



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

PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

PART I. 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 01
Date: 29/05/2012

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 renewable energy projects in South Africa in order to 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. Technologies included in the Programme of Activities are wind and solar PV. The programme focuses on greenfield renewable energy projects.

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 2030¹.
- 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, solar and hydro energy technology 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 will act as the Coordinating/Managing Entity (CME) for the PoA. The CME will be responsible for:

¹ Integrated Resource Plan for Electricity 2010-2030, Department of Energy, Electricity Regulation Act No.4 of 2006, 6 May 2006



1. Development of the PoA Design Document (CDM-PoA-DD) and CDM Programme 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 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:

- 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 and provide hard and 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, which will be Independent Power Producers. The contractual agreements will summarize roles and responsibilities regarding the implementation of the individual project activities as a CDM Programme 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 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 Ltd.	No
South Africa (host)	Climate Corporation Emissions Trading GmbH	No

A.5. Physical/ Geographical boundary of the PoA

The geographical area within which CDM programme activities (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

The geographic coordinates of South Africa are given in Table 1 below.

Table 1. Coordinates South Africa

Latitude	Longitude
22°25'24.10"S	31°18'26.11"E
28°38'5.99"S	16°27'28.51"E
34°50'3.34"S	19°59'38.61"E
26°51'29.72"S	32°53'28.35"E

In line with EB 60, Annex 26 Clarification regarding the “Procedures for registration of a Programme of Activities as a single CDM project and issuance of certified emission reductions for a Programme of Activities, 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 project
- Greenfield solar PV project

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. Generally, the turning rotor spins a generator, producing electricity.

Solar PV

The solar photovoltaic cells, also known as the 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 amount of solar cells in crystalline modules varies typically between 36 and 72 cells. 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.

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 two wind power plants connected to the grid. The 3 MW Klipheuwel Wind Farm which is owned by Eskom, and the 5.2 MW Darling Wind Farm which is an IPP owned by private investors. Both wind farms have been developed as



demonstration projects and are very small compared to the 47,463 MW of installed capacity. 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) Programme. Under the Programme, bidders are required to specify a tariff for the electricity produced. The tariff should not exceed the applicable tariff 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 technological, 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 two CPA types:

1. Greenfield wind power plants/units in South Africa
2. Greenfield solar PV plants/units in South Africa

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, EB65, Annex 3) and on the provisions in ACM0002 (version 13.0.0).

The eligibility criteria consist of two sets of criteria: (1) general eligibility criteria as provided in the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple technologies for Programme of Activities* and (2) eligibility criteria for the demonstration of additionality.

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 06.0.0)

CPA TYPE I: GREENFIELD WIND POWER PLANTS/UNITS IN SOUTH AFRICA

General eligibility criteria - Wind			
	Topic	Eligibility criteria	Documentary evidence
1	Geographical boundary (a)	Is the CPA located in South Africa?	EIA report or feasibility study
2	Double counting (b)	a) Has the CPA not yet been included in another Programme of Activities or has the CPA not yet been registered as a single CDM project activity? b) Is the CPA uniquely identified with the geographical co-ordinates of the project location?	a) Contract between CME and CPA b) EIA or feasibility study
3	Technology (c)	a) Does the CPA involve the implementation of a wind power project?	Feasibility study/PPA/EIA



4	Start date (d)	Does the start of the CPA occur after the start date of the validation of the PoA (date of the start of GSC)? For the purpose of this PoA, the start date of the CPA will be when the agreement with a turbine supplier is signed. The start date must be after the date of GSC of the PoA.	Agreement with the turbine supplier.
5	Applicability of methodology (e)	a) Is the CPA connected to the grid and does it supply electricity to the grid? b) Does the CPA involve the installation of a power plant at a site where no power plant was operated prior to the implementation of the project (greenfield plant)?	Feasibility study/EIA/PPA
6	Stakeholder consultation and EIA (g)	a) Has the CPA carried out a local stakeholder consultation? b) The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations?	a) local stakeholder consultation report b) EIA report
7	ODA (h)	Has the CPA confirmed that it has not received funding from Annex I parties that results in a diversion of official development assistance?	Confirmation letter from the CPA or Annex I country

Eligibility criteria for the demonstration of additionality - Wind

	PoA additionality-related eligibility criteria	Means of verification
Add-01	Is the installed capacity of the CPA below 150 MW?	Feasibility study report/environment impact assessment report
Add-02	Is the plant load factor of the CPA for the P50 scenario below 50%?	(a) The plant load factor provided to banks and/or equity financiers while applying the project activity for project financing, or to the government while applying the project activity for implementation approval; (b) The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company);
Add-03	Is the tariff \leq 1,150 ZAR/MWh?	Power Purchase Agreement/bidding documents
Add-04	Is the CPA not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the <i>Tool for the demonstration and assessment of additionality</i> (version 06.0.0)?	Financial model and benchmark analysis
Add-05	Is the CPA not financially viable when the expected electricity generation (P50) is 10% higher?	Financial model and benchmark analysis
Add-06	Is the CPA not financially viable when the equipment cost is 10% lower?	Financial model and benchmark analysis



Add-07	Is the CPA not financially viable when the operating cost is 10% lower?	Financial model and benchmark analysis
Add-08	Can it be concluded that the CPA is not common practice as per the <i>Tool for demonstration and assessment of additionality</i> (version 06.0.0), i.e. F is lower than 0.2 and/or $N_{all} - N_{diff}$ is lower than 3?	Common practice assessment

CPA TYPE II: GREENFIELD SOLAR PV PLANTS/UNITS IN SOUTH AFRICA

General eligibility criteria – Solar PV			
	Topic	Eligibility criteria	Documentary evidence
1	Geographical boundary (a)	Is the CPA located in South Africa?	EIA report or feasibility study
2	Double counting (b)	a) Has the CPA not yet been included in another Programme of Activities or has the CPA not yet been registered as a single CDM project activity? b) Is the CPA uniquely identified with the geographical co-ordinates of the project location?	a) Contract between CME and CPA b) EIA or feasibility study
3	Technology (c)	a) Does the CPA involve the implementation of a solar PV project?	Feasibility study/PPA/EIA
4	Start date (d)	Does the start of the CPA occur after the start date of the validation of the PoA (date of the start of GSC)? For the purