "When defining eligibility criteria for CPA inclusion for a distinct type of CPAs, the CME shall consider relevant technical and economic parameters, such as:

(b) Parameters reflecting the investment climate:
  (i) Subsidies or other financial flows;
  (ii) Tariffs;
  (iii) Depreciation;
  (iv) Power purchase agreements;
  (v) Other parameters determining market circumstances;

(c) Ranges of costs (capital investment, operating and maintenance costs, etc.) and revenues (income from electricity sale, subsidies/fiscal incentives, ODA).

In line with the above guidelines, the following eligibility criteria have been formulated to prove additionality:

Step 0: Demonstration whether the proposed CPA is the first-of-its-kind

In accordance with the *Guidelines on additionality of first-of-its-kind project activities (*version 02, EB 69, Annex 7), a CPA is considered as its first-of-its-kind if:

(a) The project is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier;

(b) The project implements one or more of the measures;

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

Output is goods/services produced by the project activity including, among other things, heat, steam, electricity, methane, and biogas unless otherwise specified in the applied methodology.

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

(a) Energy source/fuel (example: energy generation by different energy sources such as wind and hydro and different types of fuels such as biomass and natural gas);

(b) Feed stock (example: production of fuel ethanol from different feed stocks such as sugar cane and starch, production of cement with varying percentage of alternative fuels or less carbon-intensive fuels);

(c) Size of installation (power capacity)/energy savings:

(i) Micro (as defined in paragraph 24 of decision 2/CMP.5 and paragraph 39 of decision 3/CMP.6);
(ii) Small (as defined in paragraph 28 of decision 1/CMP.2);
(iii) Large.

As per eligibility criteria 1 the CPA has already evidenced that it is located within the geographical boundary of South Africa. The applicable geographical area is therefore the host country South Africa. As per eligibility criteria 3.1, the CPA has also evidenced that it involves the use of wind energy, a renewable energy, which is one of the applicable measures as per paragraph 2 of the *Guidelines on additionality of first-of-its-kind project activities.* For CPAs to be included in the PoA, output is defined as electricity generation being fed into the South African national grid.

Eligibility Criteria 6.1: The CME has confirmed that the CPA is applying a technology which is different from any other project in South Africa that supplies electricity to the South African national grid and has started commercial operation before the PoA-DD and specific CPA-DD was published for Global Stakeholder Consultation[9], or before the inclusion of the CPA in the PoA or before the start date of the CPA (as defined in eligibility criterion 4), whichever is applicable and earlier. This will be evidenced by a comparison with all grid-connected power plants located in South Africa based on data, which has been made available by NERSA, Eskom and/or the Department of Energy (DoE) or any other credible source.

[9] Only applicable for the first specific CPA, which is uploaded for Global Stakeholder Consultation together with the PoA-DD.

Eligibility Criteria 6.2: The project participants selected a crediting period for the CPA that is a maximum of 10 years with no option of renewal. This will be evidenced as per section A.9 of the CPA-DD.

If the proposed CPA is the first-of-its-kind as shown above, its additionality is demonstrated in accordance with paragraph 6 of the *Guidelines on additionality of first-of-its-kind project activities*.

In line with the requirements under ACM0002 (version 13.0.0) the eligibility criteria related to costs, revenues and investment climate are also applicable to CPAs applying the first-of-its-kind argument. Those shall be updated at least every two years in order to correctly reflect the technical and market circumstances of a CPA implementation.

Revenues

The following eligibility criteria with regard to project revenues will apply to CPAs included in the PoA:

Eligibility criteria 6.3: The CPA has applied for a tariff of not more than 1,150 ZAR/MWh in accordance with the current threshold of the IPP procurement programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence, or, if not available at the time of CPA inclusion, confirmation in the PoA participation agreement or in a confirmation letter signed by the CPA implementing entity, that the CPA implementing entity will comply with relevant provisions in the IPP procurement programme, including the provisions related to the electricity tariff. The applicable tariff cap will be updated every two years or whenever the tariff is updated under the IPP procurement programme or other relevant government regulation, whichever occurs first.

Capital investment (CAPEX)

The total CAPEX per MW for the CPA shall be higher than the CAPEX amount reported by Bloomberg New Energy Finance Wind Turbine Price Index[10] for a typical project in the world, which is 1,250,000 EUR/MW.[11] It is expected that if the capital investment gets lower than a typical project in the world, the project will be viable without CDM revenues. Currently, there are no large-scale operational wind power projects in Sub-Saharan Africa and, therefore, development and investment costs are expected to be higher due to uncertainties in development and construction phases.

CAPEX costs will be estimated based on the provisions in Volume 4 – Financial requirements of the IPP Procurement Programme. The cost of the wind turbine generator as well as the BoP (Balance of Plant) costs will depend on the type of wind turbine used and will be evidenced by quotations from turbine suppliers or contracts with turbine suppliers.

The following eligibility criteria with regard to CAPEX will apply to CPAs included in the PoA:

Eligibility criteria 6.4: The total CAPEX of the project is more than 1,250,000 Euro/MW taking into account CAPEX items being derived from and be in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by documentation submitted to the South African

[10] See Bloomberg New Energy Finance (2012) *Q1 2012 Clean Energy Policy and Market Briefing.* The briefing contains data on Wind Turbine Price Index. The index reports a turbine price of 0.94 million EUR/MW for 2011. Since the cost of the wind turbine constitutes approximately 75% of the total CAPEX (see e.g. EWEA, *The Economics of Wind Energy*), the total CAPEX is 1,25 million EUR.

[11] A similar figure (1,227 EUR/kW) has been reported by the European Wind Energy Agency in a report published in 2009, *The Economics of Wind Energy*.

Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence used to estimate the CAPEX. The applicable CAPEX threshold will be updated every two years.

Operating cost:

The total operating costs will be at least 12 EUR/MWh. The threshold is based on experience and figures reported in the EWEA (2009) *The Economics of Wind Energy*. The document reports operating costs of 12-15 EUR/MWh. Currently, there is very little public information available regarding operating costs for wind farms in South Africa. This is due to the absence of large-scale wind power projects in South Africa. It is expected that some of the operating cost items will be lower than in Europe but these cost gains will be offset by lack of experience and inefficiencies in the system. Therefore, the price ranges for Europe are considered appropriate for the South African context. Projects that have operating costs lower than 12 EUR/MWh are expected to be commercially viable without the additional revenue from the CERs.

Operating costs will be estimated based on the provisions in Volume 4 – Financial requirements of the IPP Procurement Programme and will include:

- Costs related to land leases or land acquisition
- Service and warranty costs
- Operation and maintenance costs
- Administrative costs
- Costs related to socio-economic development

The following eligibility criteria with regard to operating costs will apply to CPAs included in the PoA:

Eligibility criteria 6.5: The total operating costs will be at least 12 EUR/MWh, taking into account requirements regarding OPEX items in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence used to estimate the operating costs. The range of operating costs will be updated every two years.

Investment climate

Eligibility criteria 6.6: In its submission to become an Independent Power Producer under the IPP Procurement Programme, the CPA has considered or will consider all relevant regulations and provisions with regard to financial flows, taxes, tariffs, depreciation and power purchase agreements applicable in South Africa at the time of the submission. This is evidenced by documentation submitted to the South African Department of Energy (DoE), to financing entities and equity investors, or, if not available at the time of CPA inclusion, confirmation in the PoA participation agreement or in a confirmation letter signed by the CPA implementing entity, that the CPA implementing entity will consider the relevant investment climate in terms of financial flows, taxes, tariffs, depreciation and power purchase agreements applicable in South Africa. The CME will confirm the investment climate parameters and update them at least every two years.

14 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;

In accordance with the requirements of the National Environmental Management Act (Act No 107 of 1998) (NEMA), and relevant EIA regulations made in terms of this Act and promulgated in April 2006 (Government Notice No 385), and listed activities under (Government Notice No 386 and 387), the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with South African regulations.

Eligibility criteria 7.1: The CPA has carried out an Environmental Impact Assessment in line with South African regulations. This will be evidenced through the Environmental Authorisation (Record of Decision) from the Department of Environmental Affairs.

As part of the EIA process in South Africa, the project proponent has to carry out a public participation process including consultations with Interested and Affect Parties (IAP). The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. The CPA may also decide to carry out and report on a separate CDM stakeholder consultation in line with the CDM requirements and (if available) DNA requirements.

Eligibility criteria 7.2: The CPA has carried out a stakeholder consultation meeting according to the CDM requirements and (if available) DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

14 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;

Eligibility criteria 8.1: In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

Eligibility criteria 8.2: In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

14 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);

Eligibility criteria 9.1: The CPA is connected to the South African grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

14 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;

The PoA and CPAs do not involve sampling.

14 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;

The PoA and CPAs are not small-scale or micro-scale.

14 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.

The PoA and CPAs are not small-scale or micro-scale.

CPA TYPE II: GREENFIELD WIND POWER PLANTS/UNITS IN SOUTH AFRICA APPLYING INVESTMENT ANALYSIS

14 a. The geographical boundary of the CPA including any time-induced boundary consistent with

the geographical boundary set in the PoA

CPAs included in the Programme of Activities will be located in South Africa.

Eligibility criteria 1: The geographic boundary of the CPA is located in South Africa. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in South Africa (an EIA license for a proposed CPA issued by the South African authorities would automatically imply that the CPA is located in South Africa).

14 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a wind power project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:
1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website[12] that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C and the CME management manual. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C and the CME management manual. The check by the CME will be presented in a signed confirmation letter from the CME.

Eligibility criteria 2.1: The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

Eligibility criteria 2.2: The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced through a confirmation letter from the CME.

[12] http://cdm.unfccc.int/

Eligibility criteria 2.3: The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

Eligibility criteria 2.4: The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in South Africa. This will be evidenced through a signed confirmation letter from the CME.

14 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;

Eligibility criteria 3.1: The CPA involves the implementation of a wind power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

Eligibility criteria 3.2: The turbine technology shall be certified to IEC 61400 standard in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme*. This will be evidenced through the IEC 61400 certificate. If at the time of the inclusion of the CPA, the IEC 61400 certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria according to ACM0002 version 13.0.0:

Eligibility criteria 3.3: The installed capacity of the CPA will be minimal 1 MW and not more than 140MW per grid connection point. This is in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* which requires that "Projects must have a minimum installed capacity of 1 MW and, in order to limit congestion on the grid connections to the Transmission or Distribution System, have a maximum installed capacity of 140 MW for a single grid connection point assuming that the connection point can facilitate such capacity". The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

Eligibility criteria 3.4: The CPA will have a net load factor between 16.2% and 49.6% based on the P50 forecast. Net load factors are a function of wind speeds, the type of wind turbine and losses in the system. The range is based on projects that have been registered under the CDM (or are in the pipeline) and, therefore, provides a realistic range of circumstances under which a wind projects can be developed. The P50 forecast is in line with the requirement in Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme,* para 2.6.1.5

Eligibility criteria 3.5: The CPA will have an average wind speed between 5-11 m/s at hub height based on 12 months of measurement data reported by an independent third party. This wind speed is considered as representative of the South Africa's context when compared to available studies[13][14] and it is generally considered that project below that range are not commercially viable as per industry standards.

16 d. Conditions to check the start date of the CPA through documentary evidence;

[13] Mesoscale wind atlas of South Africa. Kilian Hagemann. University of Cape Town. November 2008
[14] First verified numerical wind atlas for South Africa, DTU Wind Energy, Technical University of Denmark

According to the *Clean Development Mechanism Project Standard* (version 01.0), the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date on which the PoA-DD is first published for global stakeholder consultation. The proposed PoA was first published for global stakeholder consultation on 02/06/2012. Furthermore, for the purpose of this PoA, the start date of the CPA will be when the agreement with the turbine supplier will be signed because this is the date on which real action towards the implementation of the CPA occurs. If an earlier contract such as the lending agreement is signed before the contract with the turbine supplier, this one will determine the start date of the CPA. If, at the time of inclusion, the CPA has not yet signed an agreement with the turbine supplier, the start date of the CPA will by definition be after 02/06/2012 and therefore, the CPA will have met the requirement of having a start date which is not prior to the commencement of the validation of the proposed PoA.

Eligibility criteria 4: The start of the CPA occurs after 02/06/2012. This will be evidenced by the EPC contract, contract with the turbine supplier or other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 02/06/2012.

14 e Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs

Eligibility criteria 5: The CPA has confirmed its compliance with the applicability of ACM0002, version 13.0.0 in section D.2 of the F-CDM-CPA-DD.

14 f The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of* activities, PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies.

ACM0002, version 13.0.0 requires that: "The additionality of a project activity shall be demonstrated and assessed using the latest version of the *Tool for the demonstration and assessment of additionality"*.

In addition, ACM0002 further stipulates that: "When defining eligibility criteria for CPA inclusion for a distinct type of CPAs, the CME shall consider relevant technical and economic parameters, such as:

(b) Parameters reflecting the investment climate:
    (i) Subsidies or other financial flows;
    (ii) Tariffs;
    (iii) Depreciation;
    (iv) Power purchase agreements;
    (v) Other parameters determining market circumstances;
(c) Ranges of costs (capital investment, operating and maintenance costs, etc.) and revenues (income from electricity sale, subsidies/fiscal incentives, ODA).

In line with the above guidelines, the following eligibility criteria have been formulated to prove 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:

According to para 8 of the *Tool for the demonstration and assessment of additionality,* project activities that apply the tool in the context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity. In line with the above guidelines, the following two alternatives can be identified:

Alternative 1: The project activity not undertaken as a CDM project activity

Alternative 2: Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the *Tool to calculate the emission factor for an electricity system*.

The above identification of alternatives is in line with para 8 of the *Tool for the demonstration and assessment of additionality*. No eligibility criteria was formulated for defining alternatives because the above two alternatives would by definition be applicable to every grid renewable energy project activity and will be included in every CPA-DD.

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

The above alternatives as well as the component project activity are consistent with mandatory and regulatory requirements, especially the Electricity Regulation Act No.4 of 2006, its Amendment Act, 2007 and the Electricity Regulation Act No.4 of 2006 – Electricity Regulations on New Generation Capacity issued on 04 May 2011. These laws and regulations are relevant for both alternatives, since they constitute the legal framework for current and future grid connected power plants in South Africa.

Alternative 2 can be considered as consistent with mandatory laws and regulations, since the continuation of operation of power plants currently connected to the grid is lawful due to the fact that article 16 and article 17 of the Electricity Regulation Act No.4 of 2006 and its Amendment Act, 2007 only allow the revocation of already issued generation licenses in case of non-compliance of the licensee or on application of the licensee. The laws and regulation regarding the addition of new grid connected generation capacity is outlined as per the Electricity Regulations on New Generation Capacity issued on 04 May 2011, which applies to all types of generation technology including renewable generation and cogeneration technology except of nuclear power generation technology. Therefore the addition of new generation capacity can be considered lawful.

Since Alternative 1 describes the addition of greenfield grid connected wind power capacity to the South Africa grid without carbon credits, this can also be considered consistent with mandatory laws and regulations since the Electricity Regulations on New Generation Capacity issued on 04 May 2011 covers the establishment of wind power technologies in South Africa.

There are no further applicable national laws or regulations, which require the application as a CDM project activity.

Step 2: Investment analysis

The following steps will be taken to demonstrate that the CPA is financially additional:

Sub-step 2a: Determine appropriate analysis method

The *Tool for the demonstration and assessment of additionality* provides three methods for carrying out investment analysis:
1. Simple cost analysis (Option I),
2. Investment comparison analysis (Option II)

3. Benchmark analysis (Option III).

The CPAs included in the PoA are expected to generate financial and economic benefits other than CDM related income (income from the sales of electricity) therefore the simple cost analysis (Option I) cannot be applied.

In line with ACM0002 (version 13.0.0), the baseline scenario for the project activities is the supply of electricity from a grid. Therefore, the baseline scenario does not necessarily require investment and is outside the control of the project developers. Option III, benchmark analysis is selected as the appropriate analysis method for the project activities.

Eligibility Criteria 6.1: The CPA has carried out benchmark analysis to demonstrate additionality. This will be demonstrated through the investment analysis spread sheet.

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

In line with paragraph 12 of the *Guidelines on the assessment of investment analysis* (version 05), CPAs will use one of the following two benchmark indicators:

- Pre-tax nominal Weighted Average Cost of Capital (WACC)
- Post-tax nominal Return on Equity

The WACC will be the benchmark for the Project IRR and the Return on Equity will be the benchmark for the Equity IRR.

The pre-tax, nominal Weighted Average Cost of Capital is an appropriate benchmark because it circumvents the impact of loan interest on income tax calculations (see also para 11 in the *Guidelines on the assessment of investment analysis* (version 05). The post-tax nominal Return on Equity is considered an appropriate benchmark because equity investors and shareholders are mostly interested in after tax cash flows.

Eligibility criteria 6.2: The CPA has applied (a) the pre-tax nominal WACC in combination with the Project IRR or (b) the post-tax nominal Return on Equity in combination with the Equity IRR, as explained below. This will be evidenced through the investment analysis spread sheet.

For CPAs applying option (a), the following formula will be used to determine the pre-tax nominal WACC:

$$WACC = w_d K_d + w_e K_e$$

Where:

WACC = Weighted Average Cost of Capital
w_d = Percentage of debt financing
w_e = Percentage of equity financing
K_d = Average cost of debt financing
K_e = Average cost of equity financing

The values of w_d and w_e will be determined and evidenced at the CPA inclusion stage.

The default value for the cost of equity financing is provided as a real term, post-tax value in the *Guidelines on the assessment of investment analysis*. Therefore, the following two steps were undertaken to convert the value to a nominal, pre-tax value:

1. CPAs will add the inflation rate to convert the real value into a nominal value using the Fisher Equation:

$$\text{Nominal rate} = (1 + \text{real rate}) \times (1 + \text{inflation}) - 1$$

The inflation will be based on one of the following options:

- The inflation forecast of the South African Reserve Bank for the duration of the CPA crediting period
- The target inflation of the South African Reserve Bank
- The average forecasted inflation rate for South Africa published by the IMF or the World Bank for the next five years after start of the project activity[15]

2. The post-tax default value will be further converted to a pre-tax value by dividing the post-tax value by (1 – tax rate). The tax rate used will be 28% in line with the South African income tax.

For CPAs applying option (b), the use of the post-tax, nominal Return on Equity as a benchmark to compare with the Equity IRR, the following steps will be taken to determine the post-tax, nominal Return on Equity:

The Return on Equity will be based on the default value as provided in the latest version of the *Guidelines on the assessment of investment analysis* for Group 1 projects in South Africa. The default value is provided as a real term, post-tax value therefore, the following procedure is followed to convert the value to a nominal, post-tax value:

To convert the real value into a nominal value the Fisher Equation is used:

$$\text{Nominal rate} = (1 + \text{real rate}) \times (1 + \text{inflation}) - 1$$

The inflation will be based on:

- The inflation forecast of the South African Reserve Bank for the duration of the CPA crediting period
- The target inflation of the South African Reserve Bank
- The average forecasted inflation rate for South Africa published by the IMF or the World Bank for the next five years after start of the project activity[16]

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

After determination and calculation of the benchmark, the CPA will determine the Project IRR or Equity IRR, as applicable. In line with the *Guidelines on the assessment of the investment analysis*, all values used in the investment analysis will be applicable at the time of the investment decision. For the purpose of the PoA, the time of the investment decision will be either the date on which the plant load factor has become available to the board based on which the board has decided to proceed with the project, or the date on which significant resources have been committed towards the implementation of the project.

The following eligibility criteria have been formulated to assess the calculation and comparison of financial indicators.

[15] To be in line with the requirement that input values used in the investment analysis should be valid and applicable at the time of the investment decision.

[16] To be in line with the requirement that input values used in the investment analysis should be valid and applicable at the time of the investment decision.

Eligibility criteria 6.3: Without the CER revenue, the CPA has a less favourable Project IRR or Equity IRR, whichever is applicable, than the benchmark. This will be evidenced in the investment analysis spreadsheet.

Eligibility criteria 6.4: All input values applied in the investment analysis are applicable at the time of the investment decision. The CME will check whether all the input values are valid at the time of the investment decision.

Eligibility criteria 6.5: The date of the investment decision is either based on the date on which the project has received the wind assessment report and the board has decided to proceed with the project or the date on which the project has committed significant financial resources towards the implementation of the project. This will be evidenced by the wind assessment report together with a board resolution or by a contract involving the commitment of significant financial resources towards the implementation of the project.

The following considerations will be made in terms of revenues, costs and other parameter values in the investment analysis. In line with the requirements under ACM0002 (version 13.0.0) the eligibility criteria related to costs, revenues and investment climate shall be updated at least every two years in order to correctly reflect the technical and market circumstances of a CPA implementation.

Revenues:

Revenues from electricity sales will be calculated based on the following parameters and consideration:

The electricity generation will be based on the energy yield and net plant load factor as determined by a third party in line with the requirements under the *Guidelines for the reporting and validation of plant load factors*. The net plant load factor will be based on the P50 forecast and will include losses including but not limited to plant availability, maintenance, curtailment, hysteresis, blade degradation, etc.

The tariff used will not be higher than 1,150 ZAR/MWh. This is in line with para 5.1.4.5 of Part A of he *Request for qualification and proposals for new generation capacity under the IPP procurement programme*.

The following eligibility criteria with regard to project revenues will apply to CPAs included in the PoA:

Eligibility criteria 6.6: The CPA has used a tariff of not more than 1,150 ZAR/MWh in the investment analysis. This will be evidenced by the investment analysis spread sheet. The applicable tariff cap will be updated every two years, or whenever the tariff is updated under the IPP procurement programme or other relevant government regulation, whichever occurs first.

Capital investment (CAPEX)

The total CAPEX per MW for the CPA shall be higher than the CAPEX amount reported by Bloomberg New Energy Finance Wind Turbine Price Index[17] for a typical project in the world, which is 1,250,000 EUR/MW.[18] It is expected that if the capital investment gets lower than a typical project in the world, the

[17] See Bloomberg New Energy Finance (2012) *Q1 2012 Clean Energy Policy and Market Briefing.* The briefing contains data on Wind Turbine Price Index. The index reports a turbine price of 0.94 million EUR/MW for 2011. Since the cost of the wind turbine constitutes approximately 75% of the total CAPEX (see e.g. EWEA, *The Economics of Wind Energy*), the total CAPEX is 1,25 million EUR.

[18] A similar figure (1,227 EUR/kW) has been reported by the European Wind Energy Agency in a report published in 2009, *The Economics of Wind Energy*.

project will be viable without CDM revenues. Currently, there are no large-scale operational wind power project in Sub-Saharan Africa and, therefore, development and investment costs are expected to be higher due to uncertainties in development and construction phases.

CAPEX costs included in the calculation of the IRR will be derived from and be in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. The cost of the wind turbine generator as well as the BoP costs will depend on the type of wind turbine used and will be evidenced by quotations from turbine suppliers or contracts with turbine suppliers. If at the time of the investment decision no quotations or contracts from turbine suppliers are available, alternative evidences can be used including quotations or contracts from the same turbine supplier for other projects in South Africa email quotations. In the latter case (email), the conservativeness of the quotation will be cross-checked with quotations received after the date of the investment decision.

Additional CAPEX costs can be included to the investment analysis in case they are properly evidenced.

The following eligibility criteria with regard to CAPEX will apply to CPAs included in the PoA:

Eligibility criteria 6.7: The total CAPEX of the project is more than 1,250,000 Euro/MW taking into account CAPEX items being derived from and be in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by the investment analysis spread sheet. The applicable CAPEX threshold will be updated every two years.

Operating cost:

The total operating costs will be at least 12 EUR/MWh. The threshold is based on experience and figures reported in EWEA (2009) *The Economics of Wind Energy*. The document reports operating costs of 12-15 EUR/MWh. Currently, there is very little public information available regarding operating costs for wind farms in South Africa. This is due to the absence of large-scale wind power projects in South Africa. It is expected that some of the operating cost items will be lower than in Europe but these cost gains will be offset by lack of experience and inefficiencies in the system. Therefore, the price ranges for Europe are considered appropriate for the South African context. Projects that have operating costs lower than 12 EUR/MWh are expected to be commercially viable without the additional revenue from the CERs.

Operating costs will be estimated based on the provisions in Volume 4 – Financial requirements of the IPP Procurement Programme and will include:

- Costs related to land leases or land acquisition
- Service and warranty costs
- Operation and maintenance costs
- Administrative costs
- Costs related to socio-economic development

Additional operating costs can be included to the investment analysis in case they are properly evidenced.

The following eligibility criteria with regard to operating costs will apply to CPAs included in the PoA:

Eligibility criteria 6.8: The total operating costs will be at least 12 EUR/MWh, taking into account requirements regarding OPEX items in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This will be evidenced by the investment analysis spread sheet. The range of operating costs will be updated every two years.

Taxation and depreciation

Eligibility criteria 6.9: The CPA has used an income tax rate of 28% in the investment analysis, which is the South African income tax rate. This will be evidenced by the investment analysis spread sheet. The tax rate will be updated every two years, or whenever the income tax regulations in South Africa change, whichever occurs earlier.

Eligibility criteria 6.10: The CPA has applied the applicable depreciation rates in the investment analysis as provided by the South African regulations with regard to capital allowances. At the time of writing the PoA DD, the capital allowance for energy infrastructure projects in South Africa was 50% for the first year of operation, 30% for the second year of operation and 20% for the third year of operation. The applicable depreciation will be updated every two years, or whenever the applicable depreciation rates in South Africa change, whichever occurs earlier.

Exchange rates

Exchange rates provided by the South African government as part of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* will be used. Alternatively, the exchange rate reported by South African Reserve Bank on the date of the investment decision can be used. In case both are available, the most conservative one will be used.

Eligibility criteria 6.11: In terms of exchange rates, the exchange rates provided by the South African government as part of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* will be used. Alternatively, the exchange rate reported by South African Reserve Bank on the date of the investment decision can be used. In case both are available, the most conservative one will be used.

Sub-step 2d: Sensitivity analysis

Eligibility criteria 6.12: The CPA implementing entity will have carried out a sensitivity analysis on variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues. This will be evidenced in the investment analysis spread sheet. The sensitivity analysis will cover a range of +10% and -10%. The following parameters will be subject to sensitivity analysis:

- Investment cost
- Electricity generation
- Operating and maintenance cost
- Tariff

Eligibility criteria 6.13: The CPA implementing entity will have assessed at which parameter level the benchmark will be crossed and will have discussed the likelihood of those parameter levels to occur. This will be evidenced in the investment analysis spread sheet and specific CPA-DD.

Step 4: Common practice analysis

Eligibility criteria 6.14: In line with the *Tool for the demonstration and assessment of additionality*, it can be concluded that the CPA is not common practice as F is lower than 0.2 and $N_{all} - N_{diff}$ is lower than 3. The common practice analysis will be based on publicly availably data and information from NERSA, Eskom and/or the Department of Energy (DoE) or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.

14 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;

In accordance with the requirements of the National Environmental Management Act (Act No 107 of 1998) (NEMA), and relevant EIA regulations made in terms of this Act and promulgated in April 2006 (Government Notice No 385), and listed activities under (Government Notice No 386 and 387), the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with South African regulations.

Eligibility criteria 7.1: The CPA has carried out an Environmental Impact Assessment in line with South African regulations. This will be evidenced through the Environmental Authorisation (Record of Decision) from the Department of Environmental Affairs.

As part of the EIA process in South Africa, the project proponent has to carry out a public participation process including consultations with Interested and Affect Parties (IAP). The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. The CPA may also decide to carry out and report on a separate CDM stakeholder consultation in line with the CDM requirements and (if available) DNA requirements.

Eligibility criteria 7.2: The CPA has carried out a stakeholder consultation meeting according to the CDM requirements and (if available) DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

14 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;

Eligibility criteria 8.1: In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

Eligibility criteria 8.2: In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

14 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);

Eligibility criteria 9.1: The CPA is connected to the South African grid. This will be evidenced through the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

14 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;

The PoA and CPAs do not involve sampling.

14 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA;

The PoA and CPAs are not small-scale or micro-scale.

14 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.

The PoA and CPAs are not small-scale or micro-scale.

CPA TYPE III: GREENFIELD SOLAR PV PLANTS/UNITS IN SOUTH AFRICA APPLYING FIRST-OF-ITS-KIND BARRIER

14 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

CPAs included in the Programme of Activities will be located in South Africa.

Eligibility criteria 1: The geographic boundary of the CPA is located in South Africa. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in South Africa (an EIA license for a proposed CPA issued by the South African authorities would automatically imply that the CPA is located in South Africa).

14 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic power project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:
1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website[19] that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C and the CME management manual. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C and the CME management manual. The check by the CME will be presented in a signed confirmation letter from the CME.

Eligibility criteria 2.1: The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through

[19] http://cdm.unfccc.int/

the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

Eligibility criteria 2.2: The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

Eligibility criteria 2.3: The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

Eligibility criteria 2.4: The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in South Africa. This will be evidenced by a signed confirmation letter from the CME.

16c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;

Eligibility criteria 3.1: The CPA involves the implementation of a solar photovoltaic (PV) power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

Eligibility criteria 3.2: The solar photovoltaic module technology shall be certified to IEC/EN 61215 and IEC/EN 61730 standards (IEC 62108 for concentrated solar photovoltaic) in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme*. This will be evidenced by the IEC certificate. If at the time of the inclusion of the CPA, the certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria according to ACM0002 version 13.0.0.

Eligibility criteria 3.3: The installed capacity of the CPA will be minimal 1 MW and not more than 75MW per grid connection point. This is in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* which requires that "Projects must have a minimum installed capacity of 1 MW and a maximum installed capacity of 75 MW for a single grid connection point". The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

Eligibility criteria 3.4: The CPA will have a net load factor between 10% and 25%, or between 20% and 35% if concentrated solar photovoltaic, based on the P50 forecast. Net load factors are a function of solar irradiation, the type of photovoltaic module and losses in the system. The range is based on projects that have been registered under the CDM and, therefore, provides a realistic range of circumstances under which a solar PV projects can be developed. The P50 forecast is in line with the requirement in Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme,* para 2.6.2.5.1.

Eligibility criteria 3.5: The CPA will have an average annual global horizontal solar irradiation between 1,800 and 2,600 kWh/m2 based on data reported by an independent third party. This solar irradiation is

considered as representative of the South Africa's context when compared to available reports[20] and it is generally considered that projects below that range are not commercially viable as per industry standards.

14 d. Conditions to check the start date of the CPA through documentary evidence;

According to the *Clean Development Mechanism Project Standard* (version 01.0), the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date on which the PoA-DD is first published for global stakeholder consultation. The proposed PoA was first published for global stakeholder consultation on 02/06/2012. Furthermore, for the purpose of this PoA, the start date of the CPA will be when the agreement with the solar module supplier will be signed because this is the date on which real action towards the implementation of the CPA occurs. If an earlier contract such as the lending agreement is signed before the contract with the equipment supplier, this one will determine the start date of the CPA. If, at the time of inclusion, the CPA has not yet signed an agreement with the solar module supplier, the start date of the CPA will by definition be after 02/06/2012 and therefore, the CPA will have met the requirement of having a start date which is not prior to the commencement of the validation of the proposed PoA.

Eligibility criteria 4: The start of the CPA occurs after 02/06/2012. This will be evidenced by the EPC contract, contract with the turbine supplier or other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 02/06/2012.

14 e Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs

Eligibility criteria 5: The CPA has confirmed its compliance with the applicability of ACM0002, version 13.0.0 in section D.2 of the F-CDM-CPA-DD.

14 f The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of* activities, PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies.

ACM0002, version 13.0.0 requires that: "The additionality of a project activity shall be demonstrated and assessed using the latest version of the *Tool for the demonstration and assessment of additionality"*.

In addition, ACM0002 further stipulates that: "When defining eligibility criteria for CPA inclusion for a distinct type of CPAs, the CME shall consider relevant technical and economic parameters, such as:

(b) Parameters reflecting the investment climate:
    (i) Subsidies or other financial flows;
    (ii) Tariffs;
    (iii) Depreciation;
    (iv) Power purchase agreements;
    (v) Other parameters determining market circumstances;
(c) Ranges of costs (capital investment, operating and maintenance costs, etc.) and revenues (income from electricity sale, subsidies/fiscal incentives, ODA).

[20] Yearly sum of global irradiation incident on optimatlly-inclined surface, PCGIS, European Commission Joint Research Center, 2001

In line with the above guidelines, the following eligibility criteria have been formulated:

Step 0: Demonstration whether the proposed CPA is the first-of-its-kind

In accordance with the *Guidelines on additionality of first-of-its-kind project activities (*version 02, EB 69, Annex 7), a CPA is considered as its first-of-its-kind if:

(a) The project is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier;

(b) The project implements one or more of the measures;

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

Output is goods/services produced by the project activity including, among other things, heat, steam, electricity, methane, and biogas unless otherwise specified in the applied methodology.

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

(a) Energy source/fuel (example: energy generation by different energy sources such as wind and hydro and different types of fuels such as biomass and natural gas);

(b) Feed stock (example: production of fuel ethanol from different feed stocks such as sugar cane and starch, production of cement with varying percentage of alternative fuels or less carbon-intensive fuels);

(d) Size of installation (power capacity)/energy savings:

(i) Micro (as defined in paragraph 24 of decision 2/CMP.5 and paragraph 39 of decision 3/CMP.6);
(ii) Small (as defined in paragraph 28 of decision 1/CMP.2);
(iii) Large.

As per eligibility criteria 1 the CPA has already evidenced that it is located within the geographical boundary of South Africa. The applicable geographical area is therefore the host country South Africa. As per eligibility criteria 3.1, the CPA has also evidenced that it involves the use of solar PV energy, a renewable energy, which is one of the applicable measures as per paragraph 2 of the *Guidelines on additionality of first-of-its-kind project activities.* For CPAs to be included to the PoA, output is defined as electricity generation being fed into the South African national grid.

Eligibility Criteria 6.1: The CME has confirmed that the CPA is applying a technology which is different from any other project in South Africa that supplies electricity to the South African national grid and has started commercial operation before the PoA-DD and specific CPA-DD was published for Global

Stakeholder Consultation[21], or before the inclusion of the CPA in the PoA or before the start date of the CPA (as defined in eligibility criterion 4), whichever is applicable and earlier. This will be evidenced by a comparison with all grid-connected power plants located in South Africa based on data, which has been made available by NERSA, Eskom and/or the Department of Energy (DoE) or any other credible source.

Eligibility Criteria 6.2: The project participants selected a crediting period for the CPA that is a maximum of 10 years with no option of renewal. This will be evidenced as per section A.9 of the CPA-DD.

If the proposed CPA is the first-of-its-kind as shown above, its additionality is demonstrated in accordance with paragraph 6 of the *Guidelines on additionality of first-of-its-kind project activities*.

In line with the requirements under ACM0002 (version 13.0.0) the eligibility criteria related to costs, revenues and investment climate are also applicable to CPAs applying the first-of-its-kind argument. Those shall be updated at least every two years in order to correctly reflect the technical and market circumstances of a CPA implementation.

Revenues:

The following eligibility criteria with regard to project revenues will apply to CPAs included in the PoA:

Eligibility criteria 6.3: The CPA has applied for a tariff of not more than 2,850 ZAR/MWh in accordance with the current threshold of the IPP procurement programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence, or, if not available at the time of CPA inclusion, a confirmation in the PoA participation agreement or in a confirmation letter signed by the CPA implementing entity, that the CPA implementing entity will comply with relevant provisions in the IPP procurement programme, including the provisions related to the electricity tariff. The applicable tariff cap will be updated every two years or whenever the tariff is updated under the IPP procurement programme or other relevant government regulation, whichever occurs first.

Capital investment (CAPEX)

The total CAPEX per MW for the CPA shall be higher than the CAPEX amount reported by the International Renewable Energy Agency (IRENA)[22] for a typical solar PV project in the world, which is 3,000,000 USD/MW.[23] It is expected that if the capital investment gets lower than a typical project in the world, the project will be viable without CDM revenues. Currently, there are no large-scale operational solar photovoltaic power projects in Sub-Saharan Africa and, therefore, development and investment costs are expected to be higher due to uncertainties in development and construction phases.

CAPEX costs will be estimated based on the provisions in Volume 4 – Financial requirements of the IPP Procurement Programme. The cost of the solar photovoltaic modules as well as the BoP costs will depend on the type of module used and will be evidenced by quotations from modules suppliers or contracts with modules suppliers.

[21] Only applicable for the first specific CPA, which is uploaded for Global Stakeholder Consultation together with the PoA-DD.
[22] IRENA, Renewable Energy Technologies: Cost Analysis Series for Solar PV (2012)
[23] Similar figures are reported by other sources such as the International Energy Agency (IEA) which establishes an investment costs of 4 USD/W for a utility scale and 6 USD/W for a small-scale in 2008. For 2009, the best system price reported in IEA countries was 3 USD/W. Source: International Energy Agency. Technology roadmap: Solar photovoltaic energy (Tech. Rep.). IEA (2010)

The following eligibility criteria with regard to CAPEX will apply to CPAs included in the PoA:

Eligibility criteria 6.4: The total CAPEX of the project is more than 3,000,000 USD/MW, taking into account CAPEX items being derived from and be in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence used to estimate the CAPEX. The applicable CAPEX threshold will be updated every two years.

Operating cost:

The total operating costs will be at least 10 USD/MWh. The threshold is based on experience and figures reported by the International Renewable Energy Agency (IRENA).[24] Currently, there is no public information available regarding operating costs for large-scale, solar PV projects in South Africa. This is due to the absence of large-scale, solar PV projects in South Africa. It is expected that some of the operating cost items will be lower than in the rest of the world but these cost gains will be offset by lack of experience and inefficiencies in the system. Therefore, the price ranges published by IRENA are considered appropriate for the South African context. Projects that have operating costs lower than 10 USD/MWh are expected to be commercially viable without the additional revenue from the CERs.

Operating costs will be estimated based on the provisions in Volume 4 – Financial requirements of the IPP Procurement Programme and will include:

- Costs related to land leases or land acquisition
- Service and warranty costs
- Operation and maintenance costs
- Administrative costs
- Costs related to socio-economic development

The following eligibility criteria with regard to operating costs will apply to CPAs included in the PoA:

Eligibility criteria 6.5: The total operating costs will be at least 10 USD/MWh, taking into account requirements regarding OPEX items in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence that is used to estimate the operating costs. The range of operating costs will be updated every two years.

Investment climate

Eligibility criteria 6.6: In its submission to become an Independent Power Producer under the IPP Procurement Programme, the CPA has considered or will consider all relevant regulations and provisions with regard to financial flows, taxes, tariffs, depreciation and power purchase agreements applicable in South Africa at the time of the submission. This is evidenced by documentation submitted to the South African Department of Energy (DoE), to financing entities and equity investors, or, if not available at the time of CPA inclusion, confirmation in the PoA participation agreement or in a confirmation letter signed by the CPA implementing entity, that the CPA implementing entity will consider the relevant investment climate in terms of financial flows, taxes, tariffs, depreciation and power purchase agreements applicable in South Africa. The CME will confirm investment climate parameters and update them every two years.

14 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;

[24] Bazilian *et al.*, Reconsidering the economics of photovoltaic power.

In accordance with the requirements of the National Environmental Management Act (Act No 107 of 1998) (NEMA), and relevant EIA regulations made in terms of this Act and promulgated in April 2006 (Government Notice No 385), and listed activities under (Government Notice No 386 and 387), the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with South African regulations.

Eligibility criteria 7.1: The CPA has carried out an Environmental Impact Assessment in line with South African regulations. This will be evidenced through the Environmental Authorisation (Record of Decision) from the Department of Environmental Affairs.

As part of the EIA process in South Africa, the project proponent has to carry out a public participation process including consultations with Interested and Affect Parties (IAP). The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. The CPA may also decide to carry out and report on a separate CDM stakeholder consultation in line with the CDM requirements and (if available) DNA requirements.

Eligibility criteria 7.2: The CPA has carried out a stakeholder consultation meeting according to the CDM requirements and (if available) DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

14 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;

Eligibility criteria 8.1: In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

Eligibility criteria 8.2: In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

14 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);

Eligibility criteria 9.1: The CPA is connected to the South African grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

14 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;

The PoA and CPAs do not involve sampling.

14 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria6 and remains within those thresholds throughout the crediting period of the CPA;

The PoA and CPAs are not small-scale or micro-scale.

14 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.

The PoA and CPAs are not small-scale or micro-scale.

CPA TYPE IV: GREENFIELD SOLAR PV PLANTS/UNITS IN SOUTH AFRICA APPLYING INVESTMENT ANALYSIS

14 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

CPAs included in the Programme of Activities will be located in South Africa.

Eligibility criteria 1: The geographic boundary of the CPA is located in South Africa. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in South Africa (an EIA license for a proposed CPA issued by the South African authorities would automatically imply that the CPA is located in South Africa).

14 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a solar photovoltaic power project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:
1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- An agreement between the CME and the CPA, or a signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website[25] that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project in line with the procedures as outlined in section C and the CME management manual. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map provided by the project proponent. This could be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section C and the CME management manual. The check by the CME will be presented in a signed confirmation letter from the CME.

Eligibility criteria 2.1: The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through

[25] http://cdm.unfccc.int/

the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

Eligibility criteria 2.2: The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced through a confirmation letter from the CME.

Eligibility criteria 2.3: The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

Eligibility criteria 2.4: The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in South Africa. This will be evidenced through a signed confirmation letter from the CME.

14 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;

Eligibility criteria 3.1: The CPA involves the implementation of a solar photovoltaic (PV) power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

Eligibility criteria 3.2: The solar photovoltaic module technology shall be certified to IEC/EN 61215 and IEC/EN 61730 standards (IEC 62108 for concentrated solar photovoltaic) in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme*. This will be evidenced by the IEC certificate. If at the time of the inclusion of the CPA, the certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria according to ACM0002 version 13.0.0.

Eligibility criteria 3.3: The installed capacity of the CPA will be minimal 1 MW and not more than 75MW per grid connection point. This is in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* which requires that "Projects must have a minimum installed capacity of 1 MW and a maximum installed capacity of 75 MW for a single grid connection point". The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

Eligibility criteria 3.4: The CPA will have a net load factor between 10% and 25%, or between 20% and 35% if concentrated solar photovoltaic, based on the P50 forecast. Net load factors are a function of solar irradiation, the type of photovoltaic module and losses in the system. The range is based on projects that have been registered under the CDM and, therefore, provides a realistic range of circumstances under which a solar PV projects can be developed. The P50 forecast is in line with the requirement in Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme,* para 2.6.2.5.1.

Eligibility criteria 3.5: The CPA will have an average annual global horizontal solar irradiation between 1,800 and 2,600 kWh/m2 based on data reported by an independent third party. This solar irradiation is

considered as representative of the South Africa's context when compared to available reports[26] and it is generally considered that project below that range are not commercially viable as per industry standards.

14 d. Conditions to check the start date of the CPA through documentary evidence;

According to the *Clean Development Mechanism Project Standard* (version 01.0), the coordinating/managing entity shall confirm that the start date of any proposed CPA is on or after the start date of the PoA, i.e. the date on which the PoA-DD is first published for global stakeholder consultation. The proposed PoA was first published for global stakeholder consultation on 02/06/2012. Furthermore, for the purpose of this PoA, the start date of the CPA will be when the agreement with the solar module supplier will be signed because this is the date on which real action towards the implementation of the CPA occurs. If an earlier contract such as the lending agreement is signed before the contract with the equipment supplier, this one will determine the start date of the CPA. If, at the time of inclusion, the CPA has not yet signed an agreement with the solar module supplier, the start date of the CPA will by definition be after 02/06/2012 and therefore, the CPA will have met the requirement of having a start date which is not prior to the commencement of the validation of the proposed PoA.

Eligibility criteria 4: The start of the CPA occurs after 02/06/2012. This will be evidenced by the EPC contract, contract with the turbine supplier or other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 02/06/2012.

14 e Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs

Eligibility criteria 5: The CPA has confirmed its compliance with the applicability of ACM0002, version 13.0.0 in section D.2 of the F-CDM-CPA-DD.

14 f The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;

According to the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of* activities, PoAs that consist of one or more large-scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements contained in the additionality section of the large scale methodologies.

ACM0002, version 13.0.0 requires that: "The additionality of a project activity shall be demonstrated and assessed using the latest version of the *Tool for the demonstration and assessment of additionality"*.

In addition, ACM0002 further stipulates that: "When defining eligibility criteria for CPA inclusion for a distinct type of CPAs, the CME shall consider relevant technical and economic parameters, such as:

(b) Parameters reflecting the investment climate:
    (i) Subsidies or other financial flows;
    (ii) Tariffs;
    (iii) Depreciation;
    (iv) Power purchase agreements;
    (v) Other parameters determining market circumstances;
(c) Ranges of costs (capital investment, operating and maintenance costs, etc.) and revenues (income from electricity sale, subsidies/fiscal incentives, ODA).

[26] Yearly sum of global irradiation incident on optimatlly-inclined surface, PCGIS, European Commission Joint Research Center, 2001

In line with the above guidelines, the following eligibility criteria have been formulated:

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

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

According to para 8 of the *Tool for the demonstration and assessment of additionality,* project activities that apply the tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity. In line with the above guidelines, the following two alternatives can be identified:

Alternative 1: The project activity not undertaken as a CDM project activity

Alternative 2: Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the *Tool to calculate the emission factor for an electricity system*.

The above identification of alternatives is in line with para 8 of the *Tool for the demonstration and assessment of additionality*. No eligibility criteria was formulated for defining alternatives because the above two alternatives would by definition be applicable to every grid renewable energy project activity and will be included in every CPA-DD.

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

The above alternatives as well as the component project activity are consistent with mandatory and regulatory requirements, especially the Electricity Regulation Act No.4 of 2006, its Amendment Act, 2007 and the Electricity Regulation Act No.4 of 2006 – Electricity Regulations on New Generation Capacity issued on 04 May 2011. These laws and regulations are relevant for both alternatives, since they constitute the legal framework for current and future grid connected power plants in South Africa.

Alternative 2 can be considered as consistent with mandatory laws and regulations, since the continuation of operation of power plants currently connected to the grid is lawful due to the fact that article 16 and article 17 of the Electricity Regulation Act No.4 of 2006 and its Amendment Act, 2007 only allow the revocation of already issued generation licenses in case of non-compliance of the licensee or on application of the licensee. The laws and regulation regarding the addition of new grid connected generation capacity is outlined as per the Electricity Regulations on New Generation Capacity on 04 May 2011, which applies to all types of generation technology including renewable generation and cogeneration technology except of nuclear power generation technology. Therefore the addition of new generation capacity can be considered lawful.

Since Alternative 1 describes the addition of greenfield grid connected solar power capacity to the South Africa grid without carbon credits, this can also be considered consistent with mandatory laws and regulations since the Electricity Regulations on New Generation Capacity issued on 04 May 2011 covers the establishment of solar power technologies in South Africa.

There are no further applicable national laws or regulations, which require the application as a CDM project activity.

Step 2: Investment analysis

The following steps will be taken to demonstrate that the CPA is financially additional:

Sub-step 2a: Determine appropriate analysis method

The *Tool for the demonstration and assessment of additionality* provides three methods for carrying out investment analysis:
1. Simple cost analysis (Option I),
2. Investment comparison analysis (Option II)
3. Benchmark analysis (Option III).

The CPAs included in the PoA are expected to generate financial and economic benefits other than CDM related income (income from the sales of electricity) therefore the simple cost analysis (Option I) cannot be applied.

In line with ACM0002 (version 13.0.0), the baseline scenario for the project activities is the supply of electricity from a grid. Therefore, the baseline scenario does not necessarily require investment and is outside the control of the project developers. Option III, benchmark analysis is selected as the appropriate analysis method for the project activities.

Eligibility Criteria 6.1: The CPA has carried out benchmark analysis to demonstrate additionality. This will be demonstrated through the investment analysis spread sheet.

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

In line with paragraph 12 of the *Guidelines on the assessment of investment analysis* (version 05), CPAs will use one of the following two benchmark indicators:

- Pre-tax nominal Weighted Average Cost of Capital (WACC)
- Post-tax nominal Return on Equity

The WACC will be the benchmark for the Project IRR and the Return on Equity will be the benchmark for the Equity IRR.

The pre-tax, nominal Weighted Average Cost of Capital is an appropriate benchmark because it circumvents the impact of loan interest on income tax calculations (see also para 11 in the *Guidelines on the assessment of investment analysis* (version 05). The post-tax nominal Return on Equity is considered an appropriate benchmark because equity investors and shareholders are mostly interested in after tax cash flows.

Eligibility criteria 6.2: The CPA has applied (a) the pre-tax nominal WACC in combination with the Project IRR or (b) the post-tax nominal Return on Equity in combination with the Equity IRR, as explained below. This will be evidenced through the investment analysis spread sheet.

For CPAs applying option (a), the following formula will be used to determine the pre-tax nominal WACC:

$$WACC = w_d K_d + w_e K_e$$

Where:

WACC = Weighted Average Cost of Capital
w_d = Percentage of debt financing
w_e = Percentage of equity financing
K_d = Average cost of debt financing

K_e = Average cost of equity financing

The values of w_d and w_e will be determined and evidenced at the CPA inclusion stage.

The default value for the cost of equity financing is provided in the *Guidelines on the assessment of investment* analysis as a real term, post-tax value. Therefore, the following two steps were undertaken to convert the value to a nominal, pre-tax value:

1. CPAs will add the inflation rate to convert the real value into a nominal value using the Fisher Equation:

$$\text{Nominal rate} = (1 + \text{real rate}) \times (1 + \text{inflation}) - 1$$

The inflation will be based on one of the following options:

- The inflation forecast of the South African Reserve Bank for the duration of the CPA crediting period
- The target inflation of the South African Reserve Bank
- The average forecasted inflation rate for South Africa published by the IMF or the World Bank for the next five years after start of the project activity[27]

2. The post-tax default value will be further converted to a pre-tax value by dividing the post-tax value by (1 – tax rate). The tax rate used will be 28% in line with the South African income tax.

For CPAs applying option (b), the use of the post-tax, nominal Return on Equity as a benchmark to compare with the Equity IRR, the following steps will be taken to determine the post-tax, nominal Return on Equity:

The Return on Equity will be based on the default value as provided in the latest version of the *Guidelines on the assessment of investment analysis* for Group 1 projects in South Africa. The default value is provided as a real term, post-tax value, therefore, the following procedure is followed to convert the value to a nominal, post-tax value:

To convert the real value into a nominal value the Fisher Equation is used:

$$\text{Nominal rate} = (1 + \text{real rate}) \times (1 + \text{inflation}) - 1$$

The inflation will be based on one of the following options:

- The inflation forecast of the South African Reserve Bank for the duration of the CPA crediting period
- The target inflation of the South African Reserve Bank
- The average forecasted inflation rate for South Africa published by the IMF or the World Bank for the next five years after start of the project activity[28]

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

[27] To be in line with the requirement that input values used in the investment analysis should be valid and applicable at the time of the investment decision.

[28] To be in line with the requirement that input values used in the investment analysis should be valid and applicable at the time of the investment decision.

After determination and calculation of the benchmark, the CPA will determine the Project IRR or Equity IRR, as applicable. In line with the *Guidelines on the assessment of the investment analysis*, all values used in the investment analysis will be applicable at the time of the investment decision. For the purpose of the PoA, the time of the investment decision will be either the date on which the plant load factor has become available to the board based on which it has decided to proceed with the project, or the date on which significant resources have been committed towards the implementation of the project.

The following eligibility criteria have been formulated to assess the calculation and comparison of financial indicators.

Eligibility criteria 6.3: Without the CER revenue, the CPA has a less favourable Project IRR or Equity IRR, whichever is applicable, than the benchmark. This will be evidenced in the investment analysis spread sheet.

Eligibility criteria 6.4: All input values applied in the investment analysis are applicable at the time of the investment decision. The CME will check whether all the input values are valid at the time of the investment decision.

Eligibility criteria 6.5: The date of the investment decision is either based on the date on which the project has received the solar resource assessment report and the board has decided to proceed with the project or the date on which the project has committed significant financial resources towards the implementation of the project. This will be evidenced by the solar resource assessment report together with a board resolution or by a contract involving the commitment of significant financial resources towards the implementation of the project.

The following considerations will be made in terms of revenues, costs and other parameter values in the investment analysis. In line with the requirements under ACM0002 (version 13.0.0) the eligibility criteria related to costs, revenues and investment climate shall be updated at least every two years in order to correctly reflect the technical and market circumstances of a CPA implementation.

Revenues:

Revenues from electricity sales will be calculated based on the following parameters and consideration:

The electricity generation will be based on the energy yield and net plant load factor as determined by a third party in line with the requirements under the *Guidelines for the reporting and validation of plant load factors*. The net plant load factor will be based on the P50 forecast and will include losses including but not limited to plant availability, maintenance, equipment degradation, etc.

The tariff used will not be higher than 2,850 ZAR/MWh. This is in line with para 5.1.4.5 of Part A of he *Request for qualification and proposals for new generation capacity under the IPP procurement programme*.

The following eligibility criteria with regard to project revenues will apply to CPAs included in the PoA:

Eligibility criteria 6.6: The CPA has used a tariff of not more than 2,850 ZAR/MWh in the investment analysis. This will be evidenced by the investment analysis spread sheet. The applicable tariff cap will be updated every two years or whenever the tariff is updated under the IPP procurement programme or other relevant government regulation, whichever occurs first.

Capital investment (CAPEX)

The total CAPEX per MW for the CPA shall be higher than the CAPEX amount reported by the International Renewable Energy Agency (IRENA)[29] for a typical solar PV project in the world, which is 3,000,000 USD/MW.[30] It is expected that if the capital investment gets lower than a typical project in the world, the project will be viable without CDM revenues. Currently, there are no large-scale operational solar photovoltaic power projects in Sub-Saharan Africa and, therefore, development and investment costs are expected to be higher due to uncertainties in development and construction phases.

CAPEX costs included in the calculation of the IRR will be derived from and be in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. The cost of the solar photovoltaic modules as well as the BoP costs will depend on the type of module used and will be evidenced by quotations from modules suppliers or contracts with modules suppliers. If at the time of the investment decision no quotations or contracts from modules suppliers are available, alternative evidences can be used including quotations or contracts from the same modules supplier for other projects in South Africa or email quotations. In the latter case (email), the conservativeness of the quotation will be cross-checked with quotations received after the date of the investment decision.

Additional CAPEX costs can be included to the investment analysis in case they are properly evidenced.

The following eligibility criteria with regard to CAPEX will apply to CPAs included in the PoA:

Eligibility criteria 6.7: The total CAPEX of the project is more than 3,000,000 USD/MW, taking into account CAPEX items being derived from and be in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by the investment analysis spread sheet. The applicable CAPEX threshold will be updated every two years.

Operating cost:

The total operating costs will be at least 10 USD/MWh. The threshold is based on experience and figures reported by the International Renewable Energy Agency (IRENA).[31] Currently, there is no public information available regarding operating costs for large-scale, solar PV projects in South Africa. This is due to the absence of large-scale, solar PV projects in South Africa. It is expected that some of the operating cost items will be lower than in the rest of the world but these cost gains will be offset by lack of experience and inefficiencies in the system. Therefore, the price ranges published by IRENA are considered appropriate for the South African context. Projects that have operating costs lower than 10 USD/MWh are expected to be commercially viable without the additional revenue from the CERs.

Operating costs will be estimated based on the provisions in Volume 4 – Financial requirements of the IPP Procurement Programme and will include:

- Costs related to land leases or land acquisition
- Service and warranty costs
- Operation and maintenance costs
- Administrative costs
- Costs related to socio-economic development

[29] IRENA, Renewable Energy Technologies: Cost Analysis Series for Solar PV (2012)
[30] Similar figures are reported by other sources such as the International Energy Agency (IEA) which establishes an investment costs of 4 USD/W for a utility scale and 6 USD/W for a small-scale in 2008. For 2009, the best system price reported in IEA countries was 3 USD/W. Source: International Energy Agency. Technology roadmap: Solar photovoltaic energy (Tech. Rep.). IEA (2010)
[31] Bazilian *et al.*, Reconsidering the economics of photovoltaic power.

Additional operating costs can be included to the investment analysis in case they are properly evidenced.

The following eligibility criteria with regard to operating costs will apply to CPAs included in the PoA:

Eligibility criteria 6.8: The total operating costs will be at least 10 USD/MWh, taking into account requirements regarding OPEX items in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This will be evidenced by the investment analysis spread sheet. The range of operating costs will be updated every two years.

Taxation and depreciation

Eligibility criteria 6.9: The CPA has used an income tax rate of 28% in the investment analysis, which is the South African tax rate. This will be evidenced by the investment analysis spread sheet. The tax rate will be updated every two years or whenever the income tax regulations in South Africa change, whichever occurs earlier.

Eligibility criteria 6.10: The CPA has applied the applicable depreciation rates in the investment analysis as provided by the South African regulations with regard to capital allowances. At the time of writing the PoA-DD. the capital allowance for energy infrastructure projects in South Africa was 50% for the first year of operation, 30% for the second year of operation and 20% for the third year of operation. The applicable depreciation will be updated every two years or whenever the applicable depreciation rates in South Africa change, whichever occurs earlier.

Exchange rates

Exchange rates provided by the South African government as part of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* will be used. Alternatively, the exchange rate reported by South African Reserve Bank on the date of the investment decision can be used. In case both are available, the most conservative one will be used.

Eligibility criteria 6.11: In terms of exchange rates, the exchange rates provided by the South African government as part of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* will be used. Alternatively, the exchange rate reported by South African Reserve Bank on the date of the investment decision can be used. In case both are available, the most conservative one will be used.

Sub-step 2d: Sensitivity analysis

Eligibility criteria 6.12: The CPA implementing entity will have carried out a sensitivity analysis on variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues. This will be evidenced in the investment analysis spread sheet. The sensitivity analysis will cover a range of +10% and -10%. The following parameters will be subject to sensitivity analysis:

- Investment cost
- Electricity generation
- Operating and maintenance cost
- Tariff

Eligibility criteria 6.13: The CPA implementing entity will have assessed at which parameter level the benchmark will be crossed and will have discussed the likelihood of those parameter levels to occur. This will be evidenced in the investment analysis spread sheet and specific CPA-DD.

Step 4: Common practice analysis

Eligibility criteria 6.14: In line with the *Tool for the demonstration and assessment of additionality*, it can be concluded that the CPA is not common practice as F is lower than 0.2 and $N_{all} - N_{diff}$ is lower than 3. The common practice analysis will be based on publicly availably data and information from NERSA, Eskom and/or the Department of Energy (DoE) or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.

14 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;

In accordance with the requirements of the National Environmental Management Act (Act No 107 of 1998) (NEMA), and relevant EIA regulations made in terms of this Act and promulgated in April 2006 (Government Notice No 385), and listed activities under (Government Notice No 386 and 387), the CPA type requires a full Scoping and Environmental Impact Assessment (EIA). The CME will therefore check whether the CPA has carried out an Environmental Impact Assessment in line with South African regulations.

Eligibility criteria 7.1: The CPA has carried out an Environmental Impact Assessment in line with South African regulations. This will be evidenced through the Environmental Authorisation (Record of Decision) from the Department of Environmental Affairs.

As part of the EIA process in South Africa, the project proponent has to carry out a public participation process including consultations with Interested and Affect Parties (IAP). The requirements for the public participation process go over and above the requirements for the CDM stakeholder consultation. Reports and records from the public participation process will be used as evidence that stakeholders have been consulted. The CPA may also decide to carry out and report on a separate CDM stakeholder consultation in line with the CDM requirements and (if available) DNA requirements.

Eligibility criteria 7.2: The CPA has carried out a stakeholder consultation meeting according to the CDM requirements and (if available) DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

14 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;

Eligibility criteria 8.1: In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

Eligibility criteria 8.2: In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

14 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);

Eligibility criteria 9.1: The CPA is connected to the South African grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

14 j. Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;

The PoA and CPAs do not involve sampling.

14 k. Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria6 and remains within those thresholds throughout the crediting period of the CPA;

The PoA and CPAs are not small-scale or micro-scale.

14 l. Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.

The PoA and CPAs are not small-scale or micro-scale.

B.3. Application of methodologies

The PoA will include grid-connected, greenfield wind power and solar PV projects.

All CPAs implemented under this PoA will apply the approved consolidated baseline and monitoring methodology ACM0002 *"Consolidated baseline methodology for grid-connected electricity generation from renewable sources"* (version 13.0.0).

Since the CPAs to be included in the PoA will be large-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each CPA. An electronic database will be established that contains general information regarding each CPA as well as data and information, which is monitored on a regular basis and which is used to determine emission reductions achieved by the CPA. The database will be accessible at any time for verification.

SECTION C. Management system

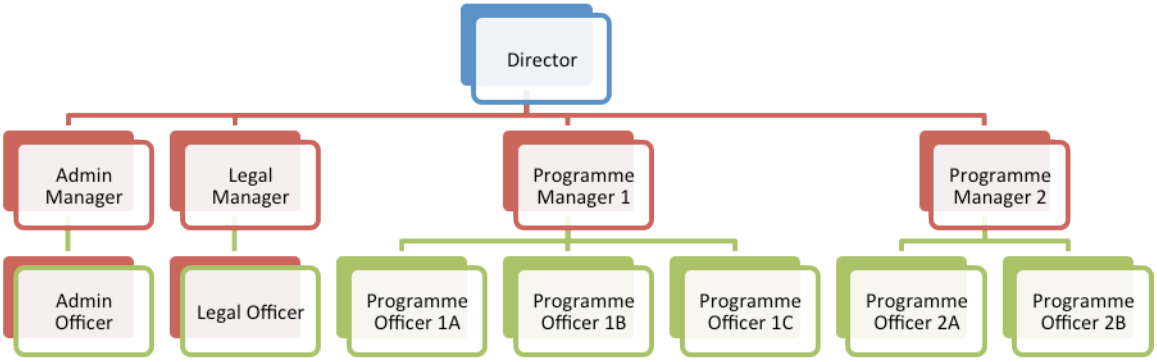
As per the *Clean Development Mechanism Project Standard* (version 01.0), paragraph 145, the CME shall establish and implement, and provide a description of the operational and management arrangements for the implementation of the proposed CDM PoA in accordance with requirements the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple technologies for programme of activities* (version 01.0). The following management system will be implemented by the CME for the inclusion of CPAs.

Roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies;

The CME of RECPA is Carbon Africa Limited. Carbon Africa shall provide the necessary managerial, technical, legal, communication and administrative functions to operate and manage the PoA in accordance with the CDM requirements, including the process of inclusion of CPAs. In the case where certain functions or tasks may be outsourced, the ultimate responsibility for final quality control and approval will remain with Carbon Africa as the CME.

Carbon Africa will assign one director-level staff member with signing authority to have overall responsibility for the management of the CME. The director will be supported by one or more Programme Managers and the legal and administrative managers of Carbon Africa. Programme Officers will in turn support the manager-level positions and undertake much of the direct work relating to the RECPA PoA Management and CPA Inclusion Manual.

An organogram of the CME management structure is shown below:



The detailed roles, responsibilities and competencies of people involved in the management of the CPA inclusion process are provided in the CME management manual, which has been shared with the DOE.

Records of arrangements for training and capacity development for personnel;

In order to ensure that CME personnel are able to improve their skills and competencies and retain relevant knowledge given the frequent changes to the CDM rules and requirements, staff will undergo a regular skills assessment (at least once every six months). This will be conducted through an internal review of skills and competency levels and an assessment of any outsourced third parties. All CME staff will be required to complete an evaluation form and present this to their respective managers. Based on the outcomes of an evaluation meeting, appropriate internal and external training sessions will be organized as necessary for the particular personnel requirements. After receiving training personnel will be required to circulate a report to the rest of the team as well as to the line manager. In this way, other CME staff will benefit and be kept abreast on relevant information required to ensure the CDM and PoA requirements are met.

Records of CME staff skills and competencies, completed staff evaluation forms and training reports will be stored by the respective managers in electronic form keeping in line with the file naming system described in the CME management manual.

Procedures for technical review of inclusion of CPAs;

The detailed procedures for the technical review of inclusion of CPAs has been included in the CME management manual which has been provided to the DOE.

A procedure to avoid double counting

Double counting could occur in case a CPA is included in more than one PoA or registered as a single CDM project or in case there is an overlap between two CPAs (e.g. overlap of two phases of a wind power project which have been developed as two separate CPAs).

In order to avoid double counting, the CME will take the following measures:

1. The CME will confirm that the CPA has not yet been included in another Programme of Activities or been registered as a single CDM project through:

- A signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single CDM project.
- A check by the CME on the CDM website that the project has not yet been included in another Programme of Activities or has been registered as a single CDM project. The check by the CME will be presented in a signed confirmation letter from the CME.

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:

- A project area map, including geographic coordinates, provided by the CPA Implementer. This will be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area. The check by the CME will be presented in a signed confirmation letter from the CME.

The above procedures will be performed by the responsible Programme Officer under the supervision of the Programme Manager, in cooperation with the Legal Manager. The Programme Officer will also give a name to the CPA that uniquely identifies the CPA in terms of location, technology and installed capacity.

In order to facilitate the avoidance of double counting, the Programme Officer will put in place, maintain and update a database of other Programme of Activities and single CDM project activities within the geographical boundary of RECPA. The database will include:

- Name of the PoA or single CDM project activity
- Geographical boundary of the PoA
- Geographical location of the CDM projects including geographical coordinates
- Technology applied and installed capacity of single CDM projects
- List of CPAs included in the PoA, with the name of the CPA, technology applied, installed capacity and geographical location of the CPA including geographical coordinates of the project location or project area

The Programme Officer will ensure that the information in the database is up to date and double check such against information on the CDM website before recommending inclusion of the CPA in the PoA. In this way the Programme Officer will be able to ensure that no double counting takes place.

Measures for continuous improvements of the PoA management system

In the course of the PoA lifetime, it is likely that some of those procedures included in the PoA Management and CPA Inclusion Manual will result in insufficient control of the CME management system. Therefore, the CME will update its processes and procedures with a view to improving them for better management system control. Any such improvements will be incorporated as soon as is reasonably possible and the Manual will be updated accordingly. This may include but is not limited to:

- Improved CME organization and structure
- Better personnel development and training procedures
- Updated document and data management and control processes
- Better internal and external communication

Quality control improvement

The CME shall also continually improve the effectiveness of the quality control system by:

- Communicating to staff the importance of meeting statutory and regulatory requirements
- Ensuring that quality objectives are established and putting in place more stringent procedures as required
- Conducting management reviews
- Ensuring the availability of resources

As the size of the RECPA grows with time and the CME structure and functions evolve, Carbon Africa may consider to apply more formal quality assurance and control procedures and processes such ISO 9001 and ISO 14064/65 to the PoA management system.

External review and feedback

In order to help achieve continual improvement, information and feedback will be solicited from CPA implementers. To this effect the Programme Manager and the Programme Officer responsible for a CPA will provide to and collect from CPA implementer a CME Assessment Form. The CME Assessment Forms will be circulated to them on an annual basis. Comments received will be taken into account to improve the CME management system.

CME management system improvement plan

A CME management system improvement plan will be developed based on the external inputs received above, CME staff comments and evaluations and the internal review undertaken by the Carbon Africa Board of Directors. It will be updated every 12 months, with details the actions to improve the management system based on analysis of the feedback received. The plan will include targets for improved performance in the future. A designated CME Programme Manager shall prepare and update the plan that will be approved by the Carbon Africa Board of Directors.

At the end of the first crediting period of the PoA, new CME management processes and procedures that have been adopted will be included in the updated PoA-DD.

Record keeping system for each CPA under the PoA

The CME will develop and maintain an electronic database, which will contain essential data and information about each CPA, including:

1. General information about CPA:
    - CPA Name
    - Name and contact details of the entity implementing the CPA
    - Geographical location of the CPA (GPS coordinates)
    - Technology employed by the CPA and installed capacity
    - Commissioning date
    - Start date of the CPA
    - Crediting period
    - Start and end date of crediting period
    - Operational lifetime
    - Verification status (number of verification and associated monitoring period)
    - Emission reductions monitored and issued each monitoring period
2. Supporting evidence for each eligibility criterion to demonstrate that the CPA meets all the eligibility criteria for inclusion into the PoA.
3. Data and information regarding the monitoring of emission reductions achieved by the CPA in line with the monitoring plan as formulated in the PoA-DD

General information regarding the CPA as well as supporting evidence for the inclusion of the CPA will be entered once into the database at the start of the implementation of the CPA. Data and information regarding monitoring of greenhouse gas emissions will be entered on a regular basis as per the requirements of the monitoring plan. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period.

The programme officer appointed by the CME will be responsible for entering, updating and maintaining data and information regarding CPAs into the electronic database.

PoA subscription

Each CPA will enter into a PoA Participation Agreement with the CME. The PoA Participation Agreement will include a confirmation that the entity implementing the CPA is aware and agrees that the CPA is being subscribed to the PoA.

SECTION D. Duration of PoA

D.1. Start date of PoA

In line with the *Glossary of CDM terms* (version 07), the start date of the PoA is 02/06/2012 which is the start date of the validation of this PoA, i.e. the date when the PoA has been uploaded on the UNFCCC website for Global Stakeholder Consultation (GSC). The start date of any future CPA is not, or will not be, prior to the start date of the PoA, therefore prior to the commencement of the validation of the PoA.

D.2. Length of the PoA

28 years

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

Environmental Analysis, including an Environmental Impact Assessment, if required by South African legislation for that specific type of project activity, will be done at the CPA level because each individual renewable energy project (CPA) is expected to have different local impacts and environmental regulations will be different depending on the location and type of project to be implemented

E.2. Analysis of the environmental impacts

Not applicable. Environmental analysis is carried out at the CPA level.

E.3. Environmental impact assessment

Not applicable. Environmental analysis is carried out at the CPA level.

SECTION F. Local stakeholder comments

F.1. Solicitation of comments from local stakeholders

The stakeholder consultations are held at CPA level, because of the different circumstances and conditions of every social environment in which each CPA is located.

F.2. Summary of comments received

Not applicable. Stakeholder consultation is done at the CPA level.

F.3. Report on consideration of comments received

Not applicable. Stakeholder consultation is done at the CPA level.

SECTION G. Approval and authorization

At the time of submission of this PoA-DD for Global Stakeholder Consultation, the Letter of approval was not available. However, the LoA has been issued by the South African DNA on 31/10/2012.

PART II. Generic component project activity (CPA)

CPA TYPE I: GREENFIELD WIND POWER PLANTS/UNITS IN SOUTH AFRICA APPLYING FIRST-OF-ITS-KIND BARRIER

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The CPA will involve the implementation and operation of a wind power plant implemented at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield project). The project activity will generate electricity from renewable sources, which will be fed into South Africa's national electricity grid, replacing fossil fuel based electricity generation. By this replacement, the project activity will lead to emission reductions.

The CPA is being pursued as a component of the PoA "Renewable Energy Carbon Programme for Africa (RECPA)" with Carbon Africa Limited as the CME.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

The CPA will apply approved consolidated baseline and monitoring methodology ACM0002 (version 13.0.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*.

ACM0002 version 13.0.0 also refers to the latest versions of the following tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool for the demonstration and assessment of additionality (version 07.0.0)*
- *Combined tool to identify the baseline scenario and demonstrate additionality (version 04.0.0)*
- *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 02)*

The CPA will only apply the *Tool to calculate the emission factor for an electricity system (version 02.2.1)* and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*. The *Combined tool to identify the baseline scenario and demonstrate additionality (version 04.0.0)* will not be used, as there is no need to use that tool to describe the baseline scenario. The *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 02)* will also not be used since the CPA will not generate CO2 emissions from fossil fuel combustion for its operations.

B.2. Application of methodology(ies)

The generic CPA meets the applicability criteria listed in the approved consolidated baseline and monitoring methodology ACM0002 (version 13.0.0) as shown below:

Applicability criteria	Generic CPA justification
This methodology is applicable to grid-connected renewable power generation project activities that: (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the	CPAs will consist of wind power projects connected to the South African grid that install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield

project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	plant)
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The CPA will install a wind power plant, an eligible technology type under this methodology.
In the 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 period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	n/a. CPAs under this PoA are greenfield projects.
In case of hydro power plants one of the following conditions must apply: • The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or • The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2; or • The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2.	n/a. CPAs consist of wind projects, not hydro power plants.
In case of hydro power plants using multiple	n/a. CPAs consist of wind projects, not hydro power

reservoirs where the power density of any of the reservoirs is lower than 4 W/m2 all of the following conditions must apply: • The power density calculated for the entire project activity using equation 5 is greater than 4W/m^2; • Multiple reservoirs and hydro power plants are located at the same river and where are designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant; • Water flow between the multiple 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 a 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.	plants.
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 result in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2	n/a. CPAs under the PoA do not consist of: (i) switching from fossil fuels to renewable energy sources at the site of the project activity, (ii) biomass fired power plants, (iii) a hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2.
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power	n/a, CPAs under this PoA are greenfield projects.

generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	

The project activities will meet the applicability of the *Tool to calculate the emission factor for an electricity system* as follows:

This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	CPAs under the PoA will supply electricity to the South African national electricity grid.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is only located in South Africa as explained in section B.6.1 of Part II of the PoA-DD, Calculation of $EF_{grid,CM,y}$, step 1. South Africa is not an annex I country.

The compliance of each CPA included in the PoA with the applicability criteria of ACM0002 (version 13.0.0) and associated tools will be ensured through eligibility criteria 5.

B.3. Sources and GHGs

The spatial extent of the project boundary will include the project power plant, the substation or connection point to the electricity system, and all power plants connected physically to the electricity system that the CDM project power plant is connected to (i.e. South African electricity grid operated by Eskom). The project activity will therefore displace electricity generated by South African fossil fuel grid-connected power plants and will therefore lead to emission reductions of CO2. The emissions sources and greenhouse gases included in the boundary for the purpose of calculating project emissions and baseline emissions for wind energy CPAs are provided in the table below:.

	Source	GHGs	Included?	Justification/Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam	CO_2	No	This PoA does not involve geothermal power plants therefore no emissions are included
		CH_4	No	This PoA does not involve geothermal power plants

				therefore no emissions are included
		N_2O	No	This PoA does not involve geothermal power plants therefore no emissions are included
	CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
		CH_4	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
		N_2O	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
	For hydro power plants, emissions of CH4 from the reservoir	CO_2	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included
		CH_4	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included
		N_2O	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included

The figure below presents a flow diagram physically delineating the project boundary of a typical wind energy CPA.

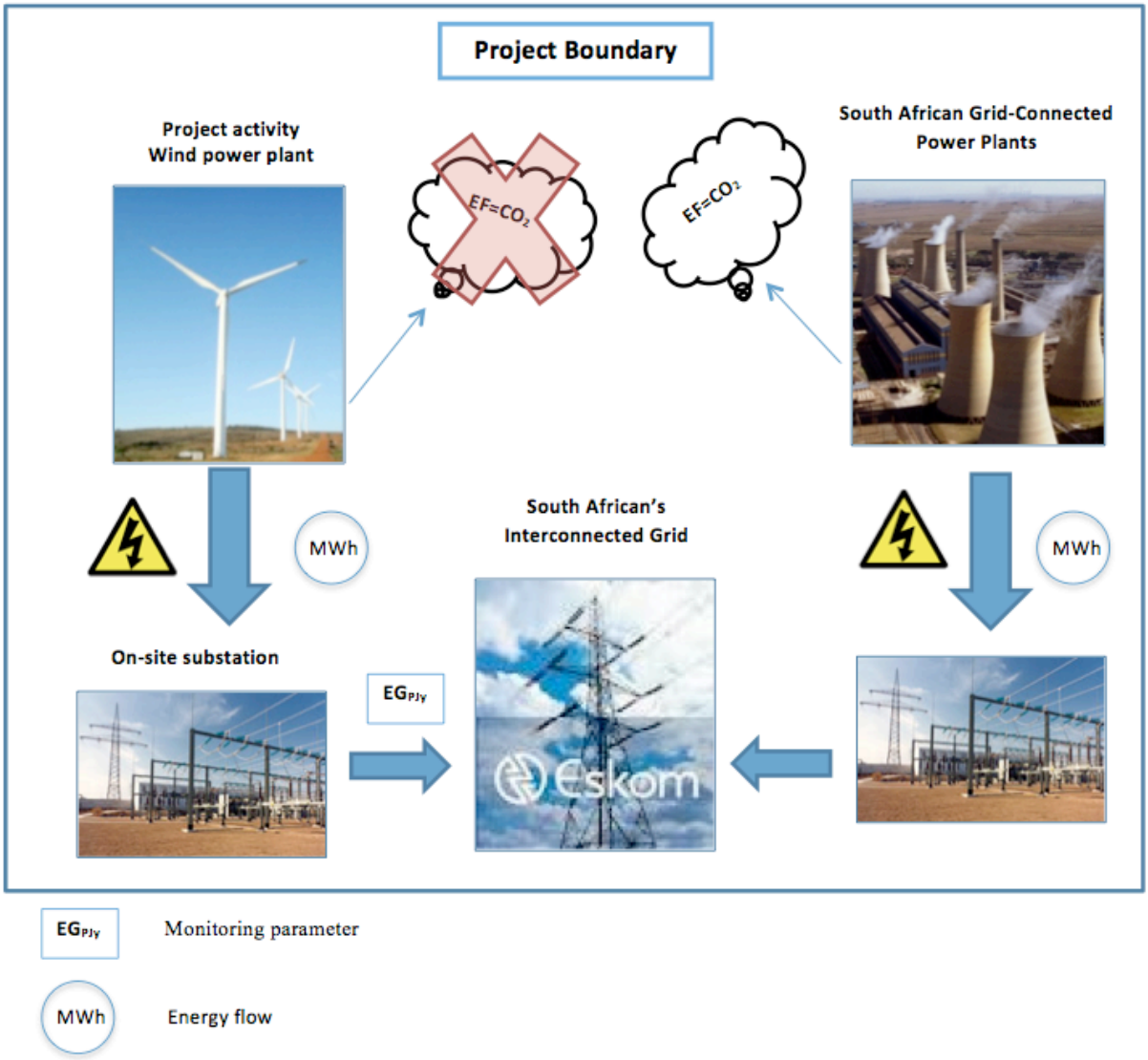


Figure 7: Flow diagram for wind power project

B.4. Description of baseline scenario

In accordance with approved consolidated baseline methodology ACM0002 (version 13.0.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*, the baseline scenario for the installation of new grid-connected renewable power plant/units is "the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculated the emission factor for an electricity system".

The South African baseline scenario is further described below.

Structure of the South African Power Sector

The South African Department of Energy (DoE) is the legislative entity responsible for the South African energy sector. The energy sector is regulated by the *National Energy Act of 2008 (No.34 of 2008)*[32].

Specifically for the electricity sector of South Africa, the *Electricity Regulation Act of 2006 (No. 4 of 2006)*[33] determines the framework of the electricity sector. In May 2011, the Department of Energy, acting as the legislative entity, amended the *Electricity Regulations on New Generation Capacity*[34] under the *Electricity Regulation Act of 2006.* According to the current regulation, 70% of the new generation capacity must be implemented by the state-owned utility company Eskom, and 30% by Independent Power Producers (IPPs).[35] The Department of Energy has the mandate to decide which planned capacity addition will be implemented by Eskom, and which will be determined by a bidding process between IPPs. However, all IPPs are mandated to sell the generated electricity to Eskom (Single-Buyer-Model) through the signing of long-term Power Purchase Agreements (PPAs) with Eskom.

The Department of Energy determines the needed capacity additions after consultation with the National Energy Regulator of South Africa, NERSA. The DoE regularly develops an "*Integrated Resource Plan for Electricity"* which is updated every two years, the latest one being the *"Integrated Resource Plan 2010-2030 for Electricity"*[36] under the *Electricity Regulation Act No. 4 of 2006.* In its current version, from the year 2011, the Integrated Resource Plan determines the proposed specific amount of each technology in the electricity generation from 2010 to 2030.

Apart from the Department of Energy (DoE) and the National Energy Regulator of South Africa (NERSA), Eskom is the main player in the South African power sector. From 2002, Eskom became a public, limited liability company wholly owned by the government. Eskom owns and operates the National Electricity Grid and parts of the distribution network, and also owns 93% of the installed generation capacity.

[32] Department of Energy (2008), National Energy Act of 2oo8 http://www.info.gov.za/view/DownloadFileAction?id=92826, accessed on 30.12.2011
[33] Department of Energy (2006), Electricity Regulation Act of 2006, http://www.info.gov.za/view/DownloadFileAction?id=67855, accessed on 30.12.2011
[34] Department of Energy (2011), Electricity Regulations on New Generation Capacity, http://www.sapvia.co.za/electricity-regulations-on-new-generation-capacity-4-may-2011/, accessed on 30.12.2011
[35] Department of Energy, http://www.energy.gov.za/files/electricity_frame.html, accessed on 30.12.2011
[36] Department of Energy (2011), Electricity Regulations on the Integrated Resource Plan 2010-2030, http://www.info.gov.za/view/DownloadFileAction?id=146082, accessed on 30.12.2011

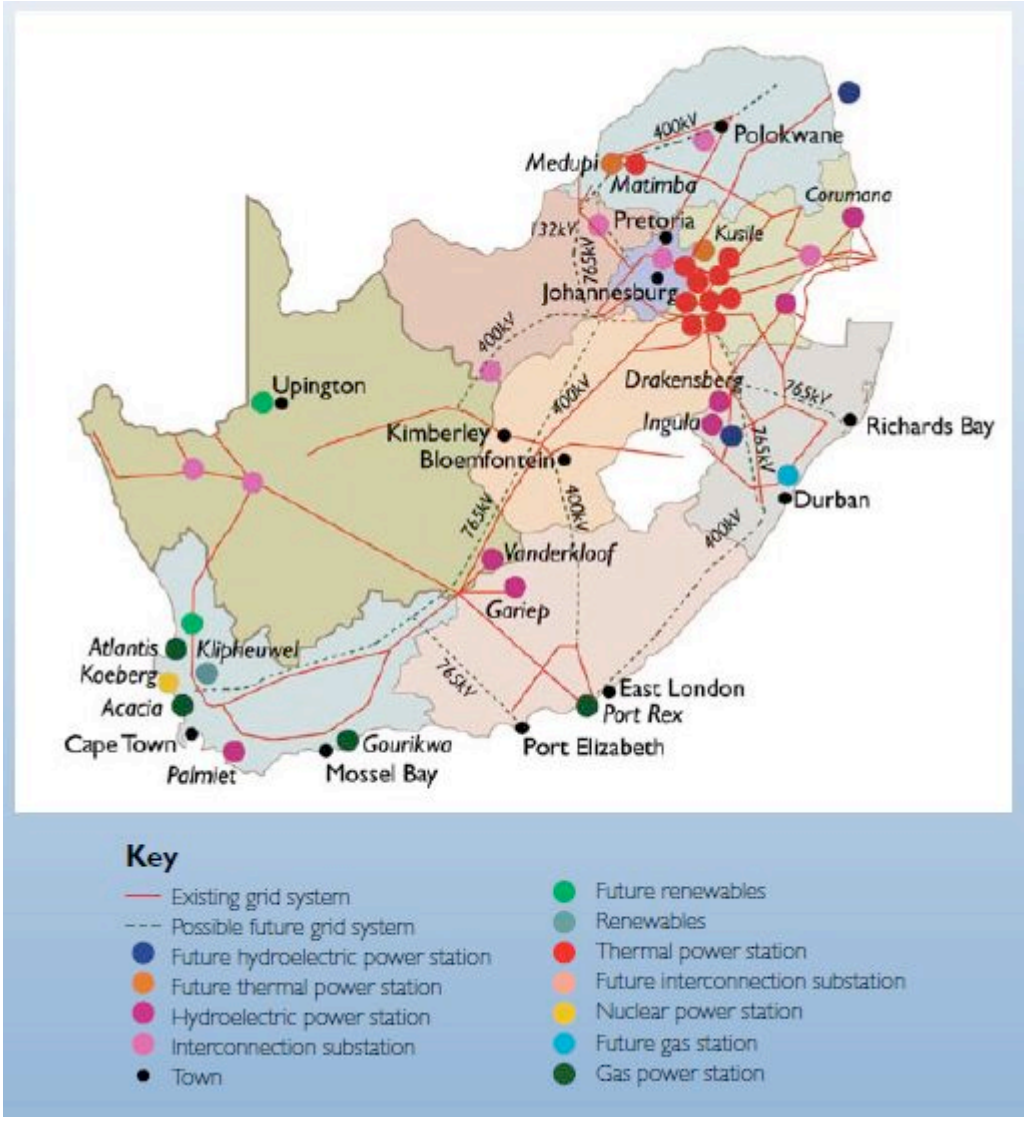


Figure 8. South African Power Sector

Generation

Electricity generation in South Africa is dominated by Eskom, which owns 93% of the installed capacity and supplies about 95% of South Africa's electricity. Municipal owned power plants and IPPs supply the remaining 5% of electricity. Approximately 90% of the total generated electricity is based on coal.[37]

Detailed description of the installed capacity for each technology is presented in the following tables. Data from Eskom's power plants is dated from 2011.[38] The latest published data for IPPs and municipal generation is from 2006[39].

[37] NERSA (2006), 2006 Electricity Supply Statistics for South Africa, http://www.nersa.org.za/Admin/Document/Editor/file/News%20and%20Publications/Publications/Current%20Issues/Electricity%20Supply%20Statistics/Electricity%20supply%20statistics%202006.pdf , accessed on 30.12.2011

[45]ESKOM (2011), Integrated Report 2011, http://financialresults.co.za/2011/eskom_ar2011/index.php, accessed on 30.12.2011

[39] NERSA (2006), 2006 Electricity Supply Statistics for South Africa, http://www.nersa.org.za/Admin/Document/Editor/file/News%20and%20Publications/Publications/Current%20Issues/Electricity%20Supply%20Statistics/Electricity%20supply%20statistics%202006.pdf accessed on 30.12.2011

Table 3. Eskom Electricity Generation Capacity

Installed Eskom capacity by source 2011	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	37,745	35,052
Gas	2,426	2,409
Hydro	661	600
Nuclear	1,910	1,830
PSHSP	1,400	1,400
Wind	3.16	3.16

Table 4. Municipalities Electricity Generation Capacity

Installed municipal capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,323	536
Gas	334	122
Hydro	4	-
PSHSP	189	174

Table 5. IPP Electricity Generation Capacity

Installed private capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,339	933
Bagasse / Coal Fired Stations	105	66
Hydro	10	-
Wind	7	7
Waste Water / Biogas	4.25	4.25
Landfill	5	5

Municipal power plants are mostly coal thermal power plants and gas power plants which generate electricity for the direct supply in their municipal distribution area. Many municipalities own their own distribution networks, and some of them add generation capacity to their distribution lines by adding their own power plants on top of the electricity purchased from the national grid. Power plants operated by IPPs are commonly based on coal/bagasse. Some of the IPP owned power plants generate electricity for on-site consumption (large industrial consumers) and only feed electricity into the grid in the case of excess generation.

Currently, there are only three wind power plants connected to the grid. The 3.16 MW Klipheuwel Wind Farm which is owned by Eskom, the 5.2 MW Darling Wind Farm and the 1.8 MW Coega Wind Farm, which are IPP's owned by private investors. These plants have been developed as demonstration projects.

In terms of installed capacity, coal power plants' share is about 85% followed by electricity generation based on gas (6%), nuclear (4%) and pumped storage hydro power plants (3%). Pumped storage plants are net consumers of electricity, which pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas, etc. are negligible.

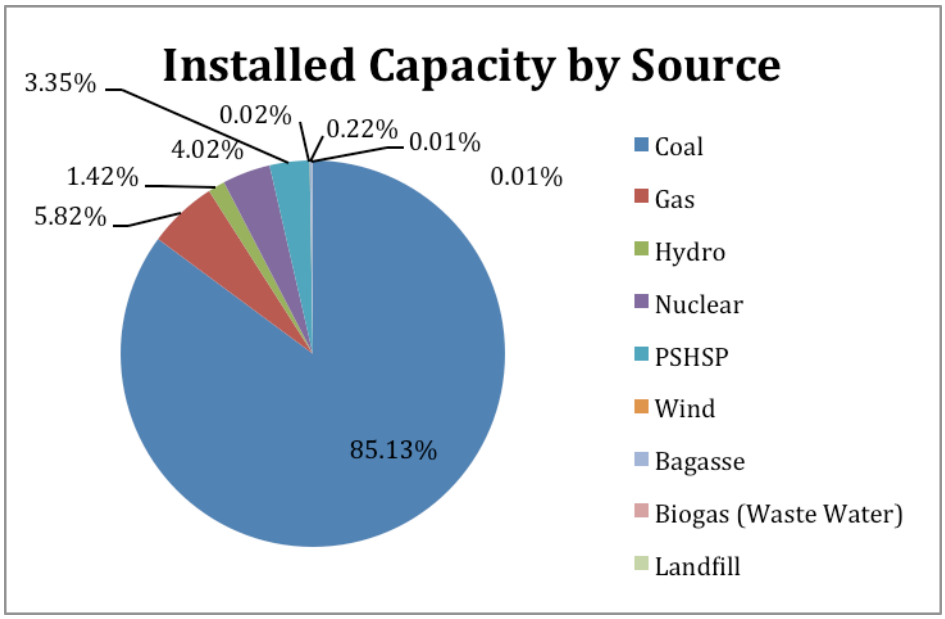


Figure 9: Installed capacity by source

The *Integrated Resource Plan 2010-2030 for Electricity,* which determines the needed capacity and share of technologies in the future proposes the following capacity additions until 2030: [40]

Table 6. Summary of capacity additions 2010-2030

	Total Capacity by year 2030		**Capacity added (including committed) from 2010 to 2030**		**New (uncommitted) capacity options from 2010 to 2030**	
	MW	**%**	**MW**	**%**	**MW**	**%**
Coal	41,071	45.9	16,383	29.0	6,250	14.7
OCGT	7,330	8.2	4,930	8.7	3,910	9.2
CCGT	2,370	2.6	2,370	4.2	2,370	5.6
Pumped Storage	2,912	3.3	1,332	2.4	0	0.0
Nuclear	11,400	12.7	9,600	17.0	9,600	22.6
Hydro	4,759	5.3	2,659	4.7	2,609	6.1
Wind	9,200	10.3	9,200	16.3	8,400	19.7
CSP	1,200	1.3	1,200	2.1	1,000	2.4
PV	8,400	9.4	8,400	14.9	8,400	19.7
Other	890	1.0	465	0.8	0	0.0
Total	**89,532**		**56,539**		**42,539**	

The current installed capacity of 47,465 MW is therefore expected to double up to 89,532 MW by the year 2030 in order to meet the estimated rising electricity demand in the country, which is expected to have a peak demand of 80,272 MW by then. Apart from the domestic generation, the Integrated Resource Plan 2010-2030 for Electricity forecasts increasing imports of electricity generated from hydro power plants located in Zambia and Mozambique from 2022 onwards. However, the Integrated Resource Plan for Electricity also mentions that in order to reach this objective cross-border negotiations and an upgrade in transnational transmission infrastructure would be necessary. Additional risks regarding imports are delays from hydro power plants in the construction of the power plants and long-lasting droughts.

[40] Department of Energy (2011), Electricity Regulations on the Integrated Resource Plan 2010-2030, http://www.info.gov.za/view/DownloadFileAction?id=146082, accessed on 30.12.2011

The Integrated Resource Plan for Electricity also forecasts the continuation of the current power shortage until the year 2016 when newly installed power plants in line with Integrated Resource Plan 2010-2030 for Electricity will start operation.

B.5. Demonstration of eligibility for a generic CPA

14 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

Eligibility criteria 1: The geographic boundary of the CPA is located in South Africa. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in South Africa (an EIA license for a proposed CPA issued by the South African authorities would automatically imply that the CPA is located in South Africa).

14 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Eligibility criteria 2.1: The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

Eligibility criteria 2.2: The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

Eligibility criteria 2.3: The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

Eligibility criteria 2.4: The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in South Africa. This will be evidenced by a signed confirmation letter from the CME.

14 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;

Eligibility criteria 3.1: The CPA involves the implementation of a wind power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

Eligibility criteria 3.2: The turbine technology shall be certified to IEC 61400 standard in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme*. This will be evidenced by the IEC 61400 certificate. If at the time of the inclusion of the CPA, the IEC 61400 certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria according to ACM0002 version 13.0.0:

Eligibility criteria 3.3: The installed capacity of the CPA will be minimal 1 MW and not more than 140MW per grid connection point. This is in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* which requires that "Projects must have a minimum installed capacity of 1 MW and, in order to limit congestion on the grid connections to the Transmission or Distribution System, have a maximum installed capacity of 140 MW for a single grid connection point assuming that the connection point can facilitate such capacity". The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

Eligibility criteria 3.4: The CPA will have a net load factor between 16.2% and 49.6% based on the P50 forecast. Net load factors are a function of wind speeds, the type of wind turbine and losses in the system. The range is based on projects that have been registered under the CDM (or are in the pipeline) and, therefore, provides a realistic range of circumstances under which a wind projects can be developed. The P50 forecast is in line with the requirement in Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme,* para 2.6.1.5

Eligibility criteria 3.5: The CPA will have an average wind speed between 5-11 m/s at hub height based on 12 months of measurement data reported by an independent third party. This wind speed is considered as representative of the South Africa's context when compared to available studies[41][42] and it is generally considered that project below that range are not commercially viable as per industry standards.

14 d. Conditions to check the start date of the CPA through documentary evidence;

Eligibility criteria 4: The start of the CPA occurs after 02/06/2012. This will be evidenced by the EPC contract, contract with the turbine supplier or other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 02/06/2012.

14 e Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs

Eligibility criteria 5: The CPA has confirmed its compliance with the applicability of ACM0002, version 13.0.0 in section D.2 of the F-CDM-CPA-DD.

14 f The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;

Step 0: Demonstration whether the proposed CPA is the first-of-its-kind

In accordance with the *Guidelines on additionality of first-of-its-kind project activities (*version 02, EB 69, Annex 7), a CPA is considered as its first-of-its-kind if:

> (a) The project is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier;

[41] Mesoscale wind atlas of South Africa. Kilian Hagemann. University of Cape Town. November 2008
[42] First verified numerical wind atlas for South Africa, DTU Wind Energy, Technical University of Denmark

(b) The project implements one or more of the measures;

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

Output is goods/services produced by the project activity including, among other things, heat, steam, electricity, methane, and biogas unless otherwise specified in the applied methodology.

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

(a) Energy source/fuel (example: energy generation by different energy sources such as wind and hydro and different types of fuels such as biomass and natural gas);

(b) Feed stock (example: production of fuel ethanol from different feed stocks such as sugar cane and starch, production of cement with varying percentage of alternative fuels or less carbon-intensive fuels);

(e) Size of installation (power capacity)/energy savings:

(i) Micro (as defined in paragraph 24 of decision 2/CMP.5 and paragraph 39 of decision 3/CMP.6);
(ii) Small (as defined in paragraph 28 of decision 1/CMP.2);
(iii) Large.

As per eligibility criteria 1 the CPA has already evidenced that it is located within the geographical boundary of South Africa. The applicable geographical area is therefore the host country South Africa. As per eligibility criteria 3.1, the CPA has also evidenced that it involves the use of wind energy, a renewable energy, which is one of the applicable measures as per paragraph 2 of the *Guidelines on additionality of first-of-its-kind project activities.* For CPAs to be included in the PoA, output is defined as electricity generation being fed into the South African national grid.

Eligibility Criteria 6.1: The CME has confirmed that the CPA is applying a technology which is different from any other project in South Africa that supplies electricity to the South African national grid and has started commercial operation before the PoA-DD and specific CPA-DD was published for Global Stakeholder Consultation[43], or before the inclusion of the CPA in the PoA or before the start date of the CPA (as defined in eligibility criterion 4), whichever is applicable and earlier. This will be evidenced by a comparison with all grid-connected power plants located in South Africa based on data, which has been made available by NERSA, Eskom and/or the Department of Energy (DoE) or any other credible source.

Eligibility Criteria 6.2: The project participants selected a crediting period for the CPA that is a maximum of 10 years with no option of renewal. This will be evidenced as per section A.9 of the CPA-DD.

If the proposed CPA is the first-of-its-kind as shown above, its additionality is demonstrated in accordance with paragraph 6 of the *Guidelines on additionality of first-of-its-kind project activities*.

In line with the requirements under ACM0002 (version 13.0.0) the eligibility criteria related to costs, revenues and investment climate are also applicable to CPAs applying the first-of-its-kind argument.

[43] Only applicable for the first specific CPA, which is uploaded for Global Stakeholder Consultation together with the PoA-DD

Those shall be updated at least every two years in order to correctly reflect the technical and market circumstances of a CPA implementation.

Eligibility criteria 6.3: The CPA has applied for a tariff of not more than 1,150 ZAR/MWh in accordance with the current threshold of the IPP procurement programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence, or, if not available at the time of CPA inclusion, confirmation in the PoA participation agreement or in a confirmation letter signed by the CPA implementing entity, that the CPA implementing entity will comply with relevant provisions in the IPP procurement programme, including the provisions related to the electricity tariff. The applicable tariff cap will be updated every two years or whenever the tariff is updated under the IPP procurement programme or other relevant government regulation, whichever occurs first..

Eligibility criteria 6.4: The total CAPEX of the project is more than 1,250,000 Euro/MW taking into account CAPEX items being derived from and be in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence used to estimate the CAPEX. The applicable CAPEX threshold will be updated every two years.

Eligibility criteria 6.5: The total operating costs will be at least 12 EUR/MWh, taking into account requirements regarding OPEX items in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence used to estimate the operating costs. The range of operating costs will be updated every two years.

Eligibility criteria 6.6: In its submission to become an Independent Power Producer under the IPP Procurement Programme, the CPA has considered or will consider all relevant regulations and provisions with regard to financial flows, taxes, tariffs, depreciation and power purchase agreements applicable in South Africa at the time of the submission. This is evidenced by documentation submitted to the South African Department of Energy (DoE), to financing entities and equity investors, or, if not available at the time of CPA inclusion, confirmation in the PoA participation agreement or in a confirmation letter signed by the CPA implementing entity, that the CPA implementing entity will consider the relevant investment climate in terms of financial flows, taxes, tariffs, depreciation and power purchase agreements applicable in South Africa. The CME will confirm he investment climate parameters and update them every two years.

14 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;

Eligibility criteria 7.1: The CPA has carried out an Environmental Impact Assessment in line with South African regulations. This will be evidenced through the Environmental Authorisation (Record of Decision) from the Department of Environmental Affairs.

Eligibility criteria 7.2: The CPA has carried out a stakeholder consultation meeting the CDM requirements and (if available) DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

14 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;

Eligibility criteria 8.1: In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

Eligibility criteria 8.2: In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

14 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);

Eligibility criteria 9.1: The CPA is connected to the South African grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The CPA will focus on grid-connected renewable electricity generation from wind energy. The PoA will include project activities that install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant).

Project emissions

This CPA includes wind power projects. Therefore, project emissions are zero ($PE_y = 0$).

Baseline Emissions

Baseline emissions include CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The baseline emissions are to be calculated as follows **(equation 6)**:

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

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2/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 emission factor for an electricity system" (tCO2/MWh)

Calculation of $EG_{PJ,y}$

CPAs under the PoA involved the installation of new grid-connected renewable energy power plants/units at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield projects), therefore $EG_{PJ,y}$ is estimated as per option a, **equation 7**:

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

Where:

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

year *y* (MWh/yr)

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

The emission factor is calculated in a transparent and conservative manner using the combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).

The procedures applied to calculate the grid emission factor for the South African electricity system are described as shown below and will be fixed at PoA level and updated after every seven year crediting period of the PoA. Equations and fixed parameter values to calculate the grid emission factor for South Africa are provided below.

Step 1. Identify the relevant electric power system
For calculating the grid emission factor, the project activity has identified the South African national grid as the relevant project electricity system.

The identification of the South African national grid as the relevant project electricity system is based on the following arguments:

- The South African DNA has not published a delineation of the project electricity system and connected electricity system.
- There are not spot markets in the South African electricity system.
- Although the South African grid is connected to a number of its neighboring countries' grids including Lesotho, Namibia, Swaziland, Botswana and Mozambique, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary.
- Finally, South Africa does not have a layered dispatch system and only one grid system serves the entire country. Therefore, and in line with version 02.2.1 of the *Tool to calculate the emission factor for an electricity system*, the national grid definition is used by default.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)
The project activity has selected Option I and only grid power plants were included in the calculation.

Step 3. Select a method to determine the operating margin (OM)
The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

a) Simple OM
b) Simple adjusted OM
c) Dispatch data analysis OM
d) Average OM

In South Africa, low-cost/must-run resources constitute more than 50% of total grid generation. Apart from hydro, wind, and nuclear power plants, most coal-fired power plants have to be considered as low-cost/must-run as:

- Coal used in South African power plants is a cheap resource compared to other technologies e.g. natural gas/kerosene because South Africa is the 6th largest producer of coal in the world with

one of the lowest coal prices in the world.[44]

- Coal power plants in South Africa have an average capacity factor higher than 75%. In line with international common practice, power plants with a capacity factor higher than 75% are considered as base-load power plants which are usually dispatched independently of the daily or seasonal load. Furthermore, Eskom Holdings Annual Report 2011 defines most of the coal power plants as baseload plants.

Because low-cost/must-run resources constitute more than 50% of the total grid generation, the simple OM method cannot be used. Therefore, the project activity has selected the average OM method for calculating the operating margin.

In terms of data vintage, the project will use the *ex ante* option, and the emission factor is determined once at the validation stage based on a 3-year generation weighted average based on the most recent data available at the time of submission of the CDM-PoA-DD to the DOE for validation.

Step 4: Calculate the operating margin emission factor according to the selected method
The average OM emission factor ($EF_{grid,OM\text{-}ave,y}$), is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under (a) for the simple OM, but also including the low-cost/must-run power plants in all equations.

The average OM emission factor is calculated using **equation 1** from option A:

$$EF_{grid,OM-ave,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,OM\text{-}ave,y}$	=	Average operating margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
m	=	All grid power units serving the grid in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

For grid power plants, $EG_{m,y}$ is based on published records from Eskom and CDM monitoring reports for the CDM power plants. The grid emission factor calculations are based on the publicly available data in South Africa, i.e. Eskom power plants and CDM projects. This represents 95% of the total electricity generated. Electricity generated from Independent Power Producers and Municipality owned power plants is not available, therefore it could not be included in this calculation. However it only represents less than 5% of the total electricity generated. For the CDM projects, three years of public available data is not available, therefore, generation has been estimated based on available monitoring reports for a

[44] The future of South African coal; Market Investment and Policy changes –Anton Eberhard

shorter period of time. However, it is considered to be more conservative to include an estimate for the electricity generation for the CDM projects than to assume that there was no electricity generation by the CDM projects for the years during which no data was available. Based on the number of months and the electricity generation reported in the monitoring report, the electricity generation has been first calculated per month and then the estimated the annual electricity generation. The table below summarizes the electricity generation for the various power plants connected to the electricity grid.

		Generation Data (*MWh*)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Amot	Coal	11,987,281	13,227,864	12,194,878
Camden	Coal	6,509,079	7,472,070	7,490,836
Duvha	Coal	21,769,489	22,581,228	20,267,508
Grootvlei	Coal	1,249,556	2,656,230	3,546,952
Hendrina	Coal	12,296,687	12,143,292	11,938,206
Kendal	Coal	23,841,401	23,307,031	25,648,258
Komati	Coal	-	1,016,023	2,060,141
Kriel	Coal	18,156,686	15,906,816	18,204,910
Lethabo	Coal	23,580,232	25,522,698	25,500,366
Majuba	Coal	22,676,924	22,340,081	24,632,585
Matimba	Coal	26,256,068	27,964,141	28,163,040
Matla	Coal	21,863,400	21,954,536	21,504,422
Tutuka	Coal	21,504,122	19,847,894	19,067,501
Acacia	Gas (Jet kerosene)	-	971.00	992.00
Port Rex	Gas (Jet kerosene)	-	322.00	5,507.00
Ankerlig	Gas/Diesel Oil	-	6,303.00	-
Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-
Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,764,661**	**228,828,053**	**232,394,838**

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

Because data on fuel consumption and electricity generation of the grid-connected units is available, Option A1 is used to determine the emission factors of the grid power units. However, for Acacia, Port Rex, Ankerlig, Gourikwa only data on electricity generation and fuel type is available for the year 2009-2010, thus Option A2 is used instead for those four power plants.

Option A1:

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	=	All grid power units serving the grid in year *y*
i	=	All fossil fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Option A2:

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO2 emission factor of fossil fuel type *i* in power unit *m* in year *y* (tCO2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency in power unit *m* in year *y* (ratio)
m	=	All grid power units serving the grid in year *y*
i	=	All fossil fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

The following table summarizes the published data on fuel consumption from the power plants:

		$FC_{i,m,y}$ (kg/year)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Amot	Coal	6,395,805,000	6,794,134,000	6,525,670,000
Camden	Coal	3,876,211,000	4,732,163,000	4,629,763,000
Duvha	Coal	11,393,553,000	11,744,606,000	10,639,393,000
Grootvlei	Coal	674,538,000	1,637,371,000	2,132,979,000
Hendrina	Coal	7,122,918,000	6,905,917,000	7,139,198,000
Kendal	Coal	15,356,595,000	13,866,514,000	15,174,501,000
Komati	Coal	0	664,497,000	1,271,010,000
Kriel	Coal	9,420,764,000	8,504,715,000	9,527,185,000
Lethabo	Coal	16,715,323,000	18,170,227,000	17,774,699,000
Majuba	Coal	12,554,406,000	12,261,833,000	13,020,512,000
Matimba	Coal	13,991,453,000	14,637,481,000	14,596,842,000
Matla	Coal	12,689,387,000	12,438,391,000	12,155,421,000
Tutuka	Coal	11,231,583,000	10,602,839,000	10,191,709,000
Acacia	Gas (Jet kerosene)	0	0	347,066.46
Port Rex	Gas (Jet kerosene)	0	0	219,913.98
Ankerlig	Gas/Diesel Oil	0	0	0
Gourikwa	Gas/Diesel Oil	0	0	0

For the Acacia and Port Rex power stations, data on fuel consumption published was in litre units. In order to convert these values to kg/ year, the density of the fuel in kg/l as shown below multiplied the values as indicated below:

Plant Name	**Fuel** ***(litres/year)***			**Density** ***(kg/l)***	**Fuel** ***(kg/year)***		
	2008-2009	***2009-2010***	***2010-2011***		***2008-2009***	***2009-2010***	***2010-2011***
Acacia	0	0	444,957	0.78	0	0	347,066.46
Port Rex	0	0	281,941	0.78	0	0	219,913.98
Ankerlig	0	0	0	0.82	0	0	0
Gourikwa	0	0	0	0.82	0	0	0

For the calculation of the individual power plants emission factors, the following net calorific values and average emission factors for the fuels have been considered:

Type	***NCV (GJ/kg)***	$EF_{co2,i,y}$ (tCO2/GJ)
Coal (Other bituminous coal)	0.0199	0.0895
Gas (Jet kerosene)	0.0420	0.0697
Gas/Diesel Oil	0.0414	0.0726

Finally, for Option A2 power plants for year 2009-2010, the following data is used:

	$EF_{CO2,m,i,y}$	$\eta_{m,y}$	$EF_{el,m,y}$
Acacia	0.0697	30%	0.84
Port Rex	0.0697	30%	0.84

Ankerlig	0.0726	39.5%	0.66
Gourikwa	0.0726	39.5%	0.66

The default value for open cycle gas turbines that began generation after the year 2000 in Annex 1 in the *Tool to calculate the emission factor for an electricity system* has been used for Ankerlig and Gourikwa power stations. For Acacia and Port Rex, the default value for old units (before and in 2000) has been used.

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

For the calculation of the build margin (BM) emission factor, Option 1 data vintage has been chosen. Hence, for the first crediting period, the build margin emission factor will be calculated *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PoA-DD submission to the DOE for validation. For the second crediting period the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period will be used.

The build margin emission factor is thus calculated using **equation 12** of the *Tool to calculate the emission factor for an electricity system*, as shown below:

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

Where:

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

The table below provides an overview of the power plants connected to the South African electricity system as well as their commissioning dates.

Number	Project Name	Type	Commissioning Date
1	Bethlehem hydroelectric project	Hydro	11/11/2009
2	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008
3	PetroSA biogas to energy	Waste water	01/09/2007
4	Gourikwa	Gas fuel	30/03/2007
5	Ankerlig	Gas fuel	29/03/2007

6	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006
7	Klipheuwel	Wind	Aug-2002
8	Majuba	Coal	01/04/1996
9	Kendal	Coal	01/10/1988
10	Palmiet	Pumped storage	18/04/1988
11	Matimba	Coal	04/12/1987
12	Lethabo	Coal	22/12/1985
13	Tutuka	Coal	01/06/1985
14	Colleywobbles	Hydropower	01/01/1985
15	Koeberg	Nuclear	21/07/1984
16	Ncora	Hydropower	01/03/1983
17	Drakensberg	Pumped storage	17/06/1981
18	Duvha	Coal	18/01/1980
19	Matla	Coal	29/09/1979
20	Second Falls	Hydropower	01/04/1979
21	First Falls	Hydropower	01/02/1979
22	Vanderkloof	Hydropower	01/01/1977
23	Port Rex	Gas fuel	30/09/1976
24	Acacia	Gas fuel	13/05/1976
25	Kriel	Coal	06/05/1976
26	Amot	Coal	21/09/1971
27	Gariep	Hydropower	08/09/1971
28	Hendrina	Coal	12/05/1970
29	Grootvlei	Coal	30/06/1969
30	Camden	Coal	21/12/1966
31	Komati	Coal	06/11/1961

In order to identify the power units *m* included in the build margin and in accordance with the *Tool to calculate the grid emission factor for an electricity system*, $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ were identified. Both $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ comprise the same power plants, thus both are SET_{sample}.

	Name	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,y (MWh/y)***
1	Gourikwa	Gas fuel	30/03/2007	0%	0
2	Ankerlig	Gas fuel	29/03/2007	0%	0
3	Klipheuwel	Wind	Aug-2002	0%	2,000
4	Majuba	Coal	01/04/1996	11%	24,632,585
5	Kendal	Coal	01/10/1988	22%	25,648,258
	Total				**50,282,843**

As some of the power plants in the SET_{sample}, Majuba and Kendal, started to supply electricity to the grid more than 10 years ago, step (d) was considered and $SET_{sample\text{-}CDM}$ was calculated.

	Name	Technology	Year of Commissioning	Cumulative %	*EGm,y (MWh/y)*
1	Gourikwa	Gas fuel	30/03/2007	0.000%	0.00
2	Ankerlig	Gas fuel	29/03/2007	0.000%	0.00
3	Klipheuwel	Wind	Aug-2002	0.001%	2,000
CDM	Bethlehem hydroelectric project	Hydro	11/11/2009	0.005%	8,983
CDM	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008	0.018%	31,723
CDM	PetroSA biogas to energy	Waste water	01/09/2007	0.028%	23,286
CDM	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006	0.030%	3,744
	Total	***AEG SET$_{sample-CDM}$***			***69,736***

AEG SET$_{sample-CDM}$ was around 0.03%, much lower than 20% required by the *Tool to calculate the emission factor for an electricity system*. Therefore, step (e) was considered and power units that started to supply electricity to the grid more than 10 years ago were added until the electricity generation of the new set comprised 20% of the annual electricity generation. The final set of power plants included in the calculation of the Build Margin (SET$_{sample-CDM>10years}$) was as follows:

Number	Name	Technology	Year of Commissioning	Cumulative %	*EGm,y (MWh/y)*
1	Gourikwa	Gas fuel	30/03/2007	0.0%	-
2	Ankerlig	Gas fuel	29/03/2007	0.0%	-
3	Klipheuwel	Wind	Aug-2002	0.0%	2,000.00
	Bethlehem hydroelectric project	Hydro	11/11/2009	0.0%	8,983.13
	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008	0.0%	31,723.20
	PetroSA biogas to energy	Waste water	01/09/2007	0.0%	23,285.54
	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006	0.0%	3,744.00
4	Majuba	Coal	01/04/1996	10.6%	24,632,585
5	Kendal	Coal	01/10/1988	21.7%	25,648,258
	Total	***AEG SETsample-CDM>10years***			***50,350,579***

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) is determined as per the guidance in step 4 (a) for the simple OM, using **equation (3)** under option A2 following guidelines in the tool that stipulates as follows "If the power units included in the build margin *m* correspond to the sample group SET$_{sample-CDM->10yrs}$, then, as a conservative approach, only option A2 from guidance in Step 4 (a) can be used and the default values provided in Annex 1 shall be used to determine the parameter $\eta_{m,y}$. "

Equation 3, option A2 is shown below:

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

Where:

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)

$EF_{CO2,m,i,,y}$ = Average CO_2 emission factor of fuel type *i* used in power plant *m* in year *y* (tCO2/GJ)

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (ratio)

m = The power *units* included in the build margin

y = The relevant year as per the data vintage chosen in Step 5

The following data was used in the calculation of $EF_{EF,m,y}$ for the plants in group $SET_{sample\text{-}CDM\text{->}10yrs}$

Name	***Technology***	$EF_{CO2,m,i,v}$ ***(tCO2/GJ)***	$\eta_{m,y}$	$EF_{EL,m,y}$
Gourikwa	Gas fuel	0.0726	39.5%	0.66
Ankerlig	Gas fuel	0.0726	39.5%	0.66
Klipheuwel	Wind	0.0000	-	-
Bethlehem hydroelectric project	Hydro	0.0000	-	-
Durban landfill gas Bisasar Road project	Land fill	0.0000	-	-
PetroSA biogas to energy	Waste water	0.0000	-	-
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	0.0000	-	-
Majuba	Coal	0.0895	35.5%	0.91
Kendal	Coal	0.0895	35.5%	0.91
	AEG $SET_{sample\text{-}CDM>10years}$			

The table below shows the values and power units applied in the calculation of the build margin.

Name	***Technology***	$EF_{el,m,v}$ ***(tCO2/MWh)***	$EG_{m,v}$ ***(MWh/y)***
Gourikwa	Gas fuel	0.66	-
Ankerlig	Gas fuel	0.66	-
Klipheuwel	Wind	-	2,000.00
Bethlehem hydroelectric project	Hydro	-	8983

Durban landfill gas Bisasar Road project	Land fill	-	31723
PetroSA biogas to energy	Waste water	-	23286
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	-	3744
Majuba	Coal	0.91	24,632,585
Kendal	Coal	0.91	25,648,258
Total	***AEG SETsample-CDM>10years***		***50,350,579***

For *y* the most recent historical year for which grid power generation data is available, in this case 2010-2011, was used and for *m,* the power *units* included in the build margin were used.

Step 6: Calculate the Combined Margin
Option A, i.e. the weighted average combined margin, is used as it is the preferred option.

The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{,grid,BM,y}$	=	Build margin CO2 emission factor in year *y* (tCO2/MWh)
$EF_{grid,CM,y}$	=	Operating margin CO2 emission factor in year *y* (tCO2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

The following default values are used for w_{OM} and $w_{BM:}$

w_{OM} = 0.75 and w_{BM} = 0.25 for the first crediting period and subsequent crediting periods as the CPA is a wind power project.

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

Emission reductions
In line with ACM0002 (version 13.0.0) the emission reductions are calculated using **(equation 11)** as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emission reductions in year *y* (tCO2e/yr)

BE_y = Baseline Emissions in year *y* (tCO2/yr)

PE_y = Project emissions in year *y* (tCO2e/yr)

LE_y = Leakage emissions in year *y* (tCO2e/yr)

B.6.2. Data and parameters that are to be reported ex-ante

Data / Parameter	**$NCV_{i,y}$**
Unit	GJ/kg
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	Fuel Type: NCV (GJ/kg) Coal (other bituminous coal): 0.0199 Gas/Jet kerosene: 0.042 Gas/Diesel Oil: 0.0414
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also no regional default values. Average OM: Calculated once for each crediting period during validation stage using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Unit	tCO2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also no regional default values. Average OM: Calculated once for each crediting period during validation stage using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

Fuel Type	EFCO2 (tCO2/GJ)
Coal (other bituminous coal)	0.0895
Gas/Jet kerosene	0.0697
Gas/Diesel Oil	0.0726

Data / Parameter	$\eta_{m,y}$
Unit	%
Description	Average net conversion efficiency of power unit *m* in year *y*
Source of data	Default value for open cycle gas turbines built after 2000 and Fluidised Bed System (FBS) coal generation technology for units built before and in 2000 is used as per Annex 1 of the *Tool to calculate the emission factor for an electricity system.*
Value(s) applied	
Choice of data or Measurement methods and procedures	There is no data published on the efficiency of Eskom's gas power plants, therefore default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Generation technology	Default efficiency
Open cycle gas turbines built after 2000	39.5%
Open cycle gas turbines built in or before 2000	30%
(FBS) coal generation technology for units built before and in 2000	35.5%

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y*
Source of data	Eskom published data and CDM Monitoring Reports for the CDM project activities
Value(s) applied	See appendix 4
Choice of data or Measurement methods and procedures	Data on electricity generation has been obtained from Eskom, the main utility company in South Africa and owner of the power plants. For the CDM power plants that are not owned by Eskom, generation data had to be calculated from the CDM Monitoring Reports. Average OM: Calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$FC_{i,m,y}$
Unit	Kg/year
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y*
Source of data	Eskom published data, other utility and government records
Value(s) applied	See appendix 4
Choice of data or Measurement methods and procedures	Data on fuel consumption has been obtained from Eskom, the main utility company in South Africa and owner of the power plants. The values provided for the coal plants are in tonnes. These values were converted to kg by multiplying by 1000. The values provided for the gas turbines i.e. Acacia, Port Rex, Ankerling and Gourikwa are in litres. These were converted to kg units by multiplying by the fuel type density given in (kg/l). For jet gasoline, the density value used was 0.78 kg/l while 0.82 kg/l was used for diesel oil. Average OM: Calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante.* For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

B.6.3. Ex-ante calculations of emission reductions

Project emissions

Project Emissions equal zero.

Baseline Emissions

The baseline emissions are to be calculated as follows:

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

Where:

BE_y = Baseline Emissions in year *y* (tCO2/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 emission factor for an electricity system* (tCO2/MWh)

Calculation of $EG_{PJ,y}$

The CPA is a project that installs a grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, therefore $EG_{PJ,y}$ is calculated as per option (a).

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

Where:

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

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

Parameter	Value	Unit	Source
$EG_{facility,y}$	[insert value]	MWh/yr	[insert source]

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

The combined margin emission factor for the grid is calculated using the following formula:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO2/MWh)

$EF_{grid,CM,y}$ = Operating margin CO2 emission factor in year *y* (tCO2/MWh)

W_{OM} = Weighting of operating margin emissions factor (%)

W_{BM} = Weighting of build margin emissions factor (%)

Values to determine $EF_{grid,CM,y}$ for wind CPAs are:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	0.9063	tCO2/MWh	GEF calculations
W_{BM}	0.25		Default
$EF_{grid,OM-DD,y}$	0.9585	tCO2/MWh	GEF calculations
W_{OM}	0.75		Default

Therefore:

$EF_{grid,CM,y}$ = 0.9454 tCO2/MWh

BE_y = [Insert] * 0.9454= [Insert] tCO2/yr

Leakage emissions

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

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emission reductions in year *y* (tCO2e/yr)

BE_y = Baseline Emissions in year y (tCO2/yr)

PE_y = Project emissions in year y (tCO2e/yr)

LE_y = Leakage emissions in year y (tCO2e/yr)

Therefore, emission reductions equal:

[insert value of BE_y] – 0 – 0 = [insert value of ER_y] tCO2e/yr

B.7. Application of the monitoring methodology and description of the monitoring plan
B.7.1. Data and parameters to be monitored by each generic CPA

Data / Parameter	**$EG_{facility,y}$**
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data	Electricity meter(s)
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The following parameters shall be measured: (i) The quantity of electricity supplied by the project plant/unit to the grid; and (ii) The quantity of electricity delivered to the project plant/unit from the grid Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards and the *Code of practice of electricity metering* SANS 474:2009/NRS 057:2009. The electricity supplied to the grid and delivered to the project plant/unit from the grid will be measured continuously (hourly measurement and at least monthly recording) by a main (facility metering installation) and a back-up meter (system metering installation). The facility meter is installed at the Delivery Point with the electricity grid as agreed with the national transmission company (NTC) or distributor, as applicable. The system meter will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.
Monitoring frequency	The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with PPA.
QA/QC procedures	Measurement results will be cross-checked with records of sold electricity. Calibration of meters will be done according to the appropriate standard and equipment specifications, whichever is more precise. According to standard SANS 474:2009/NRS 057:2009, the accuracy class of the meter and its maximum interval between calibrations are the following:

Size of project	Accuracy Class	Interval for period calibration (years)
> 100 MVA	0.2S	5
10 MVA to < 100 MVA	0.5S	5
1 MVA to < 10 MVA	1	10

Purpose of data	Calculation of baseline emissions
Additional comment	-

B.7.2. Description of the monitoring plan for a generic CPA

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. All measurements should be conducted with the calibrated measurement equipment according to relevant industry standards.

Operational and management structure

Each CPA implementing entity under the PoA will be responsible for the technical aspects related to on-site monitoring such as:

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the project activity
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, the Facility Metering Installation, according to appropriate standards or manufacturer specifications.
- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPA's monitoring responsibilities as described above. Each month/quarter, the CPA will submit monthly electricity generation records to the CME accompanied by the respective copy of records/invoices for sold electricity. The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

The CME, through its programme officer, will be responsible for the following:

- Training of CPAs on CDM monitoring requirements
- Collection of monitored data by the CPA
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored data with a copy of invoices and the proof of payment of those invoices
- Confirm that the CPA has operated the metering system in line with relevant regulations
- Preparation of monitoring report

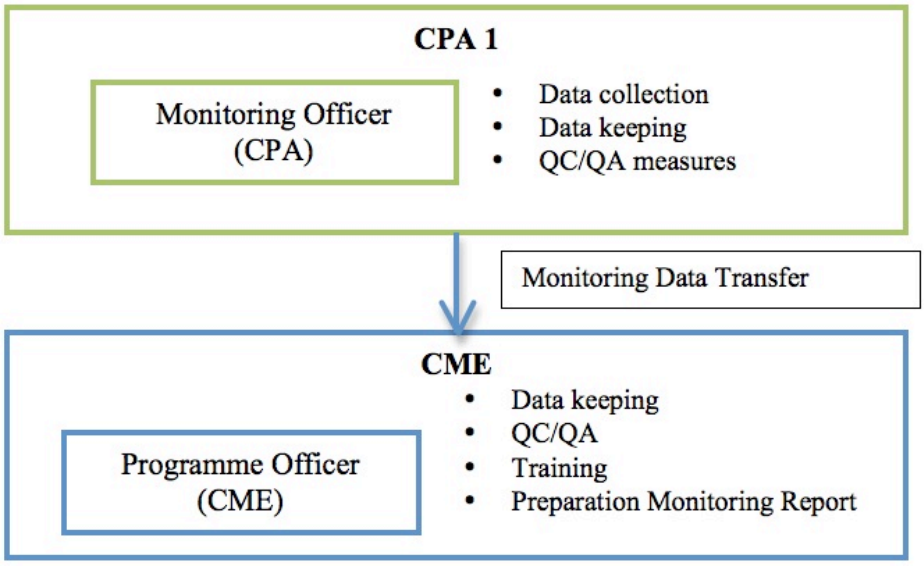


Figure 10. Monitoring organization

Parameters monitored

The only parameter monitored is the "Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y"* ($EG_{facility,y}$).

Metering

Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards. The South African National Standard has published the *Code of practice of electricity metering* SANS 474:2009/NRS 057:2009. This code of practice specifies the procedures and standards to be adhered to by electricity licensees and their agents in operating and servicing new and existing metering installations which are to be used for billing purposes. The code of practice is applicable to metering installations in their entirety, including all measuring transformers, wiring, cabling, metering panel construction, active and reactive meters, data loggers, and associated test facilities.

The CPA will be responsible for the Facility Metering Installation (main meter) procurement, installation, testing, commissioning and its operation and maintenance including:

- Calibration and maintenance of equipment
- Physical reading and day-to-day handling
- Quality Control and Quality assurance measures

The national transmission company (NTC) or the distribution company, as applicable, will be responsible for the System Metering Installation (back up meter) procurement, installation, testing, commissioning and its operation and maintenance. This meter cannot be accessed by the CPA implementing entity and the NTC or distributor only uses it for comparison purposes against the data provide by the CPA entity's Facility Metering Installation.

The Facility Metering Installation will be installed at the Delivery Point, which defines the commercial boundary between the licensee and the customer. The System Metering Installation will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.

QA/QC

The Facility Metering Installation readings will be crosschecked with the copies of invoices sent by the CPA implementing entity to the NTC or distributor, and the proof of payment of those invoices. If there is a difference between the values, the most conservative value will be used.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise. According to standard SANS 474:2009/NRS 057:2009, the accuracy class of the meter and its maximum interval between calibrations are the following:

Table 7. Metering accuracy and calibration frequency

Size of project	Accuracy Class	Interval for period calibration (years)
> 100 MVA	0.2S	5
10 MVA to < 100 MVA	0.5S	5
1 MVA to < 10 MVA	1	10

Emergency procedure: In case there is disagreement between the NTC and the CPA implementing entity with regard to the meter readings because the readings of the Facility Metering Installation and the System Metering Installation are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 7 above then the Facility Metering Installation and the System Metering Installation shall both be tested. Should the Facility Metering Installation be found to

have a level of inaccuracy beyond the tolerance as described above, then the Facility Metering Installation shall be recalibrated and the electricity output will be based on the readings registered by the System Metering Installation from the date of the last previous test of the Facility Metering Installation.

Should both the System Metering Installation and the Facility Metering Installation be found to have a level of inaccuracy falling outside the maximum tolerance level then each of the System Metering Installation and the Facility Metering Installation shall be recalibrated and the electricity output shall be recalculated applying the error identified in the calibration test of the Facility Metering Installations for all values from the date of the last previous test of the Facility Metering Installation.

In cases where one meter breaks down, then the readings of the other meter will be applied in the emission reduction calculations. If both meters break down or are unavailable, then the electricity generation value for that period will be assumed to be zero as a conservative approach.

The meter(s) readings will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data.

Data storage and archiving

Data will be stored electronically by the CME in a centralized database system for at least two years following the end of the last crediting period. The CPAs will need to provide a copy of the documentation, such as electricity sales invoices, proof of payment of those invoices and meter readings to the CME that will verify those.

The database contains the following information:

- Name of the CPA
- CPA implementing entity and contacts
- GPS coordinates
- Technical description
- Installed capacity
- Number of verifications and associated monitoring periods
- Monitored parameters and relevant evidence
- Emission reductions monitored

Training

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

PART II. Generic component project activity (CPA)

CPA TYPE II: GREENFIELD WIND POWER PLANTS/UNITS IN SOUTH AFRICA APPLYING INVESTMENT ANALYSIS

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The CPA will involve the implementation and operation of a wind power plant implemented at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield project). The project activity will generate electricity from renewable sources, which will be fed into South Africa's national electricity grid, replacing fossil fuel based electricity generation. By this replacement, the project activity will lead to emission reductions.

The CPA is being pursued as a component of the PoA "Renewable Energy Carbon Programme for Africa (RECPA)" with Carbon Africa Limited as the CME.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

The CPA will apply approved consolidated baseline and monitoring methodology ACM0002 (version 13.0.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*.

ACM0002 version 13.0.0 also refers to the latest versions of the following tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool for the demonstration and assessment of additionality (version 07.0.0)*
- *Combined tool to identify the baseline scenario and demonstrate additionality (version 04.0.0)*
- *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 02)*

The CPA will only use the first two, the *Tool to calculate the emission factor for an electricity system (version 02.2.1)* and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*. The *Combined tool to identify the baseline scenario and demonstrate additionality (version 04.0.0)* will not be used, as there is no need to use that tool to describe the baseline scenario. The *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 02)* will also not be used as the CPA does not generate CO2 emissions from fossil fuel combustion for its operations.

B.2. Application of methodology(ies)

The generic CPA meets the applicability criteria listed in the approved consolidated baseline and monitoring methodology ACM0002 (version 13.0.0) as shown below:

Applicability criteria	Generic CPA justification
This methodology is applicable to grid-connected renewable power generation project activities that: (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the	CPAs will consist of wind power projects connected to the South African grid that install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield

project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	plant)
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The CPA will install a wind power plant, an eligible technology type under this methodology.
In the 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 period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	n/a. CPAs under this PoA are greenfield projects.
In case of hydro power plants one of the following conditions must apply: • The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or • The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2; or • The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2.	n/a. CPAs consist of wind projects, not hydro power plants.
In case of hydro power plants using multiple	n/a. CPAs consist of wind projects, not hydro power

reservoirs where the power density of any of the reservoirs is lower than 4 W/m2 all of the following conditions must apply: • The power density calculated for the entire project activity using equation 5 is greater than 4W/m^2; • Multiple reservoirs and hydro power plants are located at the same river and where are designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant; • Water flow between the multiple 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 a 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.	plants.
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 result in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2	n/a. CPAs under the PoA do not consist of: (i) switching from fossil fuels to renewable energy sources at the site of the project activity, (ii) biomass fired power plants, (iii) a hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2.
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power	n/a, CPAs under this PoA are greenfield projects.

generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	

The CPA will use the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*. The project activities will meet the applicability of the *Tool to calculate the emission factor for an electricity system* as follows:

This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	CPAs under the PoA will supply electricity to the South African national electricity grid.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is only located in South Africa as explained in section B.6.1 of part II of the PoA-DD, Calculation of $EF_{grid,CM,y}$, step 1. South Africa is not an annex I country.

The compliance of each CPA included in the PoA with the applicability criteria of ACM0002 (version 13.0.0) and associated tools will be ensured through eligibility criteria 5.

B.3. Sources and GHGs

The spatial extent of the project boundary will include the project power plant, the substation or connection point to the electricity system, and all power plants connected physically to the electricity system that the CDM project power plant is connected to (i.e. South African electricity grid operated by Eskom). The project activity will therefore displace electricity generated by South African fossil fuel grid connected power plants and will therefore lead to emission reductions of CO2. The emissions sources and greenhouse gases included in the boundary for the purpose of calculating project emissions and baseline emissions for wind energy CPAs are provided in the table below:

Source		GHGs	Included?	Justification/Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam	CO_2	No	This PoA does not involve geothermal power plants therefore no emissions are included
		CH_4	No	This PoA does not involve

				geothermal power plants therefore no emissions are included
		N_2O	No	This PoA does not involve geothermal power plants therefore no emissions are included
	CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
		CH_4	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
		N_2O	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
	For hydro power plants, emissions of CH4 from the reservoir	CO_2	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included
		CH_4	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included
		N_2O	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included

The figure below presents a flow diagram physically delineating the project boundary of a wind energy CPA.

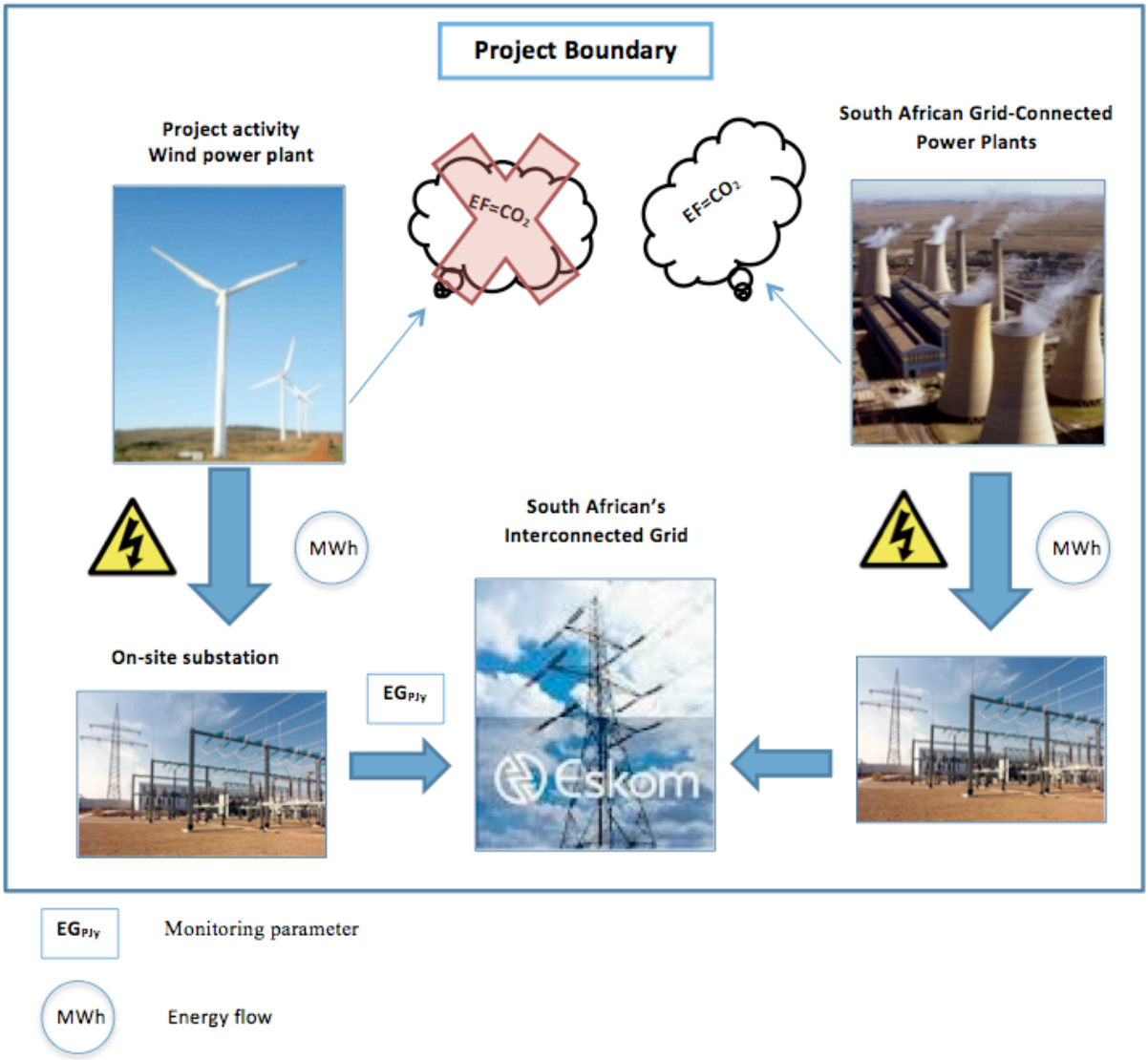


Figure 11: Flow diagram for wind power project

B.4. Description of baseline scenario

In accordance with approved consolidated baseline methodology ACM0002 (version 13.0.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*, the baseline scenario for the installation of new grid-connected renewable power plant/units is "the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculated the emission factor for an electricity system".

The South African baseline scenario is further described below.

Structure of the South African Power Sector

The South African Department of Energy (DoE) is the legislative entity responsible for the South African energy sector. The energy sector is regulated by the *National Energy Act of 2008 (No.34 of 2008)*[45].

Specifically for the electricity sector of South Africa, the *Electricity Regulation Act of 2006 (No. 4 of 2006)*[46] determines the framework of the electricity sector. In May 2011, the Department of Energy, acting as the legislative entity, amended the *Electricity Regulations on New Generation Capacity*[47] under the *Electricity Regulation Act of 2006.* According to the current regulation, 70% of the new generation capacity must be implemented by the state-owned utility company Eskom, and 30% by Independent Power Producers (IPPs).[48] The Department of Energy has the mandate to decide which planned capacity addition will be implemented by Eskom, and which will be determined by a bidding process between IPPs. However, all IPPs are mandated to sell the generated electricity to Eskom (Single-Buyer-Model) through the signing of long-term Power Purchase Agreements (PPAs) with Eskom.

The Department of Energy determines the needed capacity additions after consultation with the National Energy Regulator of South Africa, NERSA. The DoE regularly develops an "*Integrated Resource Plan for Electricity"* which is updated every two years, the latest one being the *"Integrated Resource Plan 2010-2030 for Electricity"*[49] under the *Electricity Regulation Act No. 4 of 2006.* In its current version, from the year 2011, the Integrated Resource Plan determines the proposed specific amount of each technology in the electricity generation from 2010 to 2030.

Apart from the Department of Energy (DoE) and the National Energy Regulator of South Africa (NERSA), Eskom is the main player in the South African power sector. From 2002, Eskom became a public, limited liability company wholly owned by the government. Eskom owns and operates the National Electricity Grid and parts of the distribution network, and also owns 93% of the installed generation capacity.

[45] Department of Energy (2008), National Energy Act of 2oo8 http://www.info.gov.za/view/DownloadFileAction?id=92826, accessed on 30.12.2011
[46] Department of Energy (2006), Electricity Regulation Act of 2006, http://www.info.gov.za/view/DownloadFileAction?id=67855, accessed on 30.12.2011
[47] Department of Energy (2011), Electricity Regulations on New Generation Capacity, http://www.sapvia.co.za/electricity-regulations-on-new-generation-capacity-4-may-2011/, accessed on 30.12.2011
[48] Department of Energy, http://www.energy.gov.za/files/electricity_frame.html, accessed on 30.12.2011
[49] Department of Energy (2011), Electricity Regulations on the Integrated Resource Plan 2010-2030, http://www.info.gov.za/view/DownloadFileAction?id=146082, accessed on 30.12.2011

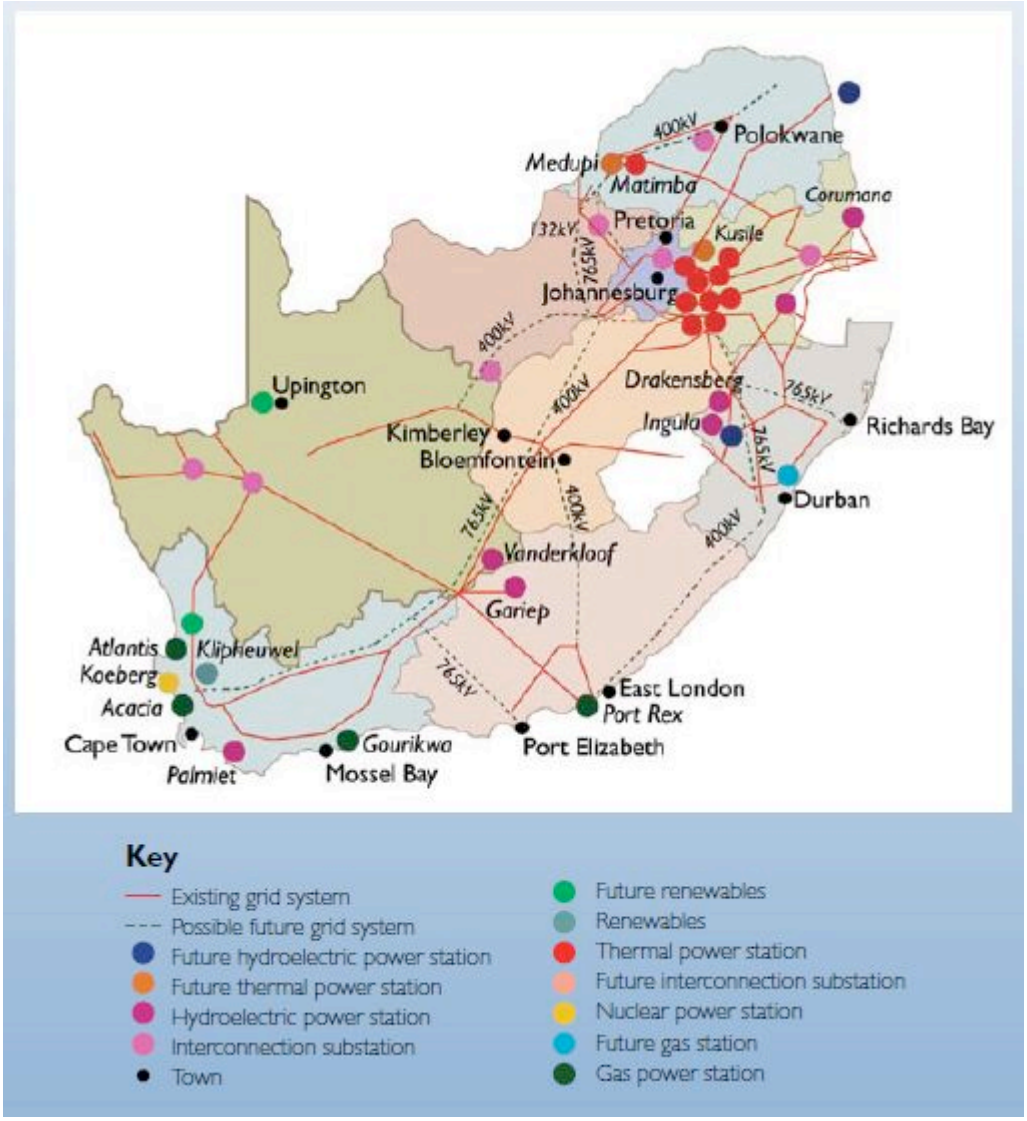


Figure 12. South African Power Sector

Generation

Electricity generation in South Africa is dominated by Eskom, which owns 93% of the installed capacity and supplies about 95% of South Africa's electricity. Municipal owned power plants and IPPs supply the remaining 5% of electricity. Approximately 90% of the total generated electricity is based on coal.[50]

Detailed description of the installed capacity for each technology is presented in the following tables. Data from Eskom's power plants is dated from 2011.[51] The latest published data for IPPs and municipal generation is from 2006[52].

[50] NERSA (2006), 2006 Electricity Supply Statistics for South Africa, http://www.nersa.org.za/Admin/Document/Editor/file/News%20and%20Publications/Publications/Current%20Issues/Electricity%20Supply%20Statistics/Electricity%20supply%20statistics%202006.pdf , accessed on 30.12.2011

[59] ESKOM (2011), Integrated Report 2011, http://financialresults.co.za/2011/eskom_ar2011/index.php, accessed on 30.12.2011

[52] NERSA (2006), 2006 Electricity Supply Statistics for South Africa, http://www.nersa.org.za/Admin/Document/Editor/file/News%20and%20Publications/Publications/Current%20Issues/Electricity%20Supply%20Statistics/Electricity%20supply%20statistics%202006.pdf accessed on 30.12.2011

Table 8. Eskom Electricity Generation Capacity

Installed Eskom capacity by source 2011	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	37,745	35,052
Gas	2,426	2,409
Hydro	661	600
Nuclear	1,910	1,830
PSHSP	1,400	1,400
Wind	3.16	3.16

Table 9. Municipalities Electricity Generation Capacity

Installed municipal capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,323	536
Gas	334	122
Hydro	4	-
PSHSP	189	174

Table 10. IPP Electricity Generation Capacity

Installed private capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,339	933
Bagasse / Coal Fired Stations	105	66
Hydro	10	-
Wind	7	7
Waste Water / Biogas	4.25	4.25
Landfill	5	5

Municipal power plants are mostly coal thermal power plants and gas power plants which generate electricity for the direct supply in their municipal distribution area. Many municipalities own their own distribution networks, and some of them add generation capacity to their distribution lines by adding their own power plants on top of the electricity purchased from the national grid. Power plants operated by IPPs are commonly based on coal/bagasse. Some of the IPP owned power plants generate electricity for on-site consumption (large industrial consumers) and only feed electricity into the grid in the case of excess generation.

Currently, there are only three wind power plants connected to the grid. The 3.16 MW Klipheuwel Wind Farm which is owned by Eskom, the 5.2 MW Darling Wind Farm and the 1.8 MW Coega Wind Farm, which are IPP's owned by private investors. These plants have been developed as demonstration projects.

In terms of installed capacity, coal power plants' share is about 85% followed by electricity generation based on gas (6%), nuclear (4%) and pumped storage hydro power plants (3%). Pumped storage plants are net consumers of electricity, which pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas, etc. are negligible.

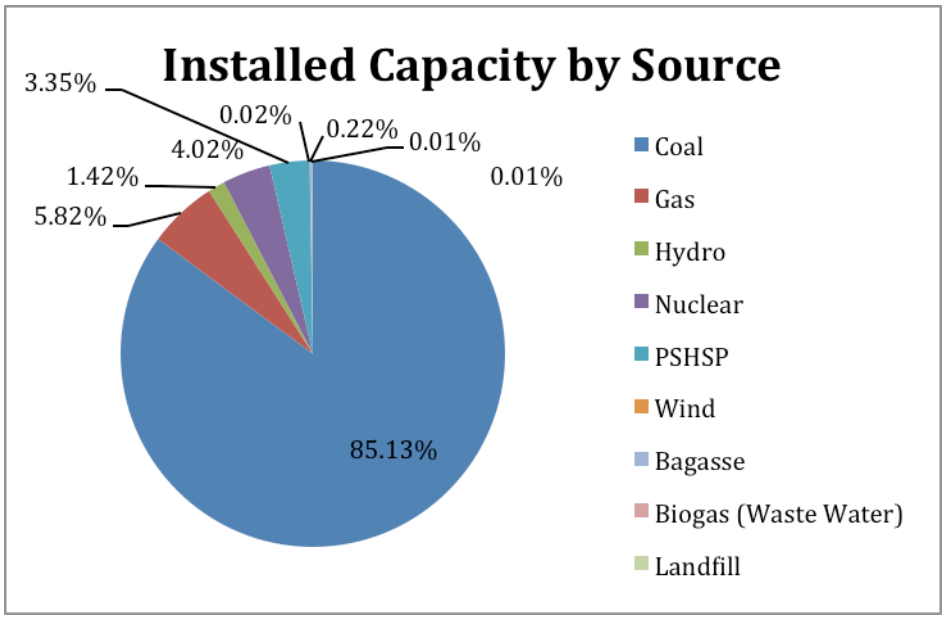


Figure 13: Installed capacity by source

The *Integrated Resource Plan 2010-2030 for Electricity,* which determines the needed capacity and share of technologies in the future proposes the following capacity additions until 2030: [53]

Table 11. Summary of capacity additions 2010-2030

	Total Capacity by year 2030		**Capacity added (including committed) from 2010 to 2030**		**New (uncommitted) capacity options from 2010 to 2030**	
	MW	**%**	**MW**	**%**	**MW**	**%**
Coal	41,071	45.9	16,383	29.0	6,250	14.7
OCGT	7,330	8.2	4,930	8.7	3,910	9.2
CCGT	2,370	2.6	2,370	4.2	2,370	5.6
Pumped Storage	2,912	3.3	1,332	2.4	0	0.0
Nuclear	11,400	12.7	9,600	17.0	9,600	22.6
Hydro	4,759	5.3	2,659	4.7	2,609	6.1
Wind	9,200	10.3	9,200	16.3	8,400	19.7
CSP	1,200	1.3	1,200	2.1	1,000	2.4
PV	8,400	9.4	8,400	14.9	8,400	19.7
Other	890	1.0	465	0.8	0	0.0
Total	**89,532**		**56,539**		**42,539**	

The current installed capacity of 47,465 MW is therefore expected to double up to 89,532 MW by the year 2030 in order to meet the estimated rising electricity demand in the country, which is expected to have a peak demand of 80,272 MW by then. Apart from the domestic generation, the Integrated Resource Plan 2010-2030 for Electricity forecasts increasing imports of electricity generated from hydro power plants located in Zambia and Mozambique from 2022 onwards. However, the Integrated Resource Plan for Electricity also mentions that in order to reach this objective cross-border negotiations and an upgrade in transnational transmission infrastructure would be necessary. Additional risks regarding imports are delays from hydro power plants in the construction of the power plants and long-lasting droughts.

[53] Department of Energy (2011), Electricity Regulations on the Integrated Resource Plan 2010-2030, http://www.info.gov.za/view/DownloadFileAction?id=146082, accessed on 30.12.2011

The Integrated Resource Plan for Electricity also forecasts the continuation of the current power shortage until the year 2016 when newly installed power plants in line with Integrated Resource Plan 2010-2030 for Electricity will start operation.

B.5. Demonstration of eligibility for a generic CPA

14 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

Eligibility criteria 1: The geographic boundary of the CPA is located in South Africa. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in South Africa (an EIA license for a proposed CPA issued by the South African authorities would automatically imply that the CPA is located in South Africa).

14 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Eligibility criteria 2.1: The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

Eligibility criteria 2.2: The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced through a confirmation letter from the CME.

Eligibility criteria 2.3: The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

Eligibility criteria 2.4: The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in South Africa. This will be evidenced through a signed confirmation letter from the CME.

14 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;

Eligibility criteria 3.1: The CPA involves the implementation of a wind power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

Eligibility criteria 3.2: The turbine technology shall be certified to IEC 61400 standard in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme*. This will be evidenced through the IEC 61400 certificate. If at the time of the inclusion of the CPA, the IEC 61400 certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria according to ACM0002 version 13.0.0:

Eligibility criteria 3.3: The installed capacity of the CPA will be minimal 1 MW and not more than 140MW per grid connection point. This is in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* which requires that "Projects must have a minimum installed capacity of 1 MW and, in order to limit congestion on the grid connections to the Transmission or Distribution System, have a maximum installed capacity of 140 MW for a single grid connection point assuming that the connection point can facilitate such capacity". The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

Eligibility criteria 3.4: The CPA will have a net load factor between 16.2% and 49.6% based on the P50 forecast. Net load factors are a function of wind speeds, the type of wind turbine and losses in the system. The range is based on projects that have been registered under the CDM (or are in the pipeline) and, therefore, provides a realistic range of circumstances under which a wind projects can be developed. The P50 forecast is in line with the requirement in Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme,* para 2.6.1.5

Eligibility criteria 3.5: The CPA will have an average wind speed between 5-11 m/s at hub height based on 12 months of measurement data reported by an independent third party. This wind speed is considered as representative of the South Africa's context when compared to available studies[5455] and it is generally considered that project below that range are not commercially viable as per industry standards.

14 d. Conditions to check the start date of the CPA through documentary evidence;

Eligibility criteria 4: The start of the CPA occurs after 02/06/2012. This will be evidenced by the EPC contract, contract with the turbine supplier or other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 02/06/2012.

14 e Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs

Eligibility criteria 5: The CPA has confirmed its compliance with the applicability of ACM0002, version 13.0.0 in section D.2 of the F-CDM-CPA-DD.

14 f The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;

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

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

According to para 8 of the *Tool for the demonstration and assessment of additionality,* project activities that apply the tool in the context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity. In line with the above guidelines, the following two alternatives can be identified:

Alternative 1: The project activity not undertaken as a CDM project activity

[54] Mesoscale wind atlas of South Africa. Kilian Hagemann. University of Cape Town. November 2008
[55] First verified numerical wind atlas for South Africa, DTU Wind Energy, Technical University of Denmark

Alternative 2: Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the *Tool to calculate the emission factor for an electricity system*.

The above identification of alternatives is in line with para 8 of the *Tool for the demonstration and assessment of additionality*. No eligibility criteria was formulated for defining alternatives because the above two alternatives would by definition be applicable to every grid renewable energy project activity and will be included in every CPA-DD.

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

The above alternatives as well as the component project activity are consistent with mandatory and regulatory requirements, especially the Electricity Regulation Act No.4 of 2006, its Amendment Act, 2007 and the Electricity Regulation Act No.4 of 2006 – Electricity Regulations on New Generation Capacity issued on 04 May 2011. These laws and regulations are relevant for both alternatives, since they constitute the legal framework for current and future grid connected power plants in South Africa.

Alternative 2 can be considered as consistent with mandatory laws and regulations, since the continuation of operation of power plants currently connected to the grid is lawful due to the fact that article 16 and article 17 of the Electricity Regulation Act No.4 of 2006 and its Amendment Act, 2007 only allow the revocation of already issued generation licenses in case of non-compliance of the licensee or on application of the licensee. The laws and regulation regarding the addition of new grid connected generation capacity is outlined as per the Electricity Regulations on New Generation Capacity issued on 04 May 2011, which applies to all types of generation technology including renewable generation and cogeneration technology except of nuclear power generation technology. Therefore the addition of new generation capacity can be considered lawful.

Since Alternative 1 describes the addition of greenfield grid connected wind power capacity to the South Africa grid without carbon credits, this can also be considered consistent with mandatory laws and regulations since the Electricity Regulations on New Generation Capacity issued on 04 May 2011 covers the establishment of wind power technologies in South Africa.

There are no further applicable national laws or regulations, which require the application as a CDM project activity.

Step 2: Investment analysis

The following steps will be taken to demonstrate that the CPA is financially additional:

Sub-step 2a: Determine appropriate analysis method

The *Tool for the demonstration and assessment of additionality* provides three methods for carrying out investment analysis:
1. Simple cost analysis (Option I),
2. Investment comparison analysis (Option II)
3. Benchmark analysis (Option III).

The CPAs included in the PoA are expected to generate financial and economic benefits other than CDM related income (income from the sales of electricity) therefore the simple cost analysis (Option I) cannot be applied.

In line with ACM0002 (version 13.0.0), the baseline scenario for the project activities is the supply of electricity from a grid. Therefore, the baseline scenario does not necessarily require investment and is outside the control of the project developers. Option III, benchmark analysis is selected as the appropriate analysis method for the project activities.

Eligibility Criteria 6.1: The CPA has carried out benchmark analysis to demonstrate additionality. This will be demonstrated through the investment analysis spread sheet.

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

Eligibility criteria 6.2: The CPA has applied (a) the pre-tax nominal WACC in combination with the Project IRR or (b) the post-tax nominal Return on Equity in combination with the Equity IRR, as explained below. This will be evidenced through the investment analysis spread sheet.

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

Eligibility criteria 6.3: Without the CER revenue, the CPA has a less favourable Project IRR or Equity IRR, whichever is applicable, than the benchmark. This will be evidenced in the investment analysis spreadsheet.

Eligibility criteria 6.4: All input values applied in the investment analysis are applicable at the time of the investment decision. The CME will check whether all the input values are valid at the time of the investment decision.

Eligibility criteria 6.5: The date of the investment decision is either based on the date on which the project has received the wind assessment report and the board has decided to proceed with the project or the date on which the project has committed significant financial resources towards the implementation of the project. This will be evidenced by the wind assessment report together with a board resolution or by a contract involving the commitment of significant financial resources towards the implementation of the project.

Eligibility criteria 6.6: The CPA has used a tariff of not more than 1,150 ZAR/MWh in the investment analysis. This will be evidenced by the investment analysis spread sheet. The applicable tariff cap will be updated every two years or whenever the tariff is updated under the IPP procurement programme or other relevant government regulation, whichever occurs first..

Eligibility criteria 6.7: The total CAPEX of the project is more than 1,250,000 Euro/MW taking into account CAPEX items being derived from and be in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by the investment analysis spread sheet. The applicable CAPEX threshold will be updated every two years.

Eligibility criteria 6.8: The total operating costs will be at least 12 EUR/MWh, taking into account requirements regarding OPEX items in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This will be evidenced by the investment analysis spread sheet. The range of operating costs will be updated every two years.

Eligibility criteria 6.9: The CPA has used an income tax rate of 28% in the investment analysis, which is the South African income tax rate. This will be evidenced by the investment analysis spread sheet. The tax rate will be updated every two years or whenever the income tax regulations in South Africa change, whichever occurs earlier.

Eligibility criteria 6.10: The CPA has applied the applicable depreciation rates in the investment analysis as provided by the South African regulations with regard to capital allowances. At the time of writing the

PoA DD, the capital allowance for energy infrastructure projects in South Africa was 50% for the first year of operation, 30% for the second year of operation and 20% for the third year of operation. The applicable depreciation will be updated every two years or whenever the applicable depreciation rates in South Africa change, whichever occurs earlier.

Eligibility criteria 6.11: In terms of exchange rates, the exchange rates provided by the South African government as part of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* will be used. Alternatively, the exchange rate reported by South African Reserve Bank on the date of the investment decision can be used. In case both are available, the most conservative one will be used.

Sub-step 2d: Sensitivity analysis

Eligibility criteria 6.12: The CPA implementing entity will have carried out a sensitivity analysis on variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues. This will be evidenced in the investment analysis spread sheet. The sensitivity analysis will cover a range of +10% and -10%. The following parameters will be subject to sensitivity analysis:

- Investment cost
- Electricity generation
- Operating and maintenance cost
- Tariff

Eligibility criteria 6.13: The CPA implementing entity will have assessed at which parameter level the benchmark will be crossed and will have discussed the likelihood of those parameter levels to occur. This will be evidenced in the investment analysis spread sheet and specific CPA-DD.

Step 4: Common practice analysis

Eligibility criteria 6.14: In line with the *Tool for the demonstration and assessment of additionality*, it can be concluded that the CPA is not common practice as F is lower than 0.2 and $N_{all} - N_{diff}$ is lower than 3. The common practice analysis will be based on publicly availably data and information from NERSA, Eskom and/or the Department of Energy (DoE) or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.

14 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;

Eligibility criteria 7.1: The CPA has carried out an Environmental Impact Assessment in line with South African regulations. This will be evidenced through the Environmental Authorisation (Record of Decision) from the Department of Environmental Affairs.

Eligibility criteria 7.2: The CPA has carried out a stakeholder consultation meeting the CDM requirements and (if available) DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

14 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;

Eligibility criteria 8.1: In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

Eligibility criteria 8.2: In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

14 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);

Eligibility criteria 9.1: The CPA is connected to the South African grid. This will be evidenced through the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The CPA will focus on grid-connected renewable electricity generation from wind energy. The PoA will include project activities that install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant).

Project emissions

This CPA includes wind power projects. Therefore, project emissions are zero ($PE_y = 0$).

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. The baseline emissions are to be calculated as follows **(equation 6)**:

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

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2/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 emission factor for an electricity system" (tCO2/MWh)

Calculation of $EG_{PJ,y}$

CPAs under the PoA involved the installation of new grid-connected renewable energy power plants/units at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield projects), therefore $EG_{PJ,y}$ is estimated as per option a, **equation 7**:

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

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year

y (MWh/yr)

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

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

The emission factor is calculated in a transparent and conservative manner using the combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the *Tool to calculate the emission factor for an electricity system version 02.2.1*.

The procedures applied to calculate the grid emission factor for the South African electricity system are described as shown below and will be fixed at PoA level and updated after every seven year crediting period of the PoA. Equations and fixed parameter values to calculate the grid emission factor for South Africa are provided below.

Step 1. Identify the relevant electric power system
For calculating the grid emission factor, the project activity has identified the South African national grid as the relevant project electricity system.

The identification of the South African national grid as the relevant project electricity system is based on the following arguments:

- The South African DNA has not published a delineation of the project electricity system and connected electricity system.
- There are not spot markets in the South African electricity system.
- Although the South African grid is connected to a number of its neighboring countries' grids including Lesotho, Namibia, Swaziland, Botswana and Mozambique, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria do not result in a clear grid boundary.
- Finally, South Africa does not have a layered dispatch system and only one grid system serves the entire country. Therefore, and in line with version 02.2.1 of the *Tool to calculate the emission factor for an electricity system*, the national grid definition is used by default.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)
The project activity has selected Option I and only grid power plants were included in the calculation.

Step 3. Select a method to determine the operating margin (OM)
The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

e) Simple OM
f) Simple adjusted OM
g) Dispatch data analysis OM
h) Average OM

In South Africa, low-cost/must-run resources constitute more than 50% of total grid generation. Apart from hydro, wind, and nuclear power plants, most coal-fired power plants have to be considered as low-cost/must-run as:

- Coal used in South African power plants is a cheap resource compared to other technologies e.g. natural gas/kerosene because South Africa is the 6th largest producer of coal in the world with

one of the lowest coal prices in the world.[56]

- Coal power plants in South Africa have an average capacity factor higher than 75%. In line with international common practice, power plants with a capacity factor higher than 75% are considered as base-load power plants, which are usually dispatched independently of the daily or seasonal load. Furthermore, Eskom Holdings Annual Report 2011 defines most of the coal power plants as baseload plants.

Because low-cost/must-run resources constitute more than 50% of the total grid generation, the simple OM method cannot be used. Therefore, the project activity has selected the average OM method for calculating the operating margin.

In terms of data vintage, the project will use the *ex ante* option, and the emission factor is determined once at the validation stage based on a 3-year generation weighted average based on the most recent data available at the time of submission of the CDM-PoA-DD to the DOE for validation.

Step 4: Calculate the operating margin emission factor according to the selected method
The average OM emission factor ($EF_{grid,OM\text{-}ave,y}$), is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under (a) for the simple OM, but also including the low-cost/must-run power plants in all equations.

The average OM emission factor is calculated using **equation 1** from option A:

$$EF_{grid,OM-ave,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,OM\text{-}ave,y}$	=	Average operating margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
m	=	All grid power units serving the grid in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

For grid power plants, $EG_{m,y}$ is based on published records from Eskom and CDM monitoring reports for the CDM power plants. The grid emission factor calculations are based on the publicly available data in South Africa, i.e. Eskom power plants and CDM projects. This represents 95% of the total electricity generated. Electricity generated from Independent Power Producers and Municipality owned power plants is not available, therefore it could not be included in this calculation. However it only represents less than 5% of the total electricity generated. For the CDM projects, three years of public available data is not available, therefore, generation has been estimated based on those available monitoring report for a

[56] The future of South African coal; Market Investment and Policy changes –Anton Eberhard

shorter period of time. However, it is considered to be more conservative to include an estimate for the electricity generation for the CDM projects than to assume that there was no electricity generation by the CDM projects for the years during which no data was available. Based on the number of months and the electricity generation reported in the monitoring report, the electricity generation has been first calculated per month and then the annual electricity generation was estimated. The table below summarizes the electricity generation for the various power plants connected to the electricity grid.

		Generation Data (*MWh*)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Amot	Coal	11,987,281	13,227,864	12,194,878
Camden	Coal	6,509,079	7,472,070	7,490,836
Duvha	Coal	21,769,489	22,581,228	20,267,508
Grootvlei	Coal	1,249,556	2,656,230	3,546,952
Hendrina	Coal	12,296,687	12,143,292	11,938,206
Kendal	Coal	23,841,401	23,307,031	25,648,258
Komati	Coal	-	1,016,023	2,060,141
Kriel	Coal	18,156,686	15,906,816	18,204,910
Lethabo	Coal	23,580,232	25,522,698	25,500,366
Majuba	Coal	22,676,924	22,340,081	24,632,585
Matimba	Coal	26,256,068	27,964,141	28,163,040
Matla	Coal	21,863,400	21,954,536	21,504,422
Tutuka	Coal	21,504,122	19,847,894	19,067,501
Acacia	Gas (Jet kerosene)	-	971.00	992.00
Port Rex	Gas (Jet kerosene)	-	322.00	5,507.00
Ankerlig	Gas/Diesel Oil	-	6,303.00	-
Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-
Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,764,661**	**228,828,053**	**232,394,838**

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

Because data on fuel consumption and electricity generation of the grid-connected units is available, Option A1 is used to determine the emission factors of the grid power units. However, for Acacia, Port Rex, Ankerlig, Gourikwa only data on electricity generation and fuel type is available for the year 2009-2010, thus Option A2 is used instead for those four power plants.

Option A1:

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	=	All grid power units serving the grid in year *y*
i	=	All fossil fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Option A2:

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO2 emission factor of fossil fuel type *i* in power unit *m* in year *y* (tCO2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency in power unit *m* in year *y* (ratio)
m	=	All grid power units serving the grid in year *y*
i	=	All fossil fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

The following table summarize the published data on fuel consumption from the power plants:

		$FC_{i,m,y}$ (kg/year)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Amot	Coal	6,395,805,000	6,794,134,000	6,525,670,000
Camden	Coal	3,876,211,000	4,732,163,000	4,629,763,000
Duvha	Coal	11,393,553,000	11,744,606,000	10,639,393,000
Grootvlei	Coal	674,538,000	1,637,371,000	2,132,979,000
Hendrina	Coal	7,122,918,000	6,905,917,000	7,139,198,000
Kendal	Coal	15,356,595,000	13,866,514,000	15,174,501,000
Komati	Coal	0	664,497,000	1,271,010,000
Kriel	Coal	9,420,764,000	8,504,715,000	9,527,185,000
Lethabo	Coal	16,715,323,000	18,170,227,000	17,774,699,000
Majuba	Coal	12,554,406,000	12,261,833,000	13,020,512,000
Matimba	Coal	13,991,453,000	14,637,481,000	14,596,842,000
Matla	Coal	12,689,387,000	12,438,391,000	12,155,421,000
Tutuka	Coal	11,231,583,000	10,602,839,000	10,191,709,000
Acacia	Gas (Jet kerosene)	0	0	347,066.46
Port Rex	Gas (Jet kerosene)	0	0	219,913.98
Ankerlig	Gas/Diesel Oil	0	0	0
Gourikwa	Gas/Diesel Oil	0	0	0

For the Acacia and Port Rex power stations, data on fuel consumption published was in litre units. In order to convert these values to kg/ year, the density of the fuel in kg/l as shown below multiplied the values as indicated below:

Plant Name	**Fuel** ***(litres/year)***			**Density** ***(kg/l)***	**Fuel** ***(kg/year)***		
	2008-2009	***2009-2010***	***2010-2011***		***2008-2009***	***2009-2010***	***2010-2011***
Acacia	0	0	444,957	0.78	0	0	347,066.46
Port Rex	0	0	281,941	0.78	0	0	219,913.98
Ankerlig	0	0	0	0.82	0	0	0
Gourikwa	0	0	0	0.82	0	0	0

For the calculation of the individual power plants emission factors, the following net calorific values and average emission factors for the fuels have been considered:

Type	***NCV (GJ/kg)***	$EF_{co2,i,y}$ (tCO2/GJ)
Coal (Other bituminous coal)	0.0199	0.0895
Gas (Jet kerosene)	0.0420	0.0697
Gas/Diesel Oil	0.0414	0.0726

Finally, for Option A2 power plants for year 2009-2010, the following data is used:

	$EF_{CO2,m,i,y}$	$\eta_{m,y}$	$EF_{el,m,y}$
Acacia	0.0697	30%	0.84
Port Rex	0.0697	30%	0.84

Ankerlig	0.0726	39.5%	0.66
Gourikwa	0.0726	39.5%	0.66

The default value for open cycle gas turbines that began generation after the year 2000 in Annex 1 in the *Tool to calculate the emission factor for an electricity system* has been used for Ankerlig and Gourikwa power stations. For Acacia and Port Rex, the default value for old units (before and in 2000) has been used.

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

For the calculation of the build margin (BM) emission factor, Option 1 data vintage has been chosen. Hence, for the first crediting period, the build margin emission factor will be calculated *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PoA-DD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period will be used.

The build margin emission factor is thus calculated using **equation 12** of the *Tool to calculate the emission factor for an electricity system*, as shown below:

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

Where:

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

The table below provides an overview of the power plants connected to the South African electricity system as well as their commissioning dates.

Number	Project Name	Type	Commissioning Date
1	Bethlehem hydroelectric project	Hydro	11/11/2009
2	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008
3	PetroSA biogas to energy	Waste water	01/09/2007
4	Gourikwa	Gas fuel	30/03/2007
5	Ankerlig	Gas fuel	29/03/2007

6	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006
7	Klipheuwel	Wind	Aug-2002
8	Majuba	Coal	01/04/1996
9	Kendal	Coal	01/10/1988
10	Palmiet	Pumped storage	18/04/1988
11	Matimba	Coal	04/12/1987
12	Lethabo	Coal	22/12/1985
13	Tutuka	Coal	01/06/1985
14	Colleywobbles	Hydropower	01/01/1985
15	Koeberg	Nuclear	21/07/1984
16	Ncora	Hydropower	01/03/1983
17	Drakensberg	Pumped storage	17/06/1981
18	Duvha	Coal	18/01/1980
19	Matla	Coal	29/09/1979
20	Second Falls	Hydropower	01/04/1979
21	First Falls	Hydropower	01/02/1979
22	Vanderkloof	Hydropower	01/01/1977
23	Port Rex	Gas fuel	30/09/1976
24	Acacia	Gas fuel	13/05/1976
25	Kriel	Coal	06/05/1976
26	Amot	Coal	21/09/1971
27	Gariep	Hydropower	08/09/1971
28	Hendrina	Coal	12/05/1970
29	Grootvlei	Coal	30/06/1969
30	Camden	Coal	21/12/1966
31	Komati	Coal	06/11/1961

In order to identify the power units *m* included in the build margin and in accordance with the *Tool to calculate the grid emission factor for an electricity system*, $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ were identified. Both $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ comprise the same power plants, thus both are SET_{sample}.

	Name	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,y (MWh/y)***
1	Gourikwa	Gas fuel	30/03/2007	0%	0
2	Ankerlig	Gas fuel	29/03/2007	0%	0
3	Klipheuwel	Wind	Aug-2002	0%	2,000
4	Majuba	Coal	01/04/1996	11%	24,632,585
5	Kendal	Coal	01/10/1988	22%	25,648,258
	Total				**50,282,843**

As some of the power plants in the SET_{sample}, Majuba and Kendal, started to supply electricity to the grid more than 10 years ago, step (d) was considered and $SET_{sample\text{-}CDM}$ was calculated.

	Name	Technology	Year of Commissioning	Cumulative %	*EGm,y (MWh/y)*
1	Gourikwa	Gas fuel	30/03/2007	0.000%	0.00
2	Ankerlig	Gas fuel	29/03/2007	0.000%	0.00
3	Klipheuwel	Wind	Aug-2002	0.001%	2,000
CDM	Bethlehem hydroelectric project	Hydro	11/11/2009	0.005%	8,983
CDM	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008	0.018%	31,723
CDM	PetroSA biogas to energy	Waste water	01/09/2007	0.028%	23,286
CDM	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006	0.030%	3,744
	Total	***AEG SET$_{sample-CDM}$***			***69,736***

AEG SET$_{sample-CDM}$ was around 0.03%, much lower than 20% required by the *Tool to calculate the emission factor for an electricity system*. Therefore, step (e) was considered and power units that started to supply electricity to the grid more than 10 years ago were added until the electricity generation of the new set comprised 20% of the annual electricity generation. The final set of power plants included in the calculation of the Build Margin (SET$_{sample-CDM>10years}$) was as follows:

Number	Name	Technology	Year of Commissioning	Cumulative %	*EGm,y (MWh/y)*
1	Gourikwa	Gas fuel	30/03/2007	0.0%	-
2	Ankerlig	Gas fuel	29/03/2007	0.0%	-
3	Klipheuwel	Wind	Aug-2002	0.0%	2,000.00
	Bethlehem hydroelectric project	Hydro	11/11/2009	0.0%	8,983.13
	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008	0.0%	31,723.20
	PetroSA biogas to energy	Waste water	01/09/2007	0.0%	23,285.54
	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006	0.0%	3,744.00
4	Majuba	Coal	01/04/1996	10.6%	24,632,585
5	Kendal	Coal	01/10/1988	21.7%	25,648,258
	Total	***AEG SETsample-CDM>10years***			***50,350,579***

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) is determined as per the guidance in step 4 (a) for the simple OM, using **equation (3)** under option A2 following guidelines in the tool that stipulates as follows "If the power units included in the build margin m correspond to the sample group SET$_{sample-CDM->10yrs}$, then, as a conservative approach, only option A2 from guidance in Step 4 (a) can be used and the default values provided in Annex 1 shall be used to determine the parameter $\eta_{m,y}$. "

Equation 3, option A2 is shown below:

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

Where:

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)

$EF_{CO2,m,i,,y}$ = Average CO_2 emission factor of fuel type *i* used in power plant *m* in year *y* (tCO2/GJ)

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (ratio)

m = The power *units* included in the build margin

y = The relevant year as per the data vintage chosen in Step 5

The following data was used in the calculation of $EF_{EF,m,y}$ for the plants in group $SET_{sample\text{-}CDM\text{->}10yrs}$

Name	***Technology***	$EF_{CO2,m,i,v}$ ***(tCO2/GJ)***	$\eta_{m,y}$	$EF_{EL,m,y}$
Gourikwa	Gas fuel	0.0726	39.5%	0.66
Ankerlig	Gas fuel	0.0726	39.5%	0.66
Klipheuwel	Wind	0.0000	-	-
Bethlehem hydroelectric project	Hydro	0.0000	-	-
Durban landfill gas Bisasar Road project	Land fill	0.0000	-	-
PetroSA biogas to energy	Waste water	0.0000	-	-
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	0.0000	-	-
Majuba	Coal	0.0895	35.5%	0.91
Kendal	Coal	0.0895	35.5%	0.91
	AEG $SET_{sample\text{-}CDM>10years}$			

The table below shows the values and power units applied in the calculation of the build margin.

Name	***Technology***	$EF_{el,m,v}$ ***(tCO2/MWh)***	$EG_{m,v}$ ***(MWh/y)***
Gourikwa	Gas fuel	0.66	-
Ankerlig	Gas fuel	0.66	-
Klipheuwel	Wind	-	2,000.00
Bethlehem hydroelectric project	Hydro	-	8983

Durban landfill gas Bisasar Road project	Land fill	-	31723
PetroSA biogas to energy	Waste water	-	23286
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	-	3744
Majuba	Coal	0.91	24,632,585
Kendal	Coal	0.91	25,648,258
Total	***AEG SETsample-CDM>10years***		***50,350,579***

For *y* the most recent historical year for which grid power generation data is available, in this case 2010-2011 was used and for *m,* the power *units* included in the build margin were used.

Step 6: Calculate the Combined Margin
Option A, i.e. the weighted average combined margin, is used as it is the preferred option.

The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{,grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO2/MWh)

$EF_{grid,CM,y}$ = Operating margin CO2 emission factor in year *y* (tCO2/MWh)

w_{OM} = Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

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

$w_{OM} = 0.75$ and $w_{BM} = 0.25$ for the first crediting period and subsequent crediting periods as the CPA is a wind power project.

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

Emission reductions
In line with ACM0002 (version 13.0.0) the emission reductions are calculated using **(equation 11)** as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emission reductions in year *y* (tCO2e/yr)

BE_y = Baseline Emissions in year *y* (tCO2/yr)

PE_y = Project emissions in year *y* (tCO2e/yr)

LE_y = Leakage emissions in year *y* (tCO2e/yr)

B.6.2. Data and parameters that are to be reported ex-ante

Data / Parameter	**$NCV_{i,y}$**
Unit	GJ/kg
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	<table><tr><th>Fuel Type</th><th>NCV (GJ/kg)</th></tr><tr><td>Coal (other bituminous coal)</td><td>0.0199</td></tr><tr><td>Gas/Jet kerosene</td><td>0.042</td></tr><tr><td>Gas/Diesel Oil</td><td>0.0414</td></tr></table>
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also no regional default values. Average OM: Calculated once for each crediting period during validation stage using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Unit	tCO2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also no regional default values. Average OM: Calculated once for each crediting period during validation stage using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

Fuel Type	EFCO2 (tCO2/GJ)
Coal (other bituminous coal)	0.0895
Gas/Jet kerosene	0.0697
Gas/Diesel Oil	0.0726

Data / Parameter	$\eta_{m,y}$
Unit	%
Description	Average net conversion efficiency of power unit *m* in year *y*
Source of data	Default value for open cycle gas turbines built after 2000 and Fluidised Bed System (FBS) coal generation technology for units built before and in 2000 is used as per Annex 1 of the *Tool to calculate the emission factor for an electricity system.*
Value(s) applied	
Choice of data or Measurement methods and procedures	There is no data published on the efficiency of Eskom's gas power plants, therefore default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Generation technology	Default efficiency
Open cycle gas turbines built after 2000	39.5%
Open cycle gas turbines built in or before 2000	30%
(FBS) coal generation technology for units built before and in 2000	35.5%

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y*
Source of data	Eskom published data and CDM Monitoring Reports for the CDM project activities
Value(s) applied	See appendix 4
Choice of data or Measurement methods and procedures	Data on electricity generation has been obtained from Eskom, the main utility company in South Africa and owner of the power plants. For the CDM power plants that are not owned by Eskom, generation data had to be calculated from the CDM Monitoring Reports. Average OM: Calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$FC_{i,m,y}$
Unit	Kg/year
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y*
Source of data	Eskom published data, other utility and government records
Value(s) applied	See appendix 4
Choice of data or Measurement methods and procedures	Data on fuel consumption has been obtained from Eskom, the main utility company in South Africa and owner of the power plants. The values provided for the coal plants are in tonnes. These values were converted to kg by multiplying by 1000. The values provided for the gas turbines i.e. Acacia, Port Rex, Ankerling and Gourikwa are in litres. These were converted to kg units by multiplying by the fuel type density given in (kg/l). For jet gasoline, the density value used was 0.78 kg/l while 0.82 kg/l was used for diesel oil. Average OM: Calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante.* For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

B.6.3. Ex-ante calculations of emission reductions

Project emissions

Project Emissions equal zero.

Baseline Emissions

The baseline emissions are to be calculated as follows:

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

Where:

BE_y = Baseline Emissions in year *y* (tCO2/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 emission factor for an electricity system" (tCO2/MWh)

Calculation of $EG_{PJ,y}$

The CPA is a project that installs a grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, therefore $EG_{PJ,y}$ is calculated as per option (a).

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

Where:

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

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

Parameter	Value	Unit	Source
$EG_{facility,y}$	[insert value]	MWh/yr	[insert source]

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

The combined margin emission factor for the grid is calculated using the following formula:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,CM,y}$ = Operating margin CO2 emission factor in year y (tCO2/MWh)
W_{OM} = Weighting of operating margin emissions factor (%)
W_{BM} = Weighting of build margin emissions factor (%)

Values to determine $EF_{grid,CM,y}$ for wind CPAs are:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	0.9063	tCO2/MWh	GEF calculations
W_{BM}	0.25		Default
$EF_{grid,OM-DD,y}$	0.9585	tCO2/MWh	GEF calculations
W_{OM}	0.75		Default

Therefore:

$EF_{grid,CM,y}$ = 0.9454 tCO2/MWh

BE_y = [Insert] * 0.9454= [Insert] tCO2/yr

Leakage emissions

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

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year y (tCO2e/yr)
BE_y	=	Baseline Emissions in year y (tCO2/yr)
PE_y	=	Project emissions in year y (tCO2e/yr)
LE_y	=	Leakage emissions in year y (tCO2e/yr)

Therefore, emission reductions equal:

[insert value of BE_y] – 0 – 0 = [insert value of ER_y] tCO2e/yr

B.7. Application of the monitoring methodology and description of the monitoring plan
B.7.1. Data and parameters to be monitored by each generic CPA

Data / Parameter	**$EG_{facility,y}$**
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data	Electricity meter(s)
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The following parameters shall be measured: (i) The quantity of electricity supplied by the project plant/unit to the grid; and (ii) The quantity of electricity delivered to the project plant/unit from the grid Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards and the *Code of practice of electricity metering* SANS 474:2009/NRS 057:2009. The electricity supplied to the grid and delivered to the project plant/unit from the grid will be measured continuously (hourly measurement and at least monthly recording) by a main (facility metering installation) and a back-up meter (system metering installation). The facility meter is installed at the Delivery Point with the electricity grid as agreed with the national transmission company (NTC) or distributor, as applicable. The system meter will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.
Monitoring frequency	The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with PPA.
QA/QC procedures	Measurement results will be cross-checked with records of sold electricity. Calibration of meters will be done according to the appropriate standard and equipment specifications, whichever is more precise. According to standard SANS 474:2009/NRS 057:2009, the accuracy class of the meter and its maximum interval between calibrations are the following: Size of project — Accuracy Class — Interval for period calibration (years) > 100 MVA — 0.2S — 5 10 MVA to < 100 MVA — 0.5S — 5 1 MVA to < 10 MVA — 1 — 10
Purpose of data	Calculation of baseline emissions
Additional comment	-

B.7.2. Description of the monitoring plan for a generic CPA

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. All data

collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. All measurements should be conducted with the calibrated measurement equipment according to relevant industry standards.

Operational and management structure

Each CPA implementing entity under the PoA will be responsible for the technical aspects related to on-site monitoring such as:

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the project activity
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, the Facility Metering Installation, according to appropriate standards or manufacturer specifications.
- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPA's monitoring responsibilities as described above. Each month/quarter, the CPA will submit monthly electricity generation records to the CME accompanied by the respective copy of records/invoices for sold electricity. The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

The CME, through its programme officer, will be responsible for the following:

- Training of CPAs on CDM monitoring requirements
- Collection of monitored data by the CPA
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored data with a copy of invoices and the proof of payment of those invoices
- Confirm that the CPA has operated the metering system in line with relevant regulations
- Preparation of monitoring report

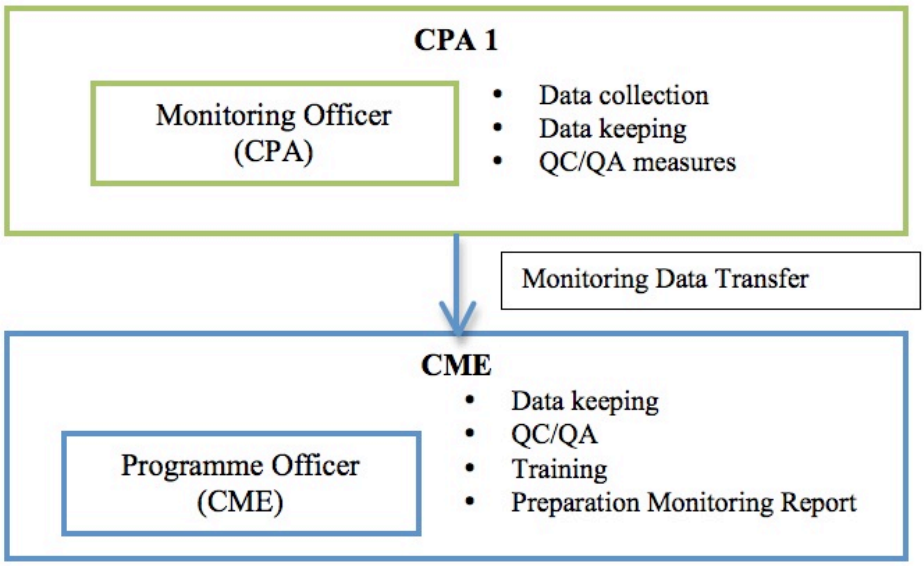


Figure 14. Monitoring organization

Parameters monitored

The only parameter monitored is the "Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y"* ($EG_{facility,y}$).

Metering

Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards. The South African National Standard has published the *Code of practice of electricity metering* SANS 474:2009/NRS 057:2009. This code of practice specifies the procedures and standards to be adhered to by electricity licensees and their agents in operating and servicing new and existing metering installations which are to be used for billing purposes. The code of practice is applicable to metering installations in their entirety, including all measuring transformers, wiring, cabling, metering panel construction, active and reactive meters, data loggers, and associated test facilities.

The CPA will be responsible for the Facility Metering Installation (main meter) procurement, installation, testing, commissioning and its operation and maintenance including:

- Calibration and maintenance of equipment
- Physical reading and day-to-day handling
- Quality Control and Quality assurance measures

The national transmission company (NTC) or the distribution company, as applicable, will be responsible for the System Metering Installation (back up meter) procurement, installation, testing, commissioning and its operation and maintenance. This meter cannot be accessed by the CPA implementing entity and the NTC or distributor only uses it for comparison purposes against the data provide by the CPA entity's Facility Metering Installation.

The Facility Metering Installation will be installed at the Delivery Point, which defines the commercial boundary between the licensee and the customer. The System Metering Installation will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.

QA/QC

The Facility Metering Installation readings will be crosschecked with the copies of invoices sent by the CPA implementing entity to the NTC or distributor, and the proof of payment of those invoices. If there is a difference between the values, the most conservative value will be used.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise. According to standard SANS 474:2009/NRS 057:2009, the accuracy class of the meter and its maximum interval between calibrations are the following:

Table 12. Metering accuracy and calibration frequency

Size of project	Accuracy Class	Interval for period calibration (years)
> 100 MVA	0.2S	5
10 MVA to < 100 MVA	0.5S	5
1 MVA to < 10 MVA	1	10

Emergency procedure: In case there is disagreement between the NTC and the CPA implementing entity with regard to the meter readings because the readings of the Facility Metering Installation and the System Metering Installation are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 12 above then the Facility Metering Installation and the System Metering Installation shall both be tested. Should the Facility Metering Installation be found to have a level of inaccuracy beyond the tolerance as described above, then the Facility Metering

Installation shall be recalibrated and the electricity output will be based on the readings registered by the System Metering Installation from the date of the last previous test of the Facility Metering Installation.

Should both the System Metering Installation and the Facility Metering Installation be found to have a level of inaccuracy falling outside the maximum tolerance level then each of the System Metering Installation and the Facility Metering Installation shall be recalibrated and the electricity output shall be recalculated applying the error identified in the calibration test of the Facility Metering Installations for all values from the date of the last previous test of the Facility Metering Installation.

In cases where one meter breaks down, then the readings of the other meter will be applied in the emission reduction calculations. If both meters break down or are unavailable, then the electricity generation value for that period will be assumed to be zero as a conservative approach.

The meter(s) readings will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data.

Data storage and archiving

Data will be stored electronically by the CME in a centralized database system for at least two years following the end of the last crediting period. The CPAs will need to provide a copy of the documentation, such as electricity sales invoices, proof of payment of those invoices and meter readings to the CME that will verify those.

The database contains the following information:

- Name of the CPA
- CPA implementing entity and contacts
- GPS coordinates
- Technical description
- Installed capacity
- Number of verifications and associated monitoring periods
- Monitored parameters and relevant evidence
- Emission reductions monitored

Training

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

PART II. Generic component project activity (CPA)

CPA TYPE III: GREENFIELD SOLAR PV PLANTS/UNITS IN SOUTH AFRICA APPLYING FIRST-OF-ITS-KIND BARRIER

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The CPA will involve the implementation and operation of a solar PV power plant implemented at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield project). The project activity will generate electricity from renewable sources, which will be fed into South Africa's national electricity grid, replacing fossil fuel based electricity generation. By this replacement, the project activity will lead to emission reductions.

The CPA is being pursued as a component of the PoA "Renewable Energy Carbon Programme for Africa (RECPA)" with Carbon Africa Limited as the CME.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

The CPA will apply approved consolidated baseline and monitoring methodology ACM0002 (version 13.0.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*.

ACM0002 version 13.0.0 also refers to the latest versions of the following tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool for the demonstration and assessment of additionality (version 07.0.0)*
- *Combined tool to identify the baseline scenario and demonstrate additionality (version 04.0.0)*
- *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 02)*

This CPA will only use the first two, the *Tool to calculate the emission factor for an electricity system (version 02.2.1)* and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*. The *Combined tool to identify the baseline scenario and demonstrate additionality (version 04.0.0)* will not be used, as there is no need to use that tool to describe the baseline scenario. The *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 02)* will also not be used as the CPA does not generate CO2 emissions from fossil fuel combustion for its operations.

B.2. Application of methodology(ies)

The generic CPA meets the applicability criteria listed in the approved consolidated baseline and monitoring methodology ACM0002 (version 13.0.0) as shown below:

Applicability criteria	Generic CPA justification
This methodology is applicable to grid-connected renewable power generation project activities that: (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a	CPAs will consist of solar PV projects connected to the South African grid that install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant)

capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The CPA will install a solar PV power plant, an eligible technology type under this methodology.
In the 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 period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	n/a. CPAs under this PoA are greenfield projects.
In case of hydro power plants one of the following conditions must apply: • The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or • The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2; or • The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2.	n/a. CPAs consist of solar PV projects, not hydro power plants.
In case of hydro power plants using multiple reservoirs where the power density of any of	n/a. CPAs consist of solar PV projects, not hydro power plants.

the reservoirs is lower than 4 W/m2 all of the following conditions must apply: • The power density calculated for the entire project activity using equation 5 is greater than 4W/m^2; • Multiple reservoirs and hydro power plants are located at the same river and where are designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant; • Water flow between the multiple 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 a 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 result in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2	n/a. CPAs under the PoA do not consist of: (i) switching from fossil fuels to renewable energy sources at the site of the project activity, (ii) biomass fired power plants, (iii) a hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2.
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use	n/a, CPAs under this PoA are greenfield projects.

prior to the implementation of the project activity and undertaking business as usual maintenance".	

The CPA will use the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*. The project activities will meet the applicability of the *Tool to calculate the emission factor for an electricity system* as follows:

This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	CPAs under the PoA will supply electricity to the South African national electricity grid.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is only located in South Africa as explained in section B.6.1 of part II of the PoA-DD, Calculation of $EF_{grid,CM,y}$, step 1. South Africa is not an annex I country.

The compliance of each CPA included in the PoA with the applicability criteria of ACM0002 (version 13.0.0) and associated tool will be ensured through eligibility criteria 5.

B.3. Sources and GHGs

The spatial extent of the project boundary will include the project power plant, the substation or connection point to the electricity system, and all power plants connected physically to the electricity system that the CDM project power plant is connected to (i.e. South African electricity grid operated by Eskom). The project activity will therefore displace electricity generated by South African fossil fuel based grid connected power plants and will therefore lead to emission reductions of CO2. The emissions sources and greenhouse gases included in the boundary for the purpose of calculating project emissions and baseline emissions for solar PV CPAs are provided in the table below:

	Source	GHGs	Included?	Justification/Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam	CO_2	No	This PoA does not involve geothermal power plants therefore no emissions are included
		CH_4	No	This PoA does not involve geothermal power plants

				therefore no emissions are included
		N_2O	No	This PoA does not involve geothermal power plants therefore no emissions are included
	CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
		CH_4	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
		N_2O	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
	For hydro power plants, emissions of CH4 from the reservoir	CO_2	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included
		CH_4	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included
		N_2O	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included

The figure below presents a flow diagram physically delineating the project boundary of solar PV CPAs.

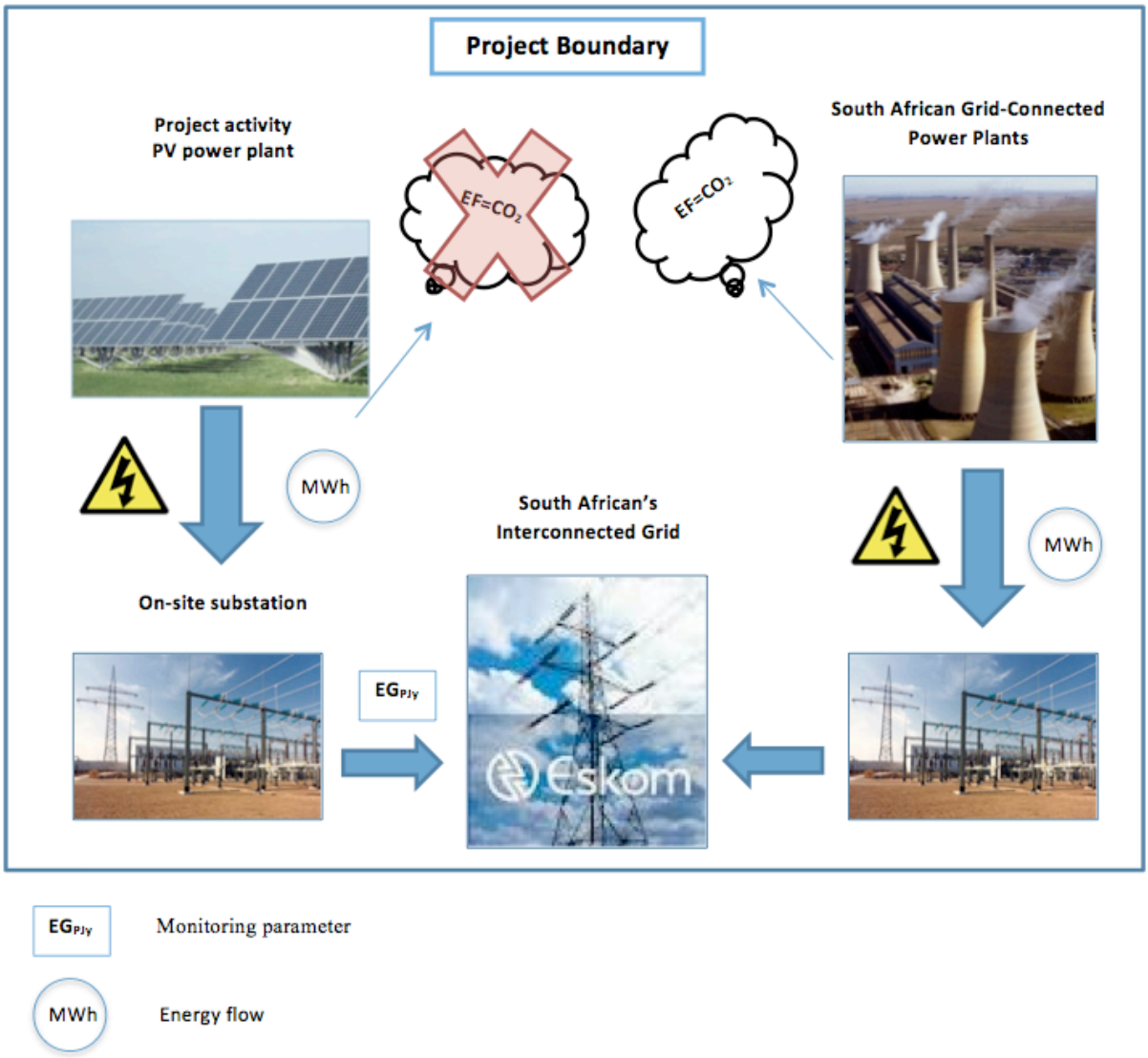


Figure 15: Flow diagram for solar PV project

B.4. Description of baseline scenario

In accordance with approved consolidated baseline methodology ACM0002 (version 13.0.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*, the baseline scenario for the installation of new grid-connected renewable power plant/units is "the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculated the emission factor for an electricity system".

The South African baseline scenario is further described below.

Structure of the South African Power Sector

The South African Department of Energy (DoE) is the legislative entity responsible for the South African energy sector. The energy sector is regulated by the *National Energy Act of 2008 (No.34 of 2008)*[57].

Specifically for the electricity sector of South Africa, the *Electricity Regulation Act of 2006 (No. 4 of 2006)*[58] determines the framework of the electricity sector. In May 2011, the Department of Energy, acting as the legislative entity, amended the *Electricity Regulations on New Generation Capacity*[59] under the *Electricity Regulation Act of 2006.* According to the current regulation, 70% of the new generation capacity must be implemented by the state-owned utility company Eskom, and 30% by Independent Power Producers (IPPs).[60] The Department of Energy has the mandate to decide which planned capacity addition will be implemented by Eskom, and which will be determined by a bidding process between IPPs. However, all IPPs are mandated to sell the generated electricity to Eskom (Single-Buyer-Model) through the signing of long-term Power Purchase Agreements (PPAs) with Eskom.

The Department of Energy determines the needed capacity additions after consultation with the National Energy Regulator of South Africa, NERSA. The DoE regularly develops an "*Integrated Resource Plan for Electricity"* which is updated every two years, the latest one being the *"Integrated Resource Plan 2010-2030 for Electricity"*[61] under the *Electricity Regulation Act No. 4 of 2006.* In its current version, from the year 2011, the Integrated Resource Plan determines the proposed specific amount of each technology in the electricity generation from 2010 to 2030.

Apart from the Department of Energy (DoE) and the National Energy Regulator of South Africa (NERSA), Eskom is the main player in the South African power sector. From 2002, Eskom became a public, limited liability company wholly owned by the government. Eskom owns and operates the National Electricity Grid and parts of the distribution network, and also owns 93% of the installed generation capacity.

[57] Department of Energy (2008), National Energy Act of 2oo8 http://www.info.gov.za/view/DownloadFileAction?id=92826, accessed on 30.12.2011
[58] Department of Energy (2006), Electricity Regulation Act of 2006, http://www.info.gov.za/view/DownloadFileAction?id=67855, accessed on 30.12.2011
[59] Department of Energy (2011), Electricity Regulations on New Generation Capacity, http://www.sapvia.co.za/electricity-regulations-on-new-generation-capacity-4-may-2011/, accessed on 30.12.2011
[60] Department of Energy, http://www.energy.gov.za/files/electricity_frame.html, accessed on 30.12.2011
[61] Department of Energy (2011), Electricity Regulations on the Integrated Resource Plan 2010-2030, http://www.info.gov.za/view/DownloadFileAction?id=146082, accessed on 30.12.2011

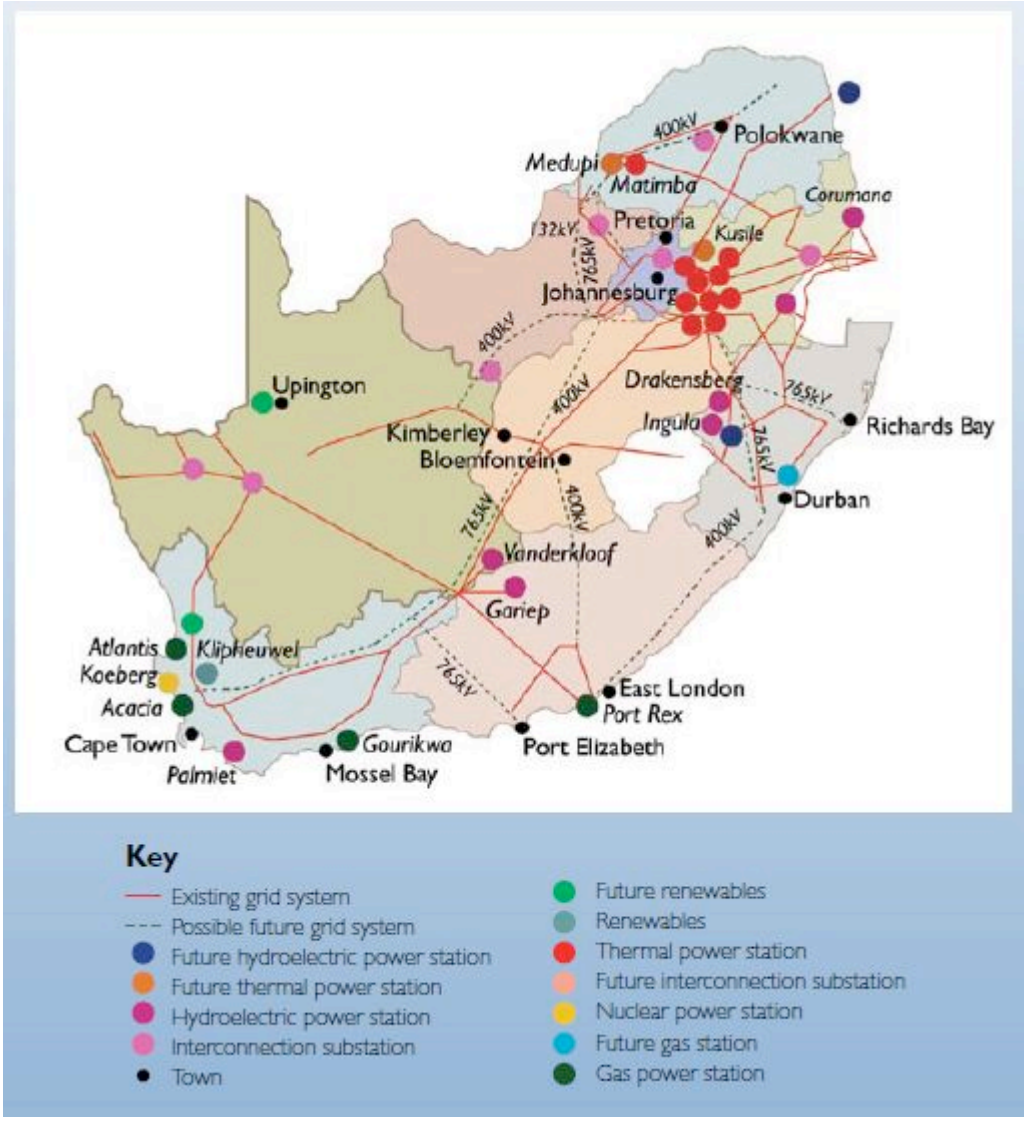


Figure 16. South African Power Sector

Generation

Electricity generation in South Africa is dominated by Eskom, which owns 93% of the installed capacity and supplies about 95% of South Africa's electricity. Municipal owned power plants and IPPs supply the remaining 5% of electricity. Approximately 90% of the total generated electricity is based on coal.[62]

Detailed description of the installed capacity for each technology is presented in the following tables. Data from Eskom's power plants is dated from 2011.[63] The latest published data for IPPs and municipal generation is from 2006[64].

[62] NERSA (2006), 2006 Electricity Supply Statistics for South Africa, http://www.nersa.org.za/Admin/Document/Editor/file/News%20and%20Publications/Publications/Current%20Issues/Electricity%20Supply%20Statistics/Electricity%20supply%20statistics%202006.pdf , accessed on 30.12.2011

[72] ESKOM (2011), Integrated Report 2011, http://financialresults.co.za/2011/eskom_ar2011/index.php, accessed on 30.12.2011

[64] NERSA (2006), 2006 Electricity Supply Statistics for South Africa, http://www.nersa.org.za/Admin/Document/Editor/file/News%20and%20Publications/Publications/Current%20Issues/Electricity%20Supply%20Statistics/Electricity%20supply%20statistics%202006.pdf accessed on 30.12.2011

Table 13. Eskom Electricity Generation Capacity

Installed Eskom capacity by source 2011	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	37,745	35,052
Gas	2,426	2,409
Hydro	661	600
Nuclear	1,910	1,830
PSHSP	1,400	1,400
Wind	3.16	3.16

Table 14. Municipalities Electricity Generation Capacity

Installed municipal capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,323	536
Gas	334	122
Hydro	4	-
PSHSP	189	174

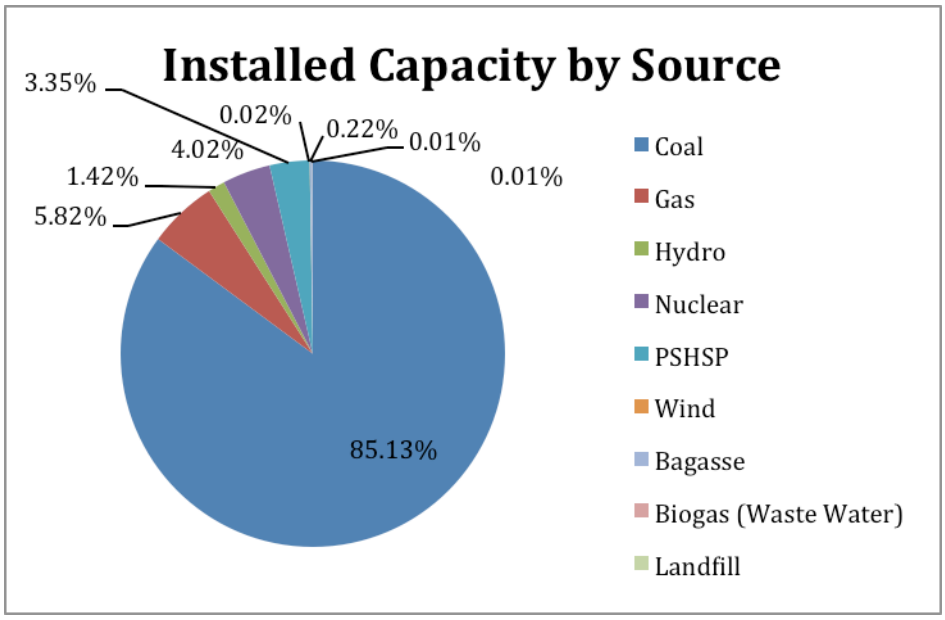
Table 15. IPP Electricity Generation Capacity

Installed private capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,339	933
Bagasse / Coal Fired Stations	105	66
Hydro	10	-
Wind	7	7
Waste Water / Biogas	4.25	4.25
Landfill	5	5

Municipal power plants are mostly coal thermal power plants and gas power plants which generate electricity for the direct supply in their municipal distribution area. Many municipalities own their own distribution networks, and some of them add generation capacity to their distribution lines by adding their own power plants on top of the electricity purchased from the national grid. Power plants operated by IPPs are commonly based on coal/bagasse. Some of the IPP owned power plants generate electricity for on-site consumption (large industrial consumers) and only feed electricity into the grid in the case of excess generation.

Currently, there are only three wind power plants connected to the grid. The 3.16 MW Klipheuwel Wind Farm which is owned by Eskom, the 5.2 MW Darling Wind Farm and the 1.8 MW Coega Wind Farm, which are IPP's owned by private investors. These plants have been developed as demonstration projects.

In terms of installed capacity, coal power plants' share is about 85% followed by electricity generation based on gas (6%), nuclear (4%) and pumped storage hydro power plants (3%). Pumped storage plants are net consumers of electricity, which pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas, etc. are negligible.



The *Integrated Resource Plan 2010-2030 for Electricity,* which determines the needed capacity and share of technologies in the future proposes the following capacity additions until 2030: [65]

Table 16. Summary of capacity additions 2010-2030

	Total Capacity by year 2030		Capacity added (including committed) from 2010 to 2030		New (uncommitted) capacity options from 2010 to 2030	
	MW	**%**	**MW**	**%**	**MW**	**%**
Coal	41,071	45.9	16,383	29.0	6,250	14.7
OCGT	7,330	8.2	4,930	8.7	3,910	9.2
CCGT	2,370	2.6	2,370	4.2	2,370	5.6
Pumped Storage	2,912	3.3	1,332	2.4	0	0.0
Nuclear	11,400	12.7	9,600	17.0	9,600	22.6
Hydro	4,759	5.3	2,659	4.7	2,609	6.1
Wind	9,200	10.3	9,200	16.3	8,400	19.7
CSP	1,200	1.3	1,200	2.1	1,000	2.4
PV	8,400	9.4	8,400	14.9	8,400	19.7
Other	890	1.0	465	0.8	0	0.0
Total	**89,532**		**56,539**		**42,539**	

The current installed capacity of 47,465 MW is therefore expected to double up to 89,532 MW by the year 2030 in order to meet the estimated rising electricity demand in the country, which is expected to have a peak demand of 80,272 MW by then. Apart from the domestic generation, the Integrated Resource Plan 2010-2030 for Electricity forecasts increasing imports of electricity generated from hydro power plants located in Zambia and Mozambique from 2022 onwards. However, the Integrated Resource Plan for Electricity also mentions that in order to reach this objective cross-border negotiations and an upgrade in transnational transmission infrastructure would be necessary. Additional risks regarding imports are delays from hydro power plants in the construction of the power plants and long-lasting droughts.

[65] Department of Energy (2011), Electricity Regulations on the Integrated Resource Plan 2010-2030, http://www.info.gov.za/view/DownloadFileAction?id=146082, accessed on 30.12.2011

The Integrated Resource Plan for Electricity also forecasts the continuation of the current power shortage until the year 2016 when newly installed power plants in line with Integrated Resource Plan 2010-2030 for Electricity will start operation.

B.5. Demonstration of eligibility for a generic CPA

14 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

Eligibility criteria 1: The geographic boundary of the CPA is located in South Africa. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in South Africa (an EIA license for a proposed CPA issued by the South African authorities would automatically imply that the CPA is located in South Africa).

14 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Eligibility criteria 2.1: The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

Eligibility criteria 2.2: The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced by the confirmation letter from the CME.

Eligibility criteria 2.3: The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

Eligibility criteria 2.4: The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in South Africa. This will be evidenced by a signed confirmation letter from the CME.

14 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;

Eligibility criteria 3.1: The CPA involves the implementation of a solar photovoltaic (PV) power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

Eligibility criteria 3.2: The solar photovoltaic module technology shall be certified to IEC/EN 61215 and IEC/EN 61730 standards (IEC 62108 for concentrated solar photovoltaic) in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme*. This will be evidenced by the IEC certificate. If at the time of the inclusion of the CPA, the certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria according to ACM0002 version 13.0.0.

Eligibility criteria 3.3: The installed capacity of the CPA will be minimal 1 MW and not more than 75MW per grid connection point. This is in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* which requires that "Projects must have a minimum installed capacity of 1 MW and a maximum installed capacity of 75 MW for a single grid connection point". The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

Eligibility criteria 3.4: The CPA will have a net load factor between 10% and 25%, or between 20% and 35% if concentrated solar photovoltaic, based on the P50 forecast. Net load factors are a function of solar irradiation, the type of photovoltaic module and losses in the system. The range is based on projects that have been registered under the CDM and, therefore, provides a realistic range of circumstances under which a solar PV projects can be developed. The P50 forecast is in line with the requirement in Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme,* para 2.6.2.5.1.

Eligibility criteria 3.5: The CPA will have an average annual global horizontal solar irradiation between 1,800 and 2,600 kWh/m2 based on data reported by an independent third party. This solar irradiation is considered as representative of the South Africa's context when compared to available reports[66] and it is generally considered that project below that range are not commercially viable as per industry standards.

14 d. Conditions to check the start date of the CPA through documentary evidence;

Eligibility criteria 4: The start of the CPA occurs after 02/06/2012. This will be evidenced by the EPC contract, contract with the turbine supplier or other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 02/06/2012.

14 e Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs

Eligibility criteria 5: The CPA has confirmed its compliance with the applicability of ACM0002, version 13.0.0 in section D.2 of the F-CDM-CPA-DD.

14 f The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;

Step 0: Demonstration whether the proposed CPA is the first-of-its-kind

In accordance with the *Guidelines on additionality of first-of-its-kind project activities (*version 02, EB 69, Annex 7), a CPA is considered as its first-of-its-kind if:

> (a) The project is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder consultation or before the start date of the proposed project activity, whichever is earlier;
>
> (b) The project implements one or more of the measures;

[66] Yearly sum of global irradiation incident on optimally-inclined surface, PCGIS, European Commission Joint Research Center, 2001

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

Output is goods/services produced by the project activity including, among other things, heat, steam, electricity, methane, and biogas unless otherwise specified in the applied methodology.

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

(a) Energy source/fuel (example: energy generation by different energy sources such as wind and hydro and different types of fuels such as biomass and natural gas);

(b) Feed stock (example: production of fuel ethanol from different feed stocks such as sugar cane and starch, production of cement with varying percentage of alternative fuels or less carbon-intensive fuels);

(f) Size of installation (power capacity)/energy savings:

(i) Micro (as defined in paragraph 24 of decision 2/CMP.5 and paragraph 39 of decision 3/CMP.6);
(ii) Small (as defined in paragraph 28 of decision 1/CMP.2);
(iii) Large.

As per eligibility criteria 1 the CPA has already evidenced that it is located within the geographical boundary of South Africa. The applicable geographical area is therefore the host country South Africa. As per eligibility criteria 3.1, the CPA has also evidenced that it involves the use of solar PV energy, a renewable energy, which is one of the applicable measures as per paragraph 2 of the *Guidelines on additionality of first-of-its-kind project activities.* For CPAs to be included to the PoA, output is defined as electricity generation being fed into the South African national grid.

Eligibility Criteria 6.1: The CME has confirmed that the CPA is applying a technology which is different from any other project in South Africa that supplies electricity to the South African national grid and has started commercial operation before the PoA and specific CPA-DD was published for Global Stakeholder Consultation[67], or before the inclusion of the CPA in the PoA or before the start date of the CPA (as defined in eligibility criterion 4), whichever is applicable and earlier. This will be evidenced by a comparison with all grid-connected power plants located in South Africa based on data, which has been made available by NERSA, Eskom and/or the Department of Energy (DoE) or any other credible source.

Eligibility Criteria 6.2: The project participants selected a crediting period for the CPA that is a maximum of 10 years with no option of renewal. This will be evidenced as per section A.9 of the CPA-DD.

If the proposed CPA is the first-of-its-kind as shown above, its additionality is demonstrated in accordance with paragraph 6 of the *Guidelines on additionality of first-of-its-kind project activities*.

In line with the requirements under ACM0002 (version 13.0.0) the eligibility criteria related to costs, revenues and investment climate are also applicable to CPAs applying the first-of-its-kind argument. Those shall be updated at least every two years in order to correctly reflect the technical and market circumstances of a CPA implementation.

[67] Only applicable for the first specific CPA, which is uploaded for Global Stakeholder Consultation together with the PoA-DD

Eligibility criteria 6.3: The CPA has applied for a tariff of not more than 2,850 ZAR/MWh in accordance with the current threshold of the IPP procurement programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence, or, if not available at the time of CPA inclusion, a confirmation in the PoA participation agreement or in a confirmation letter signed by the CPA implementing entity, that the CPA implementing entity will comply with relevant provisions in the IPP procurement programme, including the provisions related to the electricity tariff. The applicable tariff cap will be updated every two years or whenever the tariff is updated under the IPP procurement programme or other relevant government regulation, whichever occurs first..

Eligibility criteria 6.4: The total CAPEX of the project is more than 3,000,000 USD/MW, taking into account CAPEX items being derived from and be in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence used to estimate the CAPEX. The applicable CAPEX threshold will be updated every two years.

Eligibility criteria 6.5: The total operating costs will be at least 10 USD/MWh, taking into account requirements regarding OPEX items in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by documentation submitted to the South African Department of Energy (DoE) or to financing entities and equity investors, or by credible third party evidence that is used to estimate the operating costs. The range of operating costs will be updated every two years.

Eligibility criteria 6.6: In its submission to become an Independent Power Producer under the IPP Procurement Programme, the CPA has considered or will consider all relevant regulations and provisions with regard to financial flows, taxes, tariffs, depreciation and power purchase agreements applicable in South Africa at the time of the submission. This is evidenced by documentation submitted to the South African Department of Energy (DoE), to financing entities and equity investors, or, if not available at the time of CPA inclusion, confirmation in the PoA participation agreement or in a confirmation letter signed by the CPA implementing entity, that the CPA implementing entity will consider the relevant investment climate in terms of financial flows, taxes, tariffs, depreciation and power purchase agreements applicable in South Africa. The CME will confirm the investment climate parameters and update them every two years.

14 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;

Eligibility criteria 7.1: The CPA has carried out an Environmental Impact Assessment in line with South African regulations. This will be evidenced through the Environmental Authorisation (Record of Decision) from the Department of Environmental Affairs.

Eligibility criteria 7.2: The CPA has carried out a stakeholder consultation meeting the CDM requirements and (if available) DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

14 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;

Eligibility criteria 8.1: In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

Eligibility criteria 8.2: In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

14 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);

Eligibility criteria 9.1: The CPA is connected to the South African grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The CPA will focus on grid-connected renewable electricity generation from solar photovoltaic energy. The PoA will include project activities that install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant).

Project emissions

The CPA is a solar PV project. Therefore, project emissions are zero ($PE_y = 0$).

Baseline Emissions

Baseline emissions include CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The baseline emissions are to be calculated as follows **(equation 6)**:

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

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2/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 emission factor for an electricity system" (tCO2/MWh)

Calculation of $EG_{PJ,y}$

CPAs under the PoA involve the installation of new grid-connected renewable energy power plants/units at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield projects), therefore $EG_{PJ,y}$ is estimated as per option a, **equation 7**:

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

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year

y (MWh/yr)

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

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

The emission factor is calculated in a transparent and conservative manner using the combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).

The procedures applied to calculate the grid emission factor for the South African electricity system are described as shown below and will be fixed at PoA level and updated after every seven year crediting period of the PoA. Equations and fixed parameter values to calculate the grid emission factor for South Africa are provided below.

Step 1. Identify the relevant electric power system
For calculating the grid emission factor, the project activity has identified the South African national grid as the relevant project electricity system.

The identification of the South African national grid as the relevant project electricity system is based on the following arguments:

- The South African DNA has not published a delineation of the project electricity system and connected electricity system.
- There are not spot markets in the South African electricity system.
- Although the South African grid is connected to a number of its neighboring countries' grids including Lesotho, Namibia, Swaziland, Botswana and Mozambique, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary.
- Finally, South Africa does not have a layered dispatch system and only one grid system serves the entire country. Therefore, and in line with version 02.2.1 of the *Tool to calculate the emission factor for an electricity system*, the national grid definition is used by default.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)
The project activity has selected Option I and only grid power plants were included in the calculation.

Step 3. Select a method to determine the operating margin (OM)
The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

i) Simple OM
j) Simple adjusted OM
k) Dispatch data analysis OM
l) Average OM

In South Africa, low-cost/must-run resources constitute more than 50% of total grid generation. Apart from hydro, wind, and nuclear power plants, most coal-fired power plants have to be considered as low-cost/must-run as:

- Coal used in South African power plants is a cheap resource compared to other technologies e.g.

natural gas/kerosene because South Africa is the 6th largest producer of coal in the world with one of the lowest coal prices in the world.[68]

- Coal power plants in South Africa have an average capacity factor higher than 75%. In line with international common practice, power plants with a capacity factor higher than 75% are considered as base-load power plants, which are usually dispatched independently of the daily or seasonal load. Furthermore, Eskom Holdings Annual Report 2011 defines most of the coal power plants as baseload plants.

Because low-cost/must-run resources constitute more than 50% of the total grid generation, the simple OM method cannot be used. Therefore, the project activity has selected the average OM method for calculating the operating margin.

In terms of data vintage, the project will use the *ex ante* option, and the emission factor is determined once at the validation stage based on a 3-year generation weighted average based on the most recent data available at the time of submission of the CDM-PoA-DD to the DOE for validation.

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

The average OM emission factor ($EF_{grid,OM-ave,y}$), is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under (a) for the simple OM, but also including the low-cost/must-run power plants in all equations.

The average OM emission factor is calculated using **equation 1** from option A:

$$EF_{grid,OM-ave,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,OM-ave,y}$	=	Average operating margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
m	=	All grid power units serving the grid in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

For grid power plants, $EG_{m,y}$ is based on published records from Eskom and CDM monitoring reports for the CDM power plants. The grid emission factor calculations are based on the publicly available data in South Africa, i.e. Eskom power plants and CDM projects. This represents 95% of the total electricity generated. Electricity generated from Independent Power Producers and Municipality owned power plants is not available, therefore it could not be included in this calculation. However it only represents less than 5% of the total electricity generated. For the CDM projects, three years of public available data

[68] The future of South African coal; Market Investment and Policy changes –Anton Eberhard

is not available and, therefore, generation has been estimated based on those available monitoring report for a shorter period of time. However, it is considered to be more conservative to include an estimate for the electricity generation for the CDM projects than to assume that there was no electricity generation by the CDM projects for the years during which no data was available. Based on the number of months and the electricity generation reported in the monitoring report, the electricity generation has been first calculated per month and then the annual electricity generation was estimated. The table below summarizes the electricity generation for the various power plants connected to the electricity grid.

		Generation Data (*MWh*)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Amot	Coal	11,987,281	13,227,864	12,194,878
Camden	Coal	6,509,079	7,472,070	7,490,836
Duvha	Coal	21,769,489	22,581,228	20,267,508
Grootvlei	Coal	1,249,556	2,656,230	3,546,952
Hendrina	Coal	12,296,687	12,143,292	11,938,206
Kendal	Coal	23,841,401	23,307,031	25,648,258
Komati	Coal	-	1,016,023	2,060,141
Kriel	Coal	18,156,686	15,906,816	18,204,910
Lethabo	Coal	23,580,232	25,522,698	25,500,366
Majuba	Coal	22,676,924	22,340,081	24,632,585
Matimba	Coal	26,256,068	27,964,141	28,163,040
Matla	Coal	21,863,400	21,954,536	21,504,422
Tutuka	Coal	21,504,122	19,847,894	19,067,501
Acacia	Gas (Jet kerosene)	-	971.00	992.00
Port Rex	Gas (Jet kerosene)	-	322.00	5,507.00
Ankerlig	Gas/Diesel Oil	-	6,303.00	-
Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-
Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,764,661**	**228,828,053**	**232,394,838**

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

Because data on fuel consumption and electricity generation of the grid-connected units is available, Option A1 is used to determine the emission factors of the grid power units. However, for Acacia, Port Rex, Ankerlig and Gourikwa only data on electricity generation and fuel type is available for the year 2009-2010, thus Option A2 is used instead for those four power plants.

Option A1:

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	=	All grid power units serving the grid in year *y*
i	=	All fossil fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Option A2:

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO2 emission factor of fossil fuel type *i* in power unit *m* in year *y* (tCO2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency in power unit *m* in year *y* (ratio)
m	=	All grid power units serving the grid in year *y*
i	=	All fossil fuel types combusted in power unit *m* in year *y*

y = The relevant year as per the data vintage chosen in Step 3

The following table summarizes the published data on fuel consumption from the power plants:

		$FC_{i,m,y}$ (kg/year)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Amot	Coal	6,395,805,000	6,794,134,000	6,525,670,000
Camden	Coal	3,876,211,000	4,732,163,000	4,629,763,000
Duvha	Coal	11,393,553,000	11,744,606,000	10,639,393,000
Grootvlei	Coal	674,538,000	1,637,371,000	2,132,979,000
Hendrina	Coal	7,122,918,000	6,905,917,000	7,139,198,000
Kendal	Coal	15,356,595,000	13,866,514,000	15,174,501,000
Komati	Coal	0	664,497,000	1,271,010,000
Kriel	Coal	9,420,764,000	8,504,715,000	9,527,185,000
Lethabo	Coal	16,715,323,000	18,170,227,000	17,774,699,000
Majuba	Coal	12,554,406,000	12,261,833,000	13,020,512,000
Matimba	Coal	13,991,453,000	14,637,481,000	14,596,842,000
Matla	Coal	12,689,387,000	12,438,391,000	12,155,421,000
Tutuka	Coal	11,231,583,000	10,602,839,000	10,191,709,000
Acacia	Gas (Jet kerosene)	0	0	347,066.46
Port Rex	Gas (Jet kerosene)	0	0	219,913.98
Ankerlig	Gas/Diesel Oil	0	0	0
Gourikwa	Gas/Diesel Oil	0	0	0

For the Acacia and Port Rex power stations, data on fuel consumption published was in litre units. In order to convert these values to kg/ year, the density of the fuel in kg/l as shown below multiplied the values as indicated below:

Plant Name	**Fuel *(litres/year)***			**Density *(kg/l)***	**Fuel *(kg/year)***		
	2008-2009	***2009-2010***	***2010-2011***		***2008-2009***	***2009-2010***	***2010-2011***
Acacia	0	0	444,957	0.78	0	0	347,066.46
Port Rex	0	0	281,941	0.78	0	0	219,913.98
Ankerlig	0	0	0	0.82	0	0	0
Gourikwa	0	0	0	0.82	0	0	0

For the calculation of the individual power plants emission factors, the following net calorific values and average emission factors for the fuels have been considered:

Type	***NCV (GJ/kg)***	$EF_{co2,i,y}$ (tCO2/GJ)
Coal (Other bituminous coal)	0.0199	0.0895
Gas (Jet kerosene)	0.0420	0.0697
Gas/Diesel Oil	0.0414	0.0726

Finally, for Option A2 power plants for year 2009-2010, the following data is used:

	$EF_{CO2,m,i,y}$	$\eta_{m,y}$	$EF_{el,m,y}$

Acacia	0.0697	30%	0.84
Port Rex	0.0697	30%	0.84
Ankerlig	0.0726	39.5%	0.66
Gourikwa	0.0726	39.5%	0.66

The default value for open cycle gas turbines that began generation after the year 2000 in Annex 1 in the *Tool to calculate the emission factor for an electricity system* has been used for Ankerlig and Gourikwa power stations. For Acacia and Port Rex, the default value for old units (before and in 2000) has been used.

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

For the calculation of the build margin (BM) emission factor, Option 1 data vintage has been chosen. Hence, for the first crediting period, the build margin emission factor will be calculated *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PoA-DD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period will be used.

The build margin emission factor is thus calculated using **equation 12** of the *Tool to calculate the emission factor for an electricity system*, as shown below:

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

Where:

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

The table below provides an overview of the power plants connected to the South African electricity system as well as their commissioning dates.

Number	Project Name	Type	Commissioning Date
1	Bethlehem hydroelectric project	Hydro	11/11/2009
2	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008
3	PetroSA biogas to energy	Waste water	01/09/2007

4	Gourikwa	Gas fuel	30/03/2007
5	Ankerlig	Gas fuel	29/03/2007
6	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006
7	Klipheuwel	Wind	Aug-2002
8	Majuba	Coal	01/04/1996
9	Kendal	Coal	01/10/1988
10	Palmiet	Pumped storage	18/04/1988
11	Matimba	Coal	04/12/1987
12	Lethabo	Coal	22/12/1985
13	Tutuka	Coal	01/06/1985
14	Colleywobbles	Hydropower	01/01/1985
15	Koeberg	Nuclear	21/07/1984
16	Ncora	Hydropower	01/03/1983
17	Drakensberg	Pumped storage	17/06/1981
18	Duvha	Coal	18/01/1980
19	Matla	Coal	29/09/1979
20	Second Falls	Hydropower	01/04/1979
21	First Falls	Hydropower	01/02/1979
22	Vanderkloof	Hydropower	01/01/1977
23	Port Rex	Gas fuel	30/09/1976
24	Acacia	Gas fuel	13/05/1976
25	Kriel	Coal	06/05/1976
26	Amot	Coal	21/09/1971
27	Gariep	Hydropower	08/09/1971
28	Hendrina	Coal	12/05/1970
29	Grootvlei	Coal	30/06/1969
30	Camden	Coal	21/12/1966
31	Komati	Coal	06/11/1961

In order to identify the power units *m* included in the build margin and in accordance with the *Tool to calculate the grid emission factor for an electricity system*, $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ were identified. Both $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ comprise the same power plants, thus both are SET_{sample}.

	Name	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,y (MWh/y)***
1	Gourikwa	Gas fuel	30/03/2007	0%	0
2	Ankerlig	Gas fuel	29/03/2007	0%	0
3	Klipheuwel	Wind	Aug-2002	0%	2,000
4	Majuba	Coal	01/04/1996	11%	24,632,585
5	Kendal	Coal	01/10/1988	22%	25,648,258
	Total				**50,282,843**

As some of the power plants in the SET_{sample}, Majuba and Kendal, started to supply electricity to the grid more than 10 years ago, step (d) was considered and $SET_{sample-CDM}$ was calculated.

	Name	Technology	Year of Commissioning	Cumulative %	*EGm,y (MWh/y)*
1	Gourikwa	Gas fuel	30/03/2007	0.000%	0.00
2	Ankerlig	Gas fuel	29/03/2007	0.000%	0.00
3	Klipheuwel	Wind	Aug-2002	0.001%	2,000
CDM	Bethlehem hydroelectric project	Hydro	11/11/2009	0.005%	8,983
CDM	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008	0.018%	31,723
CDM	PetroSA biogas to energy	Waste water	01/09/2007	0.028%	23,286
CDM	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006	0.030%	3,744
	Total	***AEG $SET_{sample-CDM}$***			***69,736***

AEG $SET_{sample-CDM}$ was around 0.03%, much lower than 20% required by the *Tool to calculate the emission factor for an electricity system*. Therefore, step (e) was considered and power units that started to supply electricity to the grid more than 10 years ago were added until the electricity generation of the new set comprised 20% of the annual electricity generation. The final set of power plants included in the calculation of the Build Margin ($SET_{sample-CDM>10years}$) was as follows:

Number	Name	Technology	Year of Commissioning	Cumulative %	*EGm,y (MWh/y)*
1	Gourikwa	Gas fuel	30/03/2007	0.0%	-
2	Ankerlig	Gas fuel	29/03/2007	0.0%	-
3	Klipheuwel	Wind	Aug-2002	0.0%	2,000.00
	Bethlehem hydroelectric project	Hydro	11/11/2009	0.0%	8,983.13
	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008	0.0%	31,723.20
	PetroSA biogas to energy	Waste water	01/09/2007	0.0%	23,285.54
	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006	0.0%	3,744.00
4	Majuba	Coal	01/04/1996	10.6%	24,632,585
5	Kendal	Coal	01/10/1988	21.7%	25,648,258
	Total	***AEG $SET_{sample-CDM>10years}$***			***50,350,579***

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) is determined as per the guidance in step 4 (a) for the simple OM, using **equation (3)** under option A2 following guidelines in the tool that stipulates as follows "If the power units included in the build margin m correspond to the sample group $SET_{sample-CDM->10yrs}$, then, as a conservative approach, only option A2 from guidance in Step 4 (a) can be used and the default values provided in Annex 1 shall be used to determine the parameter $\eta_{m,y}$."

Equation 3, option A2 is shown below:

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

Where:

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)

$EF_{CO2,m,i,,y}$ = Average CO_2 emission factor of fuel type *i* used in power plant *m* in year *y* (tCO2/GJ)

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (ratio)

m = The power *units* included in the build margin

y = The relevant year as per the data vintage chosen in Step 5

The following data was used in the calculation of $EF_{EF,m,y}$ for the plants in group $SET_{sample\text{-}CDM\text{->}10yrs}$

Name	***Technology***	***$EF_{CO2,m,i,y}$ (tCO2/GJ)***	***$\eta_{m,y}$***	***$EF_{EL,m,y}$***
Gourikwa	Gas fuel	0.0726	39.5%	0.66
Ankerlig	Gas fuel	0.0726	39.5%	0.66
Klipheuwel	Wind	0.0000	-	-
Bethlehem hydroelectric project	Hydro	0.0000	-	-
Durban landfill gas Bisasar Road project	Land fill	0.0000	-	-
PetroSA biogas to energy	Waste water	0.0000	-	-
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	0.0000	-	-
Majuba	Coal	0.0895	35.5%	0.91
Kendal	Coal	0.0895	35.5%	0.91
	$AEG\ SET_{sample\text{-}CDM>10years}$			

The table below shows the values and power units applied in the calculation of the build margin.

Name	***Technology***	***$EF_{el,m,y}$ (tCO2/MWh)***	***$EG_{m,y}$ (MWh/y)***
Gourikwa	Gas fuel	0.66	-
Ankerlig	Gas fuel	0.66	-

Klipheuwel	Wind	-	2,000.00
Bethlehem hydroelectric project	Hydro	-	8983
Durban landfill gas Bisasar Road project	Land fill	-	31723
PetroSA biogas to energy	Waste water	-	23286
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	-	3744
Majuba	Coal	0.91	24,632,585
Kendal	Coal	0.91	25,648,258
Total	***AEG SETsample-CDM>10years***		***50,350,579***

For *y* the most recent historical year for which grid power generation data is available, in this case 2010-2011 was used and for *m,* the power *units* included in the build margin were used.

Step 6: Calculate the Combined Margin
Option A, i.e. the weighted average combined margin, is used as it is the preferred option.

The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{,grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO2/MWh)

$EF_{grid,CM,y}$ = Operating margin CO2 emission factor in year *y* (tCO2/MWh)

w_{OM} = Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

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

w_{OM} = 0.75 and w_{BM} = 0.25 for the first crediting period and subsequent crediting periods as the CPA is a solar PV project.

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

Emission reductions
In line with ACM0002 (version 13.0.0) the emission reductions are calculated using **(equation 11)** as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emission reductions in year y (tCO2e/yr)

BE_y = Baseline Emissions in year y (tCO2/yr)

PE_y = Project emissions in year y (tCO2e/yr)

LE_y = Leakage emissions in year y (tCO2e/yr)

B.6.2. Data and parameters that are to be reported ex-ante

Data / Parameter	**$NCV_{i,y}$**
Unit	GJ/kg
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	<table><tr><th>Fuel Type</th><th>NCV (GJ/kg)</th></tr><tr><td>Coal (other bituminous coal)</td><td>0.0199</td></tr><tr><td>Gas/Jet kerosene</td><td>0.042</td></tr><tr><td>Gas/Diesel Oil</td><td>0.0414</td></tr></table>
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also no regional default values. Average OM: Calculated once for each crediting period during validation stage using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Unit	tCO2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also no regional default values. Average OM: Calculated once for each crediting period during validation stage using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

Fuel Type	EFCO2 (tCO2/GJ)
Coal (other bituminous coal)	0.0895
Gas/Jet kerosene	0.0697
Gas/Diesel Oil	0.0726

Data / Parameter	$\eta_{m,y}$
Unit	%
Description	Average net conversion efficiency of power unit *m* in year *y*
Source of data	Default value for open cycle gas turbines built after 2000 and Fluidised Bed System (FBS) coal generation technology for units built before and in 2000 is used as per Annex 1 of the *Tool to calculate the emission factor for an electricity system.*
Value(s) applied	
Choice of data or Measurement methods and procedures	There is no data published on the efficiency of Eskom's gas power plants, therefore default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Generation technology	Default efficiency
Open cycle gas turbines built after 2000	39.5%
Open cycle gas turbines built in or before 2000	30%
(FBS) coal generation technology for units built before and in 2000	35.5%

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y*
Source of data	Eskom published data and CDM Monitoring Reports for the CDM project activities
Value(s) applied	See appendix 4
Choice of data or Measurement methods and procedures	Data on electricity generation has been obtained from Eskom, the main utility company in South Africa and owner of the power plants. For the CDM power plants that are not owned by Eskom, generation data had to be calculated from the CDM Monitoring Reports. Average OM: Calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$FC_{i,m,y}$
Unit	Kg/year
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y*
Source of data	Eskom published data, other utility and government records
Value(s) applied	See appendix 4
Choice of data or Measurement methods and procedures	Data on fuel consumption has been obtained from Eskom, the main utility company in South Africa and owner of the power plants. The values provided for the coal plants are in tonnes. These values were converted to kg by multiplying by 1000. The values provided for the gas turbines i.e. Acacia, Port Rex, Ankerling and Gourikwa are in litres. These were converted to kg units by multiplying by the fuel type density given in (kg/l). For jet gasoline, the density value used was 0.78 kg/l while 0.82 kg/l was used for diesel oil. Average OM: Calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante.* For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

B.6.3. Ex-ante calculations of emission reductions

Project emissions

Project Emissions equal zero.

Baseline Emissions

The baseline emissions are to be calculated as follows:

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

Where:

BE_y = Baseline Emissions in year *y* (tCO2/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 emission factor for an electricity system (tCO2/MWh)

Calculation of $EG_{PJ,y}$

The CPA is a project that installs a grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, therefore $EG_{PJ,y}$ is calculated as per option (a).

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

Where:

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

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

Parameter	Value	Unit	Source
$EG_{facility,y}$	[insert value]	MWh/yr	[insert source]

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

The combined margin emission factor for the grid is calculated using the following formula:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,CM,y}$ = Operating margin CO2 emission factor in year y (tCO2/MWh)
W_{OM} = Weighting of operating margin emissions factor (%)
W_{BM} = Weighting of build margin emissions factor (%)

Values to determine $EF_{grid,CM,y}$ for solar PV CPAs are:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	0.9063	tCO2/MWh	GEF calculations
W_{BM}	0.25		Default
$EF_{grid,OM-DD,y}$	0.9585	tCO2/MWh	GEF calculations
W_{OM}	0.75		Default

Therefore:

$EF_{grid,CM,y}$ = 0.9454 tCO2/MWh

BE_y = [Insert] * 0.9454= [Insert] tCO2/yr

Leakage emissions

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

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year y (tCO2e/yr)
BE_y	=	Baseline Emissions in year y (tCO2/yr)
PE_y	=	Project emissions in year y (tCO2e/yr)
LE_y	=	Project emissions in year y (tCO2e/yr)

Therefore, emission reductions equal:

[insert value of BE_y] – 0 – 0 = [insert value of ER_y] tCO2e/yr

B.7. Application of the monitoring methodology and description of the monitoring plan
B.7.1. Data and parameters to be monitored by each generic CPA

Data / Parameter	**$EG_{facility,y}$**
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data	Electricity meter(s)
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The following parameters shall be measured: (i) The quantity of electricity supplied by the project plant/unit to the grid; and (ii) The quantity of electricity delivered to the project plant/unit from the grid Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards and the *Code of practice of electricity metering* SANS 474:2009/NRS 057:2009. The electricity supplied to the grid and delivered to the project plant/unit from the grid will be measured continuously (hourly measurement and at least monthly recording) by a main (facility metering installation) and a back-up meter (system metering installation). The facility meter is installed at the Delivery Point with the electricity grid as agreed with the national transmission company (NTC) or distributor, as applicable. The system meter will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.
Monitoring frequency	The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with PPA.
QA/QC procedures	Measurement results will be cross-checked with records of sold electricity. Calibration of meters will be done according to the appropriate standard and equipment specifications, whichever is more precise. According to standard SANS 474:2009/NRS 057:2009, the accuracy class of the meter and its maximum interval between calibrations are the following:

Size of project	Accuracy Class	Interval for period calibration (years)
> 100 MVA	0.2S	5
10 MVA to < 100 MVA	0.5S	5
1 MVA to < 10 MVA	1	10

Purpose of data	Calculation of baseline emissions
Additional comment	-

B.7.2. Description of the monitoring plan for a generic CPA

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. All measurements should be conducted with the calibrated measurement equipment according to relevant industry standards.

Operational and management structure

Each CPA implementing entity under the PoA will be responsible for the technical aspects related to on-site monitoring such as:

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the project activity
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, the Facility Metering Installation, according to appropriate standards or manufacturer specifications.
- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPA's monitoring responsibilities as described above. Each month/quarter, the CPA will submit monthly electricity generation records to the CME accompanied by the respective copy of records/invoices for sold electricity. The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

The CME, through its programme officer, will be responsible for the following:

- Training of CPAs on CDM monitoring requirements
- Collection of monitored data by the CPA
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored data with a copy of invoices and the proof of payment of those invoices Confirm that the CPA has operated the metering system in line with relevant regulations
- Preparation of monitoring report

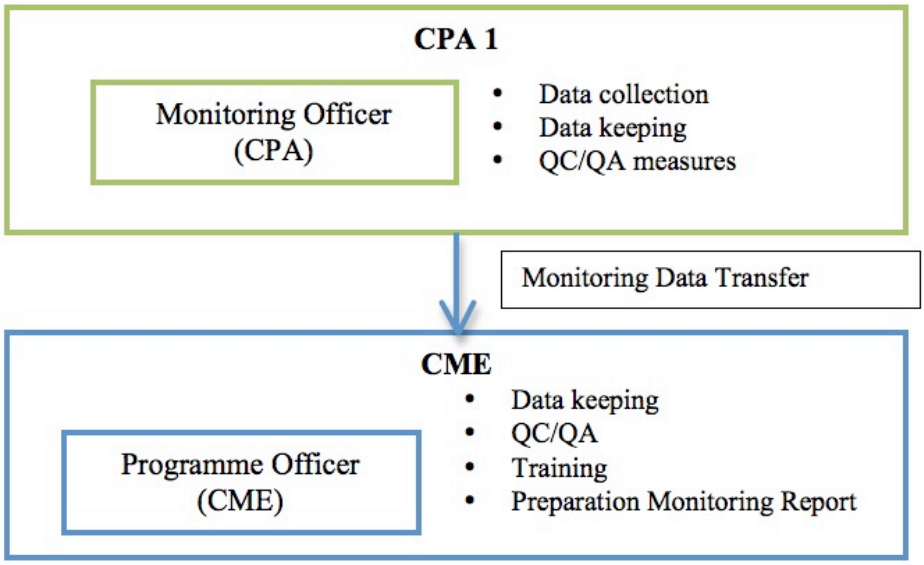


Figure 17. Monitoring organization

Parameters monitored

The only parameter monitored is the "Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y"* ($EG_{facility,y}$).

Metering

Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards. The South African National Standard has published the *Code of practice of electricity metering* SANS 474:2009/NRS 057:2009. This code of practice specifies the procedures and standards to be adhered to by electricity licensees and their agents in operating and servicing new and existing metering installations which are to be used for billing purposes. The code of practice is applicable to metering installations in their entirety, including all measuring transformers, wiring, cabling, metering panel construction, active and reactive meters, data loggers, and associated test facilities.

The CPA will be responsible for the Facility Metering Installation (main meter) procurement, installation, testing, commissioning and its operation and maintenance including:

- Calibration and maintenance of equipment
- Physical reading and day-to-day handling
- Quality Control and Quality assurance measures

The national transmission company (NTC) or the distribution company, as applicable, will be responsible for the System Metering Installation (back up meter) procurement, installation, testing, commissioning and its operation and maintenance. This meter cannot be accessed by the CPA implementing entity and the NTC or distributor only uses it for comparison purposes against the data provide by the CPA entity's Facility Metering Installation.

The Facility Metering Installation will be installed at the Delivery Point, which defines the commercial boundary between the licensee and the customer. The System Metering Installation will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.

QA/QC

The Facility Metering Installation readings will be crosschecked with the copies of invoices sent by the CPA implementing entity to the NTC or distributor, and the proof of payment of those invoices. If there is a difference between the values, the most conservative value will be used.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise. According to standard SANS 474:2009/NRS 057:2009, the accuracy class of the meter and its maximum interval between calibrations are the following:

Table 17. Metering accuracy and calibration frequency

Size of project	Accuracy Class	Interval for period calibration (years)
> 100 MVA	0.2S	5
10 MVA to < 100 MVA	0.5S	5
1 MVA to < 10 MVA	1	10

Emergency procedure: In case there is disagreement between the NTC and the CPA implementing entity with regard to the meter readings because the readings of the Facility Metering Installation and the System Metering Installation are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 17 above then the Facility Metering Installation and the System Metering Installation shall both be tested. Should the Facility Metering Installation be found

to have a level of inaccuracy beyond the tolerance as described above, then the Facility Metering Installation shall be recalibrated and the electricity output will be based on the readings registered by the System Metering Installation from the date of the last previous test of the Facility Metering Installation.

Should both the System Metering Installation and the Facility Metering Installation be found to have a level of inaccuracy falling outside the maximum tolerance level then each of the System Metering Installation and the Facility Metering Installation shall be recalibrated and the electricity output shall be recalculated applying the error identified in the calibration test of the Facility Metering Installations for all values from the date of the last previous test of the Facility Metering Installation.

In cases where one meter breaks down, then the readings of the other meter will be applied in the emission reduction calculations. If both meters break down or are unavailable, then the electricity generation value for that period will be assumed to be zero as a conservative approach.

The meter(s) readings will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data.

Data storage and archiving

Data will be stored electronically by the CME in a centralized database system for at least two years following the end of the last crediting period. The CPAs will need to provide a copy of the documentation, such as electricity sales invoices, proof of payment of those invoices and meter readings to the CME that will verify those.

The database contains the following information:

- Name of the CPA
- CPA implementing entity and contacts
- GPS coordinates
- Technical description
- Installed capacity
- Number of verifications and associated monitoring periods
- Monitored parameters and relevant evidence
- Emission reductions monitored

Training

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

PART II. Generic component project activity (CPA)

CPA TYPE IV: GREENFIELD SOLAR PV PLANTS/UNITS IN SOUTH AFRICA APPLYING INVESTMENT ANALYSIS

SECTION A. General description of a generic CPA
A.1. Purpose and general description of generic CPAs

The CPA will involve the implementation and operation of a solar PV power plant implemented at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield project). The project activity will generate electricity from renewable sources, which will be fed into South Africa's national electricity grid, replacing fossil fuel based electricity generation. By this replacement, the project activity will lead to emission reductions.

The CPA is being pursued as a component of the PoA "Renewable Energy Carbon Programme for Africa (RECPA)" with Carbon Africa Limited as the CME.

SECTION B. Application of a baseline and monitoring methodology
B.1. Reference of the approved baseline and monitoring methodology(ies) selected

The CPA will apply approved consolidated baseline and monitoring methodology ACM0002 (version 13.0.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*.

ACM0002 version 13.0.0 also refers to the latest versions of the following tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool for the demonstration and assessment of additionality (version 07.0.0)*
- *Combined tool to identify the baseline scenario and demonstrate additionality (version 04.0.0)*
- *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 02)*

The CPA will only use the first two, the *Tool to calculate the emission factor for an electricity system (version 02.2.1)* and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*. The *Combined tool to identify the baseline scenario and demonstrate additionality (version 04.0.0)* will not be used, as there is no need to use that tool to describe the baseline scenario. The *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion (version 02)* will also not be used as the CPA does not generate CO2 emissions from fossil fuel combustion for its operations.

B.2. Application of methodology(ies)

The generic CPA meets the applicability criteria listed in the approved consolidated baseline and monitoring methodology ACM0002 (version 13.0.0) as shown below:

Applicability criteria	Generic CPA justification
This methodology is applicable to grid-connected renewable power generation project activities that: (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the	CPAs will consist of solar PV projects connected to the South African grid that install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant)

project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).	
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit;	The CPA will install a solar PV power plant, an eligible technology type under this methodology.
In the 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 period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	n/a. CPAs under this PoA are greenfield projects.
In case of hydro power plants one of the following conditions must apply: • The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or • The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2; or • The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the project emissions section, is greater than 4 W/m^2.	n/a. CPAs consist of solar PV projects, not hydro power plants.
In case of hydro power plants using multiple	n/a. CPAs consist of solar PV projects, not hydro

reservoirs where the power density of any of the reservoirs is lower than 4 W/m2 all of the following conditions must apply: • The power density calculated for the entire project activity using equation 5 is greater than 4W/m^2; • Multiple reservoirs and hydro power plants are located at the same river and where are designed together to function as an integrated project that collectively constitutes the generation capacity of the combined power plant; • Water flow between the multiple 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 a 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.	power plants.
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 result in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2	n/a. CPAs under the PoA do not consist of: (i) switching from fossil fuels to renewable energy sources at the site of the project activity, (ii) biomass fired power plants, (iii) a hydro power plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the reservoir is less than 4 W/m^2.
In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power	n/a, CPAs under this PoA are greenfield projects.

generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	

The CPA will use the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) and the *Tool for the demonstration and assessment of additionality (version 07.0.0)*. The project activities will meet the applicability of the *Tool to calculate the emission factor for an electricity system* as follows:

This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	CPAs under the PoA will supply electricity to the South African national electricity grid.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is only located in South Africa as explained in section B.6.1 of part II of the PoA-DD, Calculation of $EF_{grid,CM,y}$, step 1. South Africa is not an annex I country.

The compliance of each CPA included in the PoA with the applicability criteria of ACM0002 (version 13.0.0) and associated tools will be ensured through eligibility criteria 5.

B.3. Sources and GHGs

The spatial extent of the project boundary will include the project power plant, the substation or connection point to the electricity system, and all power plants connected physically to the electricity system that the CDM project power plant is connected to (i.e. South African electricity grid operated by Eskom). The project activity will therefore displace electricity generated by South African fossil fuel based grid connected power plants and will therefore lead to emission reductions of CO2. The emissions sources and greenhouse gases included in the boundary for the purpose of calculating project emissions and baseline emissions for solar PV CPAs are provided in the table below:

Source		GHGs	Included?	Justification/Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam	CO_2	No	This PoA does not involve geothermal power plants therefore no emissions are included
		CH_4	No	This PoA does not involve

				geothermal power plants therefore no emissions are included
		N_2O	No	This PoA does not involve geothermal power plants therefore no emissions are included
	CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
		CH_4	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
		N_2O	No	This PoA does not involve geothermal or solar thermal power plants therefore no emissions are included
	For hydro power plants, emissions of CH4 from the reservoir	CO_2	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included
		CH_4	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included
		N_2O	No	This PoA does not involve hydroelectric power plants, therefore no emissions are included

The figure below presents a flow diagram physically delineating the project boundary of solar PV CPAs.

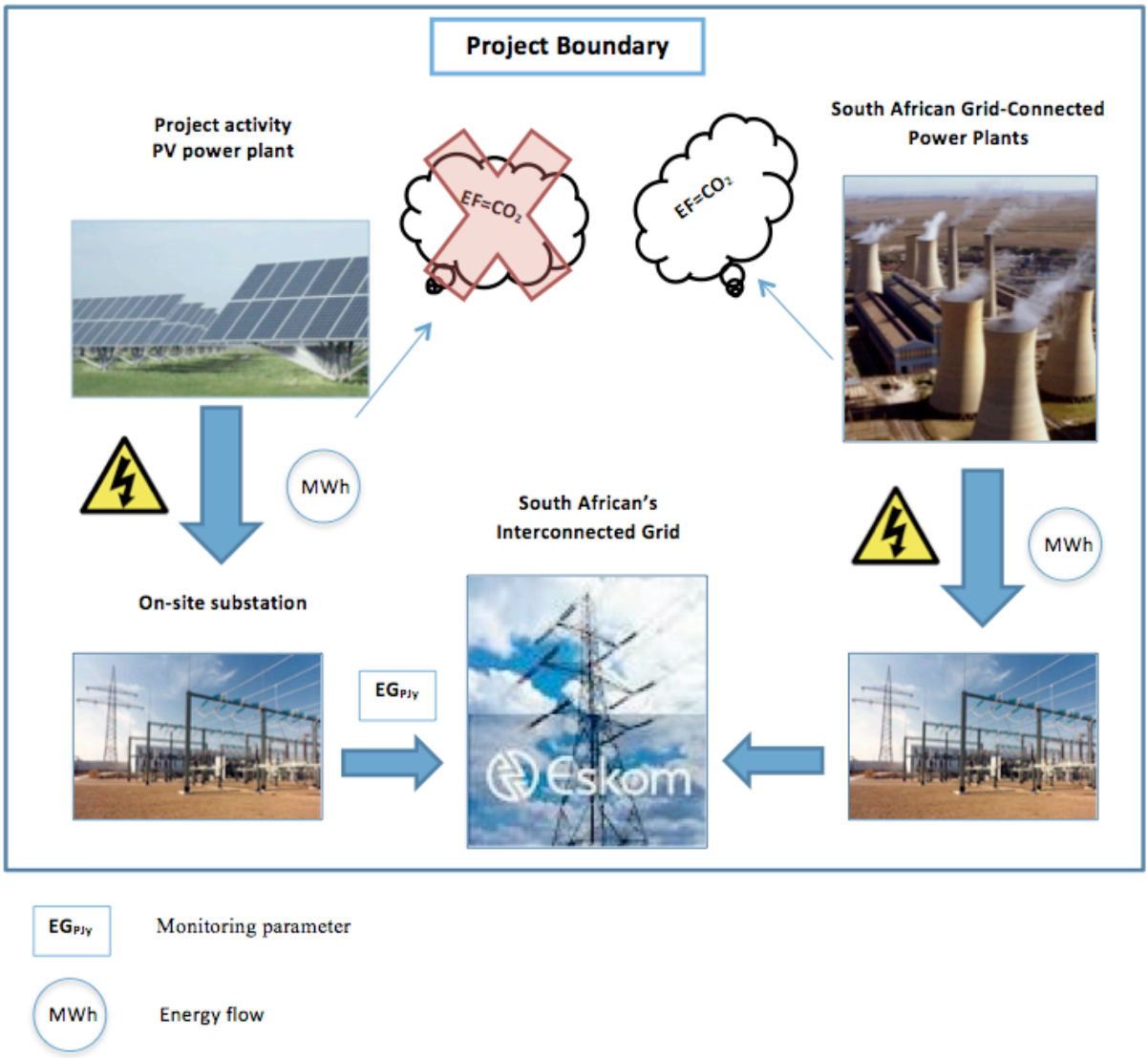


Figure 18: Flow diagram for solar PV project

B.4. Description of baseline scenario

In accordance with approved consolidated baseline methodology ACM0002 (version 13.0.0) *Consolidated baseline methodology for grid-connected electricity generation from renewable sources*, the baseline scenario for the installation of new grid-connected renewable power plant/units is "the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the "Tool to calculated the emission factor for an electricity system".

The South African baseline scenario is further described below.

Structure of the South African Power Sector

The South African Department of Energy (DoE) is the legislative entity responsible for the South African energy sector. The energy sector is regulated by the *National Energy Act of 2008 (No.34 of 2008)*[69].

Specifically for the electricity sector of South Africa, the *Electricity Regulation Act of 2006 (No. 4 of 2006)*[70] determines the framework of the electricity sector. In May 2011, the Department of Energy, acting as the legislative entity, amended the *Electricity Regulations on New Generation Capacity*[71] under the *Electricity Regulation Act of 2006.* According to the current regulation, 70% of the new generation capacity must be implemented by the state-owned utility company Eskom, and 30% by Independent Power Producers (IPPs).[72] The Department of Energy has the mandate to decide which planned capacity addition will be implemented by Eskom, and which will be determined by a bidding process between IPPs. However, all IPPs are mandated to sell the generated electricity to Eskom (Single-Buyer-Model) through the signing of long-term Power Purchase Agreements (PPAs) with Eskom.

The Department of Energy determines the needed capacity additions after consultation with the National Energy Regulator of South Africa, NERSA. The DoE regularly develops an "*Integrated Resource Plan for Electricity"* which is updated every two years, the latest one being the *"Integrated Resource Plan 2010-2030 for Electricity"*[73] under the *Electricity Regulation Act No. 4 of 2006.* In its current version, from the year 2011, the Integrated Resource Plan determines the proposed specific amount of each technology in the electricity generation from 2010 to 2030.

Apart from the Department of Energy (DoE) and the National Energy Regulator of South Africa (NERSA), Eskom is the main player in the South African power sector. From 2002, Eskom became a public, limited liability company wholly owned by the government. Eskom owns and operates the National Electricity Grid and parts of the distribution network, and also owns 93% of the installed generation capacity.

[69] Department of Energy (2008), National Energy Act of 2oo8 http://www.info.gov.za/view/DownloadFileAction?id=92826, accessed on 30.12.2011
[70] Department of Energy (2006), Electricity Regulation Act of 2006, http://www.info.gov.za/view/DownloadFileAction?id=67855, accessed on 30.12.2011
[71] Department of Energy (2011), Electricity Regulations on New Generation Capacity, http://www.sapvia.co.za/electricity-regulations-on-new-generation-capacity-4-may-2011/, accessed on 30.12.2011
[72] Department of Energy, http://www.energy.gov.za/files/electricity_frame.html, accessed on 30.12.2011
[73] Department of Energy (2011), Electricity Regulations on the Integrated Resource Plan 2010-2030, http://www.info.gov.za/view/DownloadFileAction?id=146082, accessed on 30.12.2011

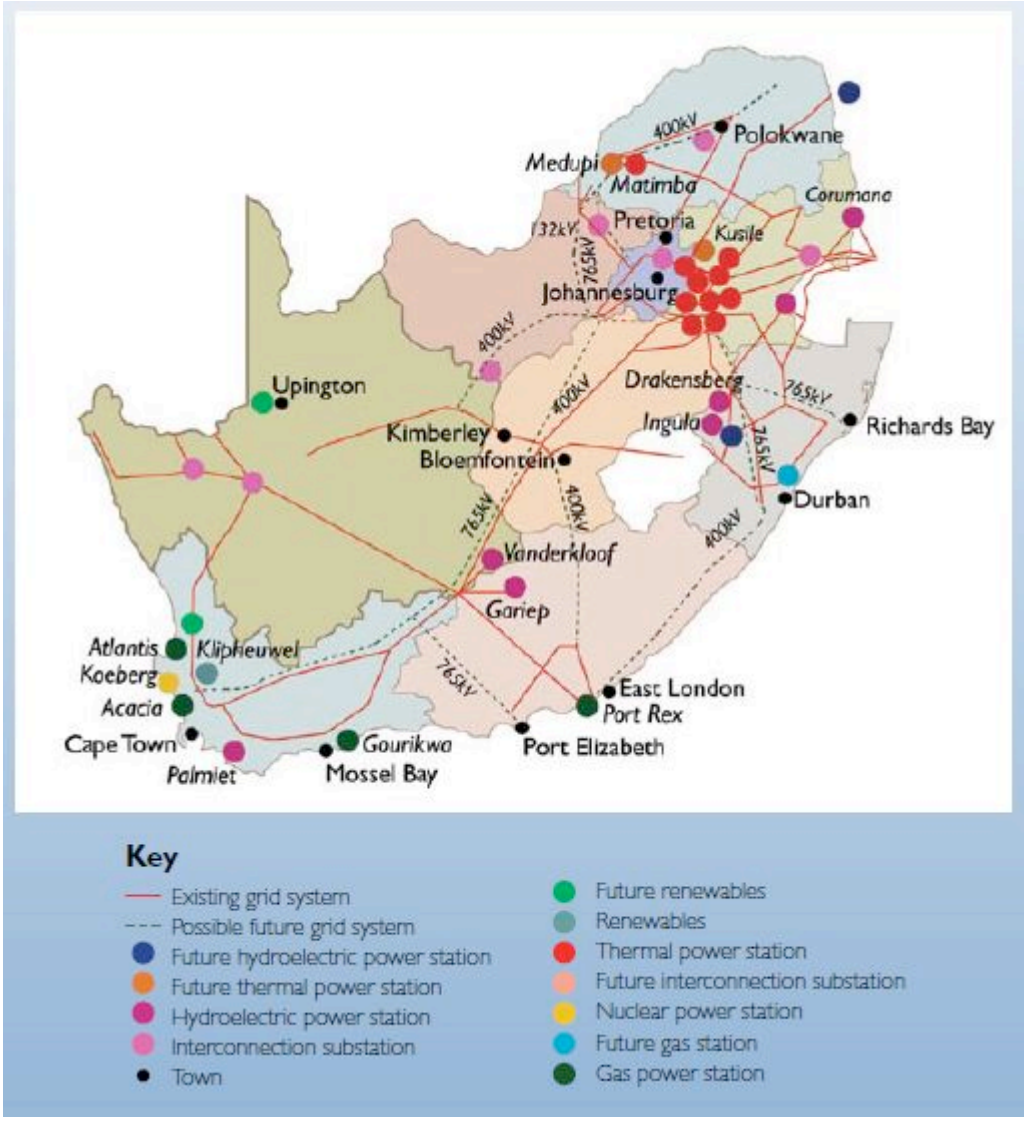


Figure 19. South African Power Sector

Generation

Electricity generation in South Africa is dominated by Eskom, which owns 93% of the installed capacity and supplies about 95% of South Africa's electricity. Municipal owned power plants and IPPs supply the remaining 5% of electricity. Approximately 90% of the total generated electricity is based on coal.[74]

Detailed description of the installed capacity for each technology is presented in the following tables. Data from Eskom's power plants is dated from 2011.[75] The latest published data for IPPs and municipal generation is from 2006[76].

[74] NERSA (2006), 2006 Electricity Supply Statistics for South Africa, http://www.nersa.org.za/Admin/Document/Editor/file/News%20and%20Publications/Publications/Current%20Issues/Electricity%20Supply%20Statistics/Electricity%20supply%20statistics%202006.pdf , accessed on 30.12.2011

[84] ESKOM (2011), Integrated Report 2011, http://financialresults.co.za/2011/eskom_ar2011/index.php, accessed on 30.12.2011

[76] NERSA (2006), 2006 Electricity Supply Statistics for South Africa, http://www.nersa.org.za/Admin/Document/Editor/file/News%20and%20Publications/Publications/Current%20Issues/Electricity%20Supply%20Statistics/Electricity%20supply%20statistics%202006.pdf accessed on 30.12.2011

Table 18. Eskom Electricity Generation Capacity

Installed Eskom capacity by source 2011	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	37,745	35,052
Gas	2,426	2,409
Hydro	661	600
Nuclear	1,910	1,830
PSHSP	1,400	1,400
Wind	3.16	3.16

Table 19. Municipalities Electricity Generation Capacity

Installed municipal capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,323	536
Gas	334	122
Hydro	4	-
PSHSP	189	174

Table 20. IPP Electricity Generation Capacity

Installed private capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,339	933
Bagasse / Coal Fired Stations	105	66
Hydro	10	-
Wind	7	7
Waste Water / Biogas	4.25	4.25
Landfill	5	5

Municipal power plants are mostly coal thermal power plants and gas power plants which generate electricity for the direct supply in their municipal distribution area. Many municipalities own their own distribution networks, and some of them add generation capacity to their distribution lines by adding their own power plants on top of the electricity purchased from the national grid. Power plants operated by IPPs are commonly based on coal/bagasse. Some of the IPP owned power plants generate electricity for on-site consumption (large industrial consumers) and only feed electricity into the grid in the case of excess generation.

Currently, there are only three wind power plants connected to the grid. The 3.16 MW Klipheuwel Wind Farm which is owned by Eskom, the 5.2 MW Darling Wind Farm and the 1.8 MW Coega Wind Farm, which are IPP's owned by private investors. These plants have been developed as demonstration projects.

In terms of installed capacity, coal power plants' share is about 85% followed by electricity generation based on gas (6%), nuclear (4%) and pumped storage hydro power plants (3%). Pumped storage plants are net consumers of electricity, which pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas, etc. are negligible.

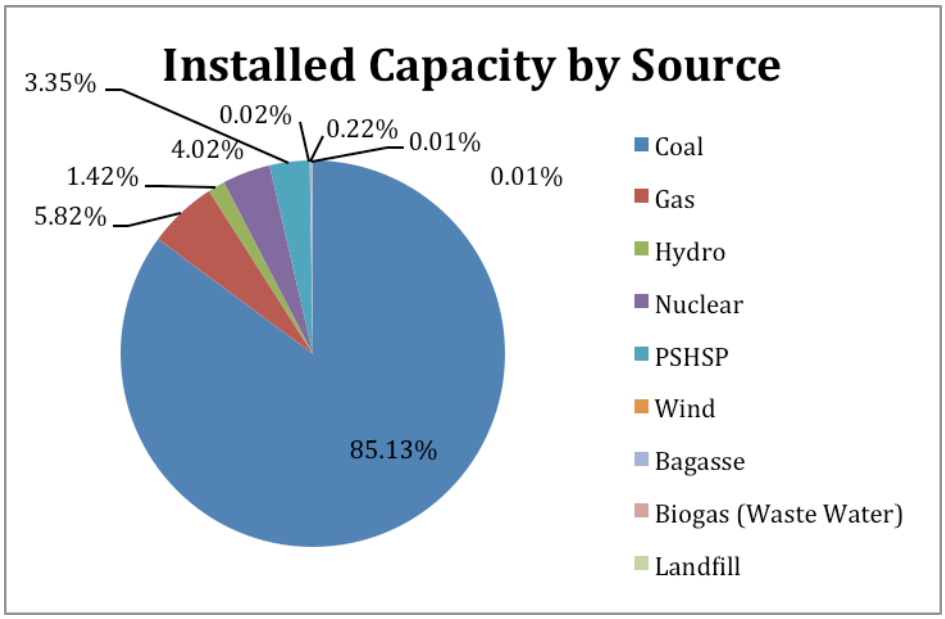


Figure 20: Installed capacity by source

The *Integrated Resource Plan 2010-2030 for Electricity,* which determines the needed capacity and share of technologies in the future proposes the following capacity additions until 2030: [77]

Table 21. Summary of capacity additions 2010-2030

	Total Capacity by year 2030		Capacity added (including committed) from 2010 to 2030		New (uncommitted) capacity options from 2010 to 2030	
	MW	**%**	**MW**	**%**	**MW**	**%**
Coal	41,071	45.9	16,383	29.0	6,250	14.7
OCGT	7,330	8.2	4,930	8.7	3,910	9.2
CCGT	2,370	2.6	2,370	4.2	2,370	5.6
Pumped Storage	2,912	3.3	1,332	2.4	0	0.0
Nuclear	11,400	12.7	9,600	17.0	9,600	22.6
Hydro	4,759	5.3	2,659	4.7	2,609	6.1
Wind	9,200	10.3	9,200	16.3	8,400	19.7
CSP	1,200	1.3	1,200	2.1	1,000	2.4
PV	8,400	9.4	8,400	14.9	8,400	19.7
Other	890	1.0	465	0.8	0	0.0
Total	**89,532**		**56,539**		**42,539**	

The current installed capacity of 47,465 MW is therefore expected to double up to 89,532 MW by the year 2030 in order to meet the estimated rising electricity demand in the country, which is expected to have a peak demand of 80,272 MW by then. Apart from the domestic generation, the Integrated Resource Plan 2010-2030 for Electricity forecasts increasing imports of electricity generated from hydro power plants located in Zambia and Mozambique from 2022 onwards. However, the Integrated Resource Plan for Electricity also mentions that in order to reach this objective cross-border negotiations and an upgrade in transnational transmission infrastructure would be necessary. Additional risks regarding imports are delays from hydro power plants in the construction of the power plants and long-lasting droughts.

[77] Department of Energy (2011), Electricity Regulations on the Integrated Resource Plan 2010-2030, http://www.info.gov.za/view/DownloadFileAction?id=146082, accessed on 30.12.2011

The Integrated Resource Plan for Electricity also forecasts the continuation of the current power shortage until the year 2016 when newly installed power plants in line with Integrated Resource Plan 2010-2030 for Electricity will start operation.

B.5. Demonstration of eligibility for a generic CPA

14 a. The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA

Eligibility criteria 1: The geographic boundary of the CPA is located in South Africa. The geographical boundary of the CPA will be evidenced through a description of the project location as provided by the CPA implementing entity. This could be in the form of a project area description in the EIA report, feasibility study/technical description or through an EIA license from the relevant authorities in South Africa (an EIA license for a proposed CPA issued by the South African authorities would automatically imply that the CPA is located in South Africa).

14 b. Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo)

Eligibility criteria 2.1: The CPA implementing entity has confirmed that the CPA has not yet been included in another PoA or has been registered as a single CDM project. This will be evidenced through the agreement between the CME and CPA or a signed confirmation letter from the CPA implementing entity.

Eligibility criteria 2.2: The CME has checked and confirmed on the CDM website that the CPA has not yet been included in another PoA or been registered as a single CDM project. This will be evidenced through a confirmation letter from the CME.

Eligibility criteria 2.3: The project proponent has provided a project area map including geographical coordinates. This will be evidenced through a project map in the feasibility study/technical description report, EIA report, or other relevant documentation.

Eligibility criteria 2.4: The CME has checked and confirmed that the project area of the proposed CPA does not overlap with the project area of another CPA or single CDM project in South Africa. This will be evidenced through a signed confirmation letter from the CME.

14 c. The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;

Eligibility criteria 3.1: The CPA involves the implementation of a solar photovoltaic (PV) power project supplying electricity to the national grid. This will be evidenced by the feasibility study/technical description, Power Purchase Agreement, EIA report or grid connection study.

Eligibility criteria 3.2: The solar photovoltaic module technology shall be certified to IEC/EN 61215 and IEC/EN 61730 standards (IEC 62108 for concentrated solar photovoltaic) in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme*. This will be evidenced by the IEC certificate. If at the time of the inclusion of the CPA, the certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificates before the start of construction.

In addition, the technology and type of service provided by the CPA will meet the following additional criteria according to ACM0002 version 13.0.0.

Eligibility criteria 3.3: The installed capacity of the CPA will be minimal 1 MW and not more than 75MW per grid connection point. This is in line with Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* which requires that "Projects must have a minimum installed capacity of 1 MW and a maximum installed capacity of 75 MW for a single grid connection point". The installed capacity will be based on the installed/rated capacity as indicated by the manufacturer and will be evidenced by the feasibility study/technical description or Power Purchase Agreement (PPA) or EIA report or EIA license.

Eligibility criteria 3.4: The CPA will have a net load factor between 10% and 25%, or between 20% and 35% if concentrated solar photovoltaic, based on the P50 forecast. Net load factors are a function of solar irradiation, the type of photovoltaic module and losses in the system. The range is based on projects that have been registered under the CDM and, therefore, provides a realistic range of circumstances under which a solar PV projects can be developed. The P50 forecast is in line with the requirement in Part B of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme,* para 2.6.2.5.1.

Eligibility criteria 3.5: The CPA will have an average annual global horizontal solar irradiation between 1,800 and 2,600 kWh/m2 based on data reported by an independent third party. This solar irradiation is considered as representative of the South Africa's context when compared to available reports[78] and it is generally considered that project below that range are not commercially viable as per industry standards.

14 d. Conditions to check the start date of the CPA through documentary evidence;

Eligibility criteria 4: The start of the CPA occurs after 02/06/2012. This will be evidenced by the EPC contract, contract with the turbine supplier or other type of substantial agreement (e.g. loan agreement), whichever is earlier. If such a contract is not yet available at the time of inclusion of the CPA, the CPA start date will automatically be after 02/06/2012.

14 e Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs

Eligibility criteria 5: The CPA has confirmed its compliance with the applicability of ACM0002, version 13.0.0 in section D.2 of the F-CDM-CPA-DD.

14 f The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A above;

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

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

According to para 8 of the *Tool for the demonstration and assessment of additionality,* project activities that apply the tool in context of approved consolidated methodology ACM0002, only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity. In line with the above guidelines, the following two alternatives can be identified:

Alternative 1: The project activity not undertaken as a CDM project activity

[78] Yearly sum of global irradiation incident on optimatlly-inclined surface, PCGIS, European Commission Joint Research Center, 2001

Alternative 2: Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the *Tool to calculate the emission factor for an electricity system*.

The above identification of alternatives is in line with para 8 of the *Tool for the demonstration and assessment of additionality*. No eligibility criteria was formulated for defining alternatives because the above two alternatives would by definition be applicable to every grid renewable energy project activity and will be included in every CPA-DD.

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

The above alternatives as well as the component project activity are consistent with mandatory and regulatory requirements, especially the Electricity Regulation Act No.4 of 2006, its Amendment Act, 2007 and the Electricity Regulation Act No.4 of 2006 – Electricity Regulations on New Generation Capacity issued on 04 May 2011. These laws and regulations are relevant for both alternatives, since they constitute the legal framework for current and future grid connected power plants in South Africa.

Alternative 2 can be considered as consistent with mandatory laws and regulations, since the continuation of operation of power plants currently connected to the grid is lawful due to the fact that article 16 and article 17 of the Electricity Regulation Act No.4 of 2006 and its Amendment Act, 2007 only allow the revocation of already issued generation licenses in case of non-compliance of the licensee or on application of the licensee. The laws and regulation regarding the addition of new grid connected generation capacity is outlined as per the Electricity Regulations on New Generation Capacity on 04 May 2011, which applies to all types of generation technology including renewable generation and cogeneration technology except of nuclear power generation technology. Therefore the addition of new generation capacity can be considered lawful.

Since Alternative 1 describes the addition of greenfield grid connected solar power capacity to the South Africa grid without carbon credits, this can also be considered consistent with mandatory laws and regulations since the Electricity Regulations on New Generation Capacity issued on 04 May 2011 covers the establishment of solar power technologies in South Africa.
There are no further applicable national laws or regulations, which require the application as a CDM project activity.

Step 2: Investment analysis

The following steps will be taken to demonstrate that the CPA is financially additional:

Sub-step 2a: Determine appropriate analysis method

The *Tool for the demonstration and assessment of additionality* provides three methods for carrying out investment analysis:
1. Simple cost analysis (Option I),
2. Investment comparison analysis (Option II)
3. Benchmark analysis (Option III).

The CPAs included in the PoA are expected to generate financial and economic benefits other than CDM related income (income from the sales of electricity) therefore the simple cost analysis (Option I) cannot be applied.

In line with ACM0002 (version 13.0.0), the baseline scenario for the project activities is the supply of electricity from a grid. Therefore, the baseline scenario does not necessarily require investment and is

outside the control of the project developers. Option III, benchmark analysis is selected as the appropriate analysis method for the project activities.

Eligibility Criteria 6.1: The CPA has carried out benchmark analysis to demonstrate additionality. This will be demonstrated through the investment analysis spread sheet.

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

Eligibility criteria 6.2: The CPA has applied (a) the pre-tax nominal WACC in combination with the Project IRR or (b) the post-tax nominal Return on Equity in combination with the Equity IRR, as explained below. This will be evidenced through the investment analysis spread sheet.

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

Eligibility criteria 6.3: Without the CER revenue, the CPA has a less favourable Project IRR or Equity IRR, whichever is applicable, than the benchmark. This will be evidenced in the investment analysis spread sheet.

Eligibility criteria 6.4: All input values applied in the investment analysis are applicable at the time of the investment decision. The CME will check whether all the input values are valid at the time of the investment decision.

Eligibility criteria 6.5: The date of the investment decision is either based on the date on which the project has received the solar resource assessment report and the board has decided to proceed with the project or the date on which the project has committed significant financial resources towards the implementation of the project. This will be evidenced by the solar resource assessment report together with a board resolution or by a contract involving the commitment of significant financial resources towards the implementation of the project.

Eligibility criteria 6.6: The CPA has used a tariff of not more than 2,850 ZAR/MWh in the investment analysis. This will be evidenced by the investment analysis spread sheet. The applicable tariff cap will be updated every two years or whenever the tariff is updated under the IPP procurement programme or other relevant government regulation, whichever occurs first..

Eligibility criteria 6.7: The total CAPEX of the project is more than 3,000,000 USD/MW, taking into account CAPEX items being derived from and be in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This is evidenced by the investment analysis spread sheet. The applicable CAPEX threshold will be updated every two years.

Eligibility criteria 6.8: The total operating costs will be at least 10 USD/MWh, taking into account requirements regarding OPEX items in accordance with Volume 4 – Financial requirements of the IPP Procurement Programme. This will be evidenced by the investment analysis spread sheet. The range of operating costs will be updated every two years.

Eligibility criteria 6.9: The CPA has used an income tax rate of 28% in the investment analysis, which is the South African tax rate. This will be evidenced by the investment analysis spread sheet. The tax rate will be updated every two years or whenever the income tax regulations in South Africa change, whichever occurs earlier.

Eligibility criteria 6.10: The CPA has applied the applicable depreciation rates in the investment analysis as provided by the South African regulations with regard to capital allowances. At the time of writing the PoA-DD. the capital allowance for energy infrastructure projects in South Africa was 50% for the first year of operation, 30% for the second year of operation and 20% for the third year of operation. The

applicable depreciation will be updated every two years or whenever the applicable depreciation rates in South Africa change, whichever occurs earlier.

Eligibility criteria 6.11: In terms of exchange rates, the exchange rates provided by the South African government as part of the *Request for qualification and proposals for new generation capacity under the IPP procurement programme* will be used. Alternatively, the exchange rate reported by South African Reserve Bank on the date of the investment decision can be used. In case both are available, the most conservative one will be used.

Sub-step 2d: Sensitivity analysis

Eligibility criteria 6.12: The CPA implementing entity will have carried out a sensitivity analysis on variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues. This will be evidenced in the investment analysis spread sheet. The sensitivity analysis will cover a range of +10% and -10%. The following parameters will be subject to sensitivity analysis:

- Investment cost
- Electricity generation
- Operating and maintenance cost
- Tariff

Eligibility criteria 6.13: The CPA implementing entity will have assessed at which parameter level the benchmark will be crossed and will have discussed the likelihood of those parameter levels to occur. This will be evidenced in the investment analysis spread sheet and specific CPA-DD.

Step 4: Common practice analysis

Eligibility criteria 6.14: In line with the *Tool for the demonstration and assessment of additionality*, it can be concluded that the CPA is not common practice as F is lower than 0.2 and $N_{all} - N_{diff}$ is lower than 3. The common practice analysis will be based on publicly availably data and information from NERSA, Eskom and/or the Department of Energy (DoE) or any other credible source. The results from the common practice analysis will be presented in the specific CPA-DD.

14 g. The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;

Eligibility criteria 7.1: The CPA has carried out an Environmental Impact Assessment in line with South African regulations. This will be evidenced through the Environmental Authorisation (Record of Decision) from the Department of Environmental Affairs.

Eligibility criteria 7.2: The CPA has carried out a stakeholder consultation meeting the CDM requirements and (if available) DNA requirements. This will be evidenced through records and reports from the public participation process (as part of the EIA process) or through records and reports from the CDM stakeholder consultation.

14 h. Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;

Eligibility criteria 8.1: In case the CPA implementing entity has not received funding from Annex I parties, it has confirmed so by issuing a signed confirmation letter.

Eligibility criteria 8.2: In case the CPA implementing entity has received funding from Annex I parties, a letter has been provided by the relevant national or supranational (e.g. EU) Annex I party(ies) agencies confirming that the funding does not result in a diversion of official development assistance.

14 i. Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);

Eligibility criteria 9.1: The CPA is connected to the South African grid. This will be evidenced in the feasibility study/technical description, EIA report, Power Purchase Agreement or grid-connection study.

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

The CPA will focus on grid-connected renewable electricity generation from solar photovoltaic energy. The PoA will include project activities that install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (greenfield plant).

Project emissions

This CPA includes solar PV projects. Therefore, project emissions are zero ($PE_y = 0$).

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. The baseline emissions are to be calculated as follows **(equation 6)**:

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

Where:

BE_y	=	Baseline Emissions in year *y* (tCO2/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 emission factor for an electricity system" (tCO2/MWh)

Calculation of $EG_{PJ,y}$

CPAs under the PoA involved the installation of new grid-connected renewable energy power plants/units at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield projects), therefore $EG_{PJ,y}$ is estimated as per option a, **equation 7**:

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

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year

y (MWh/yr)

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

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

The emission factor is calculated in a transparent and conservative manner using the combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the *Tool to calculate the emission factor for an electricity system version 02.2.1*.

The procedures applied to calculate the grid emission factor for the South African electricity system are described as shown below and will be fixed at PoA level and updated after every seven year crediting period of the PoA. Equations and fixed parameter values to calculate the grid emission factor for South Africa are provided below.

Step 1. Identify the relevant electric power system
For calculating the grid emission factor, the project activity has identified the South African national grid as the relevant project electricity system.

The identification of the South African national grid as the relevant project electricity system is based on the following arguments:

- The South African DNA has not published a delineation of the project electricity system and connected electricity system.
- There are not spot markets in the South African electricity system.
- Although the South African grid is connected to a number of its neighboring countries' grids including Lesotho, Namibia, Swaziland, Botswana and Mozambique, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary.
- Finally, South Africa does not have a layered dispatch system and only one grid system serves the entire country. Therefore, and in line with version 02.2.1 of the *Tool to calculate the emission factor for an electricity system*, the national grid definition is used by default.

Step 2. Choose whether to include off-grid power plants in the project electricity system (optional)
The project activity has selected Option I and only grid power plants were included in the calculation.

Step 3. Select a method to determine the operating margin (OM)
The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

m) Simple OM
n) Simple adjusted OM
o) Dispatch data analysis OM
p) Average OM

In South Africa, low-cost/must-run resources constitute more than 50% of total grid generation. Apart from hydro, wind, and nuclear power plants, most coal-fired power plants have to be considered as low-cost/must-run as:

- Coal used in South African power plants is a cheap resource compared to other technologies e.g. natural gas/kerosene because South Africa is the 6th largest producer of coal in the world with

one of the lowest coal prices in the world.[79]

- Coal power plants in South Africa have an average capacity factor higher than 75%. In line with international common practice, power plants with a capacity factor higher than 75% are considered as base-load power plants which are usually dispatched independently of the daily or seasonal load. Furthermore, Eskom Holdings Annual Report 2011 defines most of the coal power plants as baseload plants.

Because low-cost/must-run resources constitute more than 50% of the total grid generation, the simple OM method cannot be used. Therefore, the project activity has selected the average OM method for calculating the operating margin.

In terms of data vintage, the project will use the *ex ante* option, and the emission factor is determined once at the validation stage based on a 3-year generation weighted average based on the most recent data available at the time of submission of the CDM-PoA-DD to the DOE for validation.

Step 4: Calculate the operating margin emission factor according to the selected method
The average OM emission factor ($EF_{grid,OM\text{-}ave,y}$), is calculated as the average emission rate of all power plants serving the grid, using the methodological guidance as described under (a) for the simple OM, but also including the low-cost/must-run power plants in all equations.

The average OM emission factor is calculated using **equation 1** from option A:

$$EF_{grid,OM-ave,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

Where:

$EF_{grid,OM\text{-}ave,y}$	=	Average operating margin CO2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
m	=	All grid power units serving the grid in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

For grid power plants, $EG_{m,y}$ is based on published records from Eskom and CDM monitoring reports for the CDM power plants. The grid emission factor calculations are based on the publicly available data in South Africa, i.e. Eskom power plants and CDM projects. This represents 95% of the total electricity generated. Electricity generated from Independent Power Producers and Municipality owned power plants is not available, therefore it could not be included in this calculation. However it only represents less than 5% of the total electricity generated. For the CDM projects, three years of public available data is not available therefore, generation has been estimated based on those available monitoring reports for a

[79] The future of South African coal; Market Investment and Policy changes –Anton Eberhard

shorter period of time. However, it is considered to be more conservative to include an estimate for the electricity generation for the CDM projects than to assume that there was no electricity generation by the CDM projects for the years during which no data was available. Based on the number of months and the electricity generation reported in the monitoring report, the electricity generation has been first calculated per month and then the estimated the annual electricity generation. The table below summarizes the electricity generation for the various power plants connected to the electricity grid.

		Generation Data (*MWh*)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Amot	Coal	11,987,281	13,227,864	12,194,878
Camden	Coal	6,509,079	7,472,070	7,490,836
Duvha	Coal	21,769,489	22,581,228	20,267,508
Grootvlei	Coal	1,249,556	2,656,230	3,546,952
Hendrina	Coal	12,296,687	12,143,292	11,938,206
Kendal	Coal	23,841,401	23,307,031	25,648,258
Komati	Coal	-	1,016,023	2,060,141
Kriel	Coal	18,156,686	15,906,816	18,204,910
Lethabo	Coal	23,580,232	25,522,698	25,500,366
Majuba	Coal	22,676,924	22,340,081	24,632,585
Matimba	Coal	26,256,068	27,964,141	28,163,040
Matla	Coal	21,863,400	21,954,536	21,504,422
Tutuka	Coal	21,504,122	19,847,894	19,067,501
Acacia	Gas (Jet kerosene)	-	971.00	992.00
Port Rex	Gas (Jet kerosene)	-	322.00	5,507.00
Ankerlig	Gas/Diesel Oil	-	6,303.00	-
Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-
Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,764,661**	**228,828,053**	**232,394,838**

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

Because data on fuel consumption and electricity generation of the grid-connected units is available, Option A1 is used to determine the emission factors of the grid power units. However, for Acacia, Port Rex, Ankerlig, Gourikwa only data on electricity generation and fuel type is available for the year 2009-2010, thus Option A2 is used instead for those four power plants.

Option A1:

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO2 emission factor of fossil fuel type *i* in year *y* (tCO2/GJ)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	=	All grid power units serving the grid in year *y*
i	=	All fossil fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Option A2:

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

Where:

$EF_{EL,m,y}$	=	CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO2 emission factor of fossil fuel type *i* in power unit *m* in year *y* (tCO2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency in power unit *m* in year *y* (ratio)
m	=	All grid power units serving the grid in year *y*
i	=	All fossil fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

The following table summarize the published data on fuel consumption from the power plants:

		$FC_{i,m,y}$ (kg/year)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Amot	Coal	6,395,805,000	6,794,134,000	6,525,670,000
Camden	Coal	3,876,211,000	4,732,163,000	4,629,763,000
Duvha	Coal	11,393,553,000	11,744,606,000	10,639,393,000
Grootvlei	Coal	674,538,000	1,637,371,000	2,132,979,000
Hendrina	Coal	7,122,918,000	6,905,917,000	7,139,198,000
Kendal	Coal	15,356,595,000	13,866,514,000	15,174,501,000
Komati	Coal	0	664,497,000	1,271,010,000
Kriel	Coal	9,420,764,000	8,504,715,000	9,527,185,000
Lethabo	Coal	16,715,323,000	18,170,227,000	17,774,699,000
Majuba	Coal	12,554,406,000	12,261,833,000	13,020,512,000
Matimba	Coal	13,991,453,000	14,637,481,000	14,596,842,000
Matla	Coal	12,689,387,000	12,438,391,000	12,155,421,000
Tutuka	Coal	11,231,583,000	10,602,839,000	10,191,709,000
Acacia	Gas (Jet kerosene)	0	0	347,066.46
Port Rex	Gas (Jet kerosene)	0	0	219,913.98
Ankerlig	Gas/Diesel Oil	0	0	0
Gourikwa	Gas/Diesel Oil	0	0	0

For the Acacia and Port Rex, power stations, data on fuel consumption published was in litre units. In order to convert these values to kg/ year, the density of the fuel in kg/l as shown below multiplied the values as indicated below:

Plant Name	**Fuel** *(litres/year)*			**Density** *(kg/l)*	**Fuel** *(kg/year)*		
	2008-2009	***2009-2010***	***2010-2011***		***2008-2009***	***2009-2010***	***2010-2011***
Acacia	0	0	444,957	0.78	0	0	347,066.46
Port Rex	0	0	281,941	0.78	0	0	219,913.98
Ankerlig	0	0	0	0.82	0	0	0
Gourikwa	0	0	0	0.82	0	0	0

For the calculation of the individual power plants emission factors, the following net calorific values and average emission factors for the fuels have been considered:

Type	***NCV (GJ/kg)***	$EF_{co2,i,y}$ (tCO2/GJ)
Coal (Other bituminous coal)	0.0199	0.0895
Gas (Jet kerosene)	0.0420	0.0697
Gas/Diesel Oil	0.0414	0.0726

Finally, for Option A2 power plants for year 2009-2010, the following data is used:

	$EF_{CO2,m,i,y}$	$\eta_{m,y}$	$EF_{el,m,y}$
Acacia	0.0697	30%	0.84
Port Rex	0.0697	30%	0.84

Ankerlig	0.0726	39.5%	0.66
Gourikwa	0.0726	39.5%	0.66

The default value for open cycle gas turbines that began generation after the year 2000 in Annex 1 in the *Tool to calculate the emission factor for an electricity system* has been used for Ankerlig and Gourikwa power stations. For Acacia and Port Rex, the default value for old units (before and in 2000) has been used.

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

For the calculation of the build margin (BM) emission factor, Option 1 data vintage has been chosen. Hence, for the first crediting period, the build margin emission factor will be calculated *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PoA-DD submission to the DOE for validation. For the second crediting period, the build margin emission factor will be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period will be used.

The build margin emission factor is thus calculated using **equation 12** of the *Tool to calculate the emission factor for an electricity system*, as shown below:

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

Where:

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

The table below provides an overview of the power plants connected to the South African electricity system as well as their commissioning dates.

Number	Project Name	Type	Commissioning Date
1	Bethlehem hydroelectric project	Hydro	11/11/2009
2	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008
3	PetroSA biogas to energy	Waste water	01/09/2007
4	Gourikwa	Gas fuel	30/03/2007
5	Ankerlig	Gas fuel	29/03/2007

6	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006
7	Klipheuwel	Wind	Aug-2002
8	Majuba	Coal	01/04/1996
9	Kendal	Coal	01/10/1988
10	Palmiet	Pumped storage	18/04/1988
11	Matimba	Coal	04/12/1987
12	Lethabo	Coal	22/12/1985
13	Tutuka	Coal	01/06/1985
14	Colleywobbles	Hydropower	01/01/1985
15	Koeberg	Nuclear	21/07/1984
16	Ncora	Hydropower	01/03/1983
17	Drakensberg	Pumped storage	17/06/1981
18	Duvha	Coal	18/01/1980
19	Matla	Coal	29/09/1979
20	Second Falls	Hydropower	01/04/1979
21	First Falls	Hydropower	01/02/1979
22	Vanderkloof	Hydropower	01/01/1977
23	Port Rex	Gas fuel	30/09/1976
24	Acacia	Gas fuel	13/05/1976
25	Kriel	Coal	06/05/1976
26	Amot	Coal	21/09/1971
27	Gariep	Hydropower	08/09/1971
28	Hendrina	Coal	12/05/1970
29	Grootvlei	Coal	30/06/1969
30	Camden	Coal	21/12/1966
31	Komati	Coal	06/11/1961

In order to identify the power units *m* included in the build margin and in accordance with the *Tool to calculate the grid emission factor for an electricity system*, $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ were identified. Both $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ comprise the same power plants, thus both are SET_{sample}.

	Name	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,y (MWh/y)***
1	Gourikwa	Gas fuel	30/03/2007	0%	0
2	Ankerlig	Gas fuel	29/03/2007	0%	0
3	Klipheuwel	Wind	Aug-2002	0%	2,000
4	Majuba	Coal	01/04/1996	11%	24,632,585
5	Kendal	Coal	01/10/1988	22%	25,648,258
	Total				**50,282,843**

As some of the power plants in the SET_{sample}, Majuba and Kendal, started to supply electricity to the grid more than 10 years ago, step (d) was considered and $SET_{sample\text{-}CDM}$ was calculated.

	Name	Technology	Year of Commissioning	Cumulative %	*EGm,y (MWh/y)*
1	Gourikwa	Gas fuel	30/03/2007	0.000%	0.00
2	Ankerlig	Gas fuel	29/03/2007	0.000%	0.00
3	Klipheuwel	Wind	Aug-2002	0.001%	2,000
CDM	Bethlehem hydroelectric project	Hydro	11/11/2009	0.005%	8,983
CDM	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008	0.018%	31,723
CDM	PetroSA biogas to energy	Waste water	01/09/2007	0.028%	23,286
CDM	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006	0.030%	3,744
	Total	***AEG SET$_{sample-CDM}$***			***69,736***

AEG SET$_{sample-CDM}$ was around 0.03%, much lower than 20% required by the *Tool to calculate the emission factor for an electricity system*. Therefore, step (e) was considered and power units that started to supply electricity to the grid more than 10 years ago were added until the electricity generation of the new set comprised 20% of the annual electricity generation. The final set of power plants included in the calculation of the Build Margin (SET$_{sample-CDM>10years}$) was as follows:

Number	Name	Technology	Year of Commissioning	Cumulative %	*EGm,y (MWh/y)*
1	Gourikwa	Gas fuel	30/03/2007	0.0%	-
2	Ankerlig	Gas fuel	29/03/2007	0.0%	-
3	Klipheuwel	Wind	Aug-2002	0.0%	2,000.00
	Bethlehem hydroelectric project	Hydro	11/11/2009	0.0%	8,983.13
	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008	0.0%	31,723.20
	PetroSA biogas to energy	Waste water	01/09/2007	0.0%	23,285.54
	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	01/11/2006	0.0%	3,744.00
4	Majuba	Coal	01/04/1996	10.6%	24,632,585
5	Kendal	Coal	01/10/1988	21.7%	25,648,258
	Total	***AEG SETsample-CDM>10years***			***50,350,579***

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) is determined as per the guidance in step 4 (a) for the simple OM, using **equation (3)** under option A2 following guidelines in the tool that stipulates as follows "If the power units included in the build margin m correspond to the sample group SET$_{sample-CDM->10yrs}$, then, as a conservative approach, only option A2 from guidance in Step 4 (a) can be used and the default values provided in Annex 1 shall be used to determine the parameter $\eta_{m,y}$."

Equation 3, option A2 is shown below:

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

Where:

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)

$EF_{CO2,m,i,,y}$ = Average CO_2 emission factor of fuel type *i* used in power plant *m* in year *y* (tCO2/GJ)

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (ratio)

m = The power *units* included in the build margin

y = The relevant year as per the data vintage chosen in Step 5

The following data was used in the calculation of $EF_{EF,m,y}$ for the plants in group $SET_{sample\text{-}CDM\text{->}10yrs}$

Name	***Technology***	$EF_{CO2,m,i,v}$ ***(tCO2/GJ)***	$\eta_{m,y}$	$EF_{EL,m,y}$
Gourikwa	Gas fuel	0.0726	39.5%	0.66
Ankerlig	Gas fuel	0.0726	39.5%	0.66
Klipheuwel	Wind	0.0000	-	-
Bethlehem hydroelectric project	Hydro	0.0000	-	-
Durban landfill gas Bisasar Road project	Land fill	0.0000	-	-
PetroSA biogas to energy	Waste water	0.0000	-	-
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	0.0000	-	-
Majuba	Coal	0.0895	35.5%	0.91
Kendal	Coal	0.0895	35.5%	0.91
	AEG $SET_{sample\text{-}CDM>10years}$			

The table below shows the values and power units applied in the calculation of the build margin.

Name	***Technology***	$EF_{el,m,v}$ ***(tCO2/MWh)***	$EG_{m,v}$ ***(MWh/y)***
Gourikwa	Gas fuel	0.66	-
Ankerlig	Gas fuel	0.66	-
Klipheuwel	Wind	-	2,000.00
Bethlehem hydroelectric project	Hydro	-	8983

Durban landfill gas Bisasar Road project	Land fill	-	31723
PetroSA biogas to energy	Waste water	-	23286
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	-	3744
Majuba	Coal	0.91	24,632,585
Kendal	Coal	0.91	25,648,258
Total	***AEG SETsample-CDM>10years***		***50,350,579***

For *y* the most recent historical year for which grid power generation data is available, in this case 2010-2011 was used and for *m,* the power *units* included in the build margin were used.

Step 6: Calculate the Combined Margin
Option A, i.e. the weighted average combined margin, is used as it is the preferred option.

The combined margin emissions factor is calculated as follows:

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

Where:

$EF_{,grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO2/MWh)

$EF_{grid,CM,y}$ = Operating margin CO2 emission factor in year *y* (tCO2/MWh)

w_{OM} = Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

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

w_{OM} = 0.75 and w_{BM} = 0.25 for the first crediting period and subsequent crediting periods as the CPA is a solar PV project.

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

Emission reductions
In line with ACM0002 (version 13.0.0) the emission reductions are calculated using **(equation 11)** as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y = Emission reductions in year *y* (tCO2e/yr)

BE_y = Baseline Emissions in year *y* (tCO2/yr)

PE_y = Project emissions in year *y* (tCO2e/yr)

LE_y = Leakage emissions in year *y* (tCO2e/yr)

B.6.2. Data and parameters that are to be reported ex-ante

Data / Parameter	**$NCV_{i,y}$**
Unit	GJ/kg
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	<table><tr><th>Fuel Type</th><th>NCV (GJ/kg)</th></tr><tr><td>Coal (other bituminous coal)</td><td>0.0199</td></tr><tr><td>Gas/Jet kerosene</td><td>0.042</td></tr><tr><td>Gas/Diesel Oil</td><td>0.0414</td></tr></table>
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also no regional default values. Average OM: Calculated once for each crediting period during validation stage using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Unit	tCO2/GJ
Description	CO_2 emission factor of fossil fuel type *i* used in power unit *m* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also no regional default values. Average OM: Calculated once for each crediting period during validation stage using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

Fuel Type	EFCO2 (tCO2/GJ)
Coal (other bituminous coal)	0.0895
Gas/Jet kerosene	0.0697
Gas/Diesel Oil	0.0726

Data / Parameter	$\eta_{m,y}$
Unit	%
Description	Average net conversion efficiency of power unit *m* in year *y*
Source of data	Default value for open cycle gas turbines built after 2000 and Fluidised Bed System (FBS) coal generation technology for units built before and in 2000 is used as per Annex 1 of the *Tool to calculate the emission factor for an electricity system.*
Value(s) applied	
Choice of data or Measurement methods and procedures	There is no data published on the efficiency of Eskom's gas power plants, therefore default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Generation technology	Default efficiency
Open cycle gas turbines built after 2000	39.5%
Open cycle gas turbines built in or before 2000	30%
(FBS) coal generation technology for units built before and in 2000	35.5%

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y*
Source of data	Eskom published data and CDM Monitoring Reports for the CDM project activities
Value(s) applied	See appendix 4
Choice of data or Measurement methods and procedures	Data on electricity generation has been obtained from Eskom, the main utility company in South Africa and owner of the power plants. For the CDM power plants that are not owned by Eskom, generation data had to be calculated from the CDM Monitoring Reports. Average OM: Calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$FC_{i,m,y}$
Unit	Kg/year
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y*
Source of data	Eskom published data, other utility and government records
Value(s) applied	See appendix 4
Choice of data or Measurement methods and procedures	Data on fuel consumption has been obtained from Eskom, the main utility company in South Africa and owner of the power plants. The values provided for the coal plants are in tonnes. These values were converted to kg by multiplying by 1000. The values provided for the gas turbines i.e. Acacia, Port Rex, Ankerling and Gourikwa are in litres. These were converted to kg units by multiplying by the fuel type density given in (kg/l). For jet gasoline, the density value used was 0.78 kg/l while 0.82 kg/l was used for diesel oil. Average OM: Calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante.* For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	-

B.6.3. Ex-ante calculations of emission reductions

Project emissions

Project Emissions equal zero.

Baseline Emissions

The baseline emissions are to be calculated as follows:

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

Where:

BE_y = Baseline Emissions in year *y* (tCO2/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 emission factor for an electricity system" (tCO2/MWh)

Calculation of $EG_{PJ,y}$

The CPA is a project that installs a grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, therefore $EG_{PJ,y}$ is calculated as per option (a).

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

Where:

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

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

Parameter	Value	Unit	Source
$EG_{facility,y}$	[insert value]	MWh/yr	[insert source]

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

The combined margin emission factor for the grid is calculated using the following formula:

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

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,CM,y}$ = Operating margin CO2 emission factor in year y (tCO2/MWh)
W_{OM} = Weighting of operating margin emissions factor (%)
W_{BM} = Weighting of build margin emissions factor (%)

Values to determine $EF_{grid,CM,y}$ for solar PV CPAs are:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	0.9063	tCO2/MWh	GEF calculations
W_{BM}	0.25		Default
$EF_{grid,OM-DD,y}$	0.9585	tCO2/MWh	GEF calculations
W_{OM}	0.75		Default

Therefore:

$EF_{grid,CM,y}$ = 0.9454 tCO2/MWh

BE_y = [Insert] * 0.9454= [Insert] tCO2/yr

Leakage emissions

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

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year y (tCO2e/yr)
BE_y	=	Baseline Emissions in year y (tCO2/yr)
PE_y	=	Project emissions in year y (tCO2e/yr)
LE_y	=	Leakage emissions in year y (tCO2e/yr)

Therefore, emission reductions equal:

[insert value of BE_y] – 0 – 0 = [insert value of ER_y] tCO2e/yr

B.7. Application of the monitoring methodology and description of the monitoring plan
B.7.1. Data and parameters to be monitored by each generic CPA

Data / Parameter	**$EG_{facility,y}$**
Unit	MWh/yr
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Source of data	Electricity meter(s)
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The following parameters shall be measured: (i) The quantity of electricity supplied by the project plant/unit to the grid; and (ii) The quantity of electricity delivered to the project plant/unit from the grid Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards and the *Code of practice of electricity metering* SANS 474:2009/NRS 057:2009. The electricity supplied to the grid and delivered to the project plant/unit from the grid will be measured continuously (hourly measurement and at least monthly recording) by a main (facility metering installation) and a back-up meter (system metering installation). The facility meter is installed at the Delivery Point with the electricity grid as agreed with the national transmission company (NTC) or distributor, as applicable. The system meter will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.
Monitoring frequency	The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with PPA.
QA/QC procedures	Measurement results will be cross-checked with records of sold electricity. Calibration of meters will be done according to the appropriate standard and equipment specifications, whichever is more precise. According to standard SANS 474:2009/NRS 057:2009, the accuracy class of the meter and its maximum interval between calibrations are the following:

Size of project	Accuracy Class	Interval for period calibration (years)
> 100 MVA	0.2S	5
10 MVA to < 100 MVA	0.5S	5
1 MVA to < 10 MVA	1	10

Purpose of data	Calculation of baseline emissions
Additional comment	-

B.7.2. Description of the monitoring plan for a generic CPA

In order to enable verification of emission reductions the project activity must maintain credible, transparent and adequate data measurement, collection, estimation, and tracking systems. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period. All measurements should be conducted with the calibrated measurement equipment according to relevant industry standards.

Operational and management structure

Each CPA implementing entity under the PoA will be responsible for the technical aspects related to on-site monitoring such as:

- Employment and training of personnel responsible for gathering and recording monitoring data
- Continuous measurement of electricity generated by the project activity
- Collecting metering information
- Storage of data
- Calibration and maintenance of main metering equipment, the Facility Metering Installation, according to appropriate standards or manufacturer specifications.
- Submission of monitoring data to the CME

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPA's monitoring responsibilities as described above. Each month/quarter, the CPA will submit monthly electricity generation records to the CME accompanied by the respective copy of records/invoices for sold electricity. The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

The CME, through its programme officer, will be responsible for the following:

- Training of CPAs on CDM monitoring requirements
- Collection of monitored data by the CPA
- Storage of data for at least two years after the end of the last crediting period
- Crosscheck of monitored data with a copy of invoices and the proof of payment of those invoices
- Confirm that the CPA has operated the metering system in line with relevant regulations
- Preparation of monitoring report

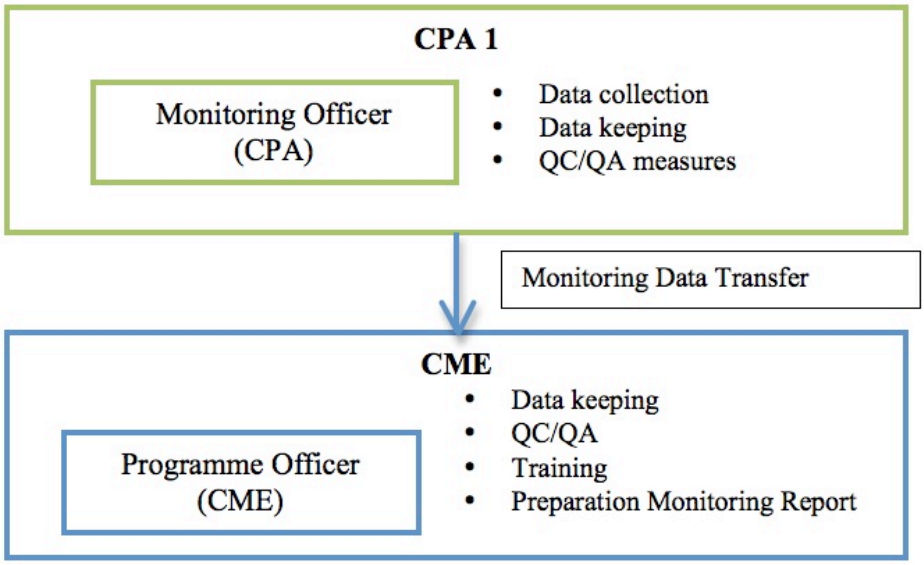


Figure 21. Monitoring organization

Parameters monitored

The only parameter monitored is the "Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y"* ($EG_{facility,y}$).

Metering

Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards. The South African National Standard has published the *Code of practice of electricity metering* SANS 474:2009/NRS 057:2009. This code of practice specifies the procedures and standards to be adhered to by electricity licensees and their agents in operating and servicing new and existing metering installations which are to be used for billing purposes. The code of practice is applicable to metering installations in their entirety, including all measuring transformers, wiring, cabling, metering panel construction, active and reactive meters, data loggers, and associated test facilities.

The CPA will be responsible for the Facility Metering Installation (main meter) procurement, installation, testing, commissioning and its operation and maintenance including:

- Calibration and maintenance of equipment
- Physical reading and day-to-day handling
- Quality Control and Quality assurance measures

The national transmission company (NTC) or the distribution company, as applicable, will be responsible for the System Metering Installation (back up meter) procurement, installation, testing, commissioning and its operation and maintenance. This meter cannot be accessed by the CPA implementing entity and the NTC or distributor only uses it for comparison purposes against the data provide by the CPA entity's Facility Metering Installation.

The Facility Metering Installation will be installed at the Delivery Point, which defines the commercial boundary between the licensee and the customer. The System Metering Installation will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.

QA/QC

The Facility Metering Installation readings will be crosschecked with the copies of invoices sent by the CPA implementing entity to the NTC or distributor, and the proof of payment of those invoices. If there is a difference between the values, the most conservative value will be used.

Calibration of meters will be performed according to the appropriate standards and manufacturer specifications, whichever is more precise. According to standard SANS 474:2009/NRS 057:2009, the accuracy class of the meter and its maximum interval between calibrations are the following:

Table 22. Metering accuracy and calibration frequency

Size of project	Accuracy Class	Interval for period calibration (years)
> 100 MVA	0.2S	5
10 MVA to < 100 MVA	0.5S	5
1 MVA to < 10 MVA	1	10

Emergency procedure: In case there is disagreement between the NTC and the CPA implementing entity with regard to the meter readings because the readings of the Facility Metering Installation and the System Metering Installation are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 22 above then the Facility Metering Installation and the System Metering Installation shall both be tested. Should the Facility Metering Installation be found

to have a level of inaccuracy beyond the tolerance as described above, then the Facility Metering Installation shall be recalibrated and the electricity output will be based on the readings registered by the System Metering Installation from the date of the last previous test of the Facility Metering Installation.

Should both the System Metering Installation and the Facility Metering Installation be found to have a level of inaccuracy falling outside the maximum tolerance level then each of the System Metering Installation and the Facility Metering Installation shall be recalibrated and the electricity output shall be recalculated applying the error identified in the calibration test of the Facility Metering Installations for all values from the date of the last previous test of the Facility Metering Installation.

In cases where one meter breaks down, then the readings of the other meter will be applied in the emission reduction calculations. If both meters break down or are unavailable, then the electricity generation value for that period will be assumed to be zero as a conservative approach.

The meter(s) readings will be readily accessible for the Designated Operational Entity (DOE) carrying out the verification of monitoring data.

Data storage and archiving

Data will be stored electronically by the CME in a centralized database system for at least two years following the end of the last crediting period. The CPAs will need to provide a copy of the documentation, such as electricity sales invoices, proof of payment of those invoices and meter readings to the CME that will verify those.

The database contains the following information:

- Name of the CPA
- CPA implementing entity and contacts
- GPS coordinates
- Technical description
- Installed capacity
- Number of verifications and associated monitoring periods
- Monitored parameters and relevant evidence
- Emission reductions monitored

Training

Before the implementation of a CPA, the CME will provide training and guidance regarding the implementation of the monitoring plan. The training will include:

- CDM project cycle and the significance of monitoring
- Management structure and work scope
- Components of the monitoring plan
- QA/QC procedures
- Monitoring report template
- Preparation for verification
- Questions and answers

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Appendix 1: Contact information on entity/individual responsible for the PoA

Organization	Carbon Africa Limited
Street/P.O. Box	P.O. Box 14938
Building	-
City	Nairobi
State/Region	-
Postcode	00800
Country	Kenya
Telephone	+254 731 851 754
Fax	-
E-mail	info@carbonafrica.co.ke
Website	www.carbonafrica.co.ke
Contact person	Adriaan Tas
Title	Director
Salutation	Mr
Last name	Tas
Middle name	-
First name	Adriaan
Department	-
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	adriaan@carbonafrica.co.ke

Organization	Climate Corporation Emissions Trading GmbH
Street/P.O. Box	Guntramsdorfer Street 103
Building	-
City	Moedling
State/Region	-
Postcode	2340
Country	Austria
Telephone	+43 2236 8002 7000
Fax	+43 2236 8002 7099
E-mail	office@climatecorp.com
Website	climatecorp.eu
Contact person	Michael Novoszad
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Salutation	Mr
Last name	Novoszad
Middle name	-
First name	Michael
Department	-
Mobile	-
Direct fax	-
Direct tel.	+43 2236 8002 7006
Personal e-mail	mn@climatecorp.com

Appendix 2: Affirmation regarding public funding

No public funding involved in the project activity

Appendix 3: Application of methodology(ies)

No additional information

Appendix 4: Further background information on ex ante calculation of emission reductions

Net electricity generated by power plant/unit *m* in year *y* ($EG_{m,y}$)

		Generation Data (MWh)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Amot	Coal	11,987,281	13,227,864	12,194,878
Camden	Coal	6,509,079	7,472,070	7,490,836
Duvha	Coal	21,769,489	22,581,228	20,267,508
Grootvlei	Coal	1,249,556	2,656,230	3,546,952
Hendrina	Coal	12,296,687	12,143,292	11,938,206
Kendal	Coal	23,841,401	23,307,031	25,648,258
Komati	Coal	-	1,016,023	2,060,141
Kriel	Coal	18,156,686	15,906,816	18,204,910
Lethabo	Coal	23,580,232	25,522,698	25,500,366
Majuba	Coal	22,676,924	22,340,081	24,632,585
Matimba	Coal	26,256,068	27,964,141	28,163,040
Matla	Coal	21,863,400	21,954,536	21,504,422
Tutuka	Coal	21,504,122	19,847,894	19,067,501
Acacia	Gas (Jet kerosene)	-	971.00	992.00
Port Rex	Gas (Jet kerosene)	-	322.00	5,507.00
Ankerlig	Gas/Diesel Oil	-	6,303.00	-
Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-
Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,756,730**	**228,828,053**	**232,394,838**

Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*

		$FC_{i,m,y}$ (kg/year)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Amot	Coal	6,395,805,000	6,794,134,000	6,525,670,000
Camden	Coal	3,876,211,000	4,732,163,000	4,629,763,000
Duvha	Coal	11,393,553,000	11,744,606,000	10,639,393,000
Grootvlei	Coal	674,538,000	1,637,371,000	2,132,979,000

Hendrina	Coal	7,122,918,000	6,905,917,000	7,139,198,000
Kendal	Coal	15,356,595,000	13,866,514,000	15,174,501,000
Komati	Coal	0	664,497,000	1,271,010,000
Kriel	Coal	9,420,764,000	8,504,715,000	9,527,185,000
Lethabo	Coal	16,715,323,000	18,170,227,000	17,774,699,000
Majuba	Coal	12,554,406,000	12,261,833,000	13,020,512,000
Matimba	Coal	13,991,453,000	14,637,481,000	14,596,842,000
Matla	Coal	12,689,387,000	12,438,391,000	12,155,421,000
Tutuka	Coal	11,231,583,000	10,602,839,000	10,191,709,000
Acacia	Gas (Jet kerosene)	0	-	347,066.46
Port Rex	Gas (Jet kerosene)	0	-	219,913.98
Ankerlig	Gas/Diesel Oil	0	-	0
Gourikwa	Gas/Diesel Oil	0	-	0

Appendix 5: Further background information on the monitoring plan

No additional information

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History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the programme design document form for CDM programmes of activities" (EB 66, Annex 12).
01	EB33, Annex 41 27 July 2007	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		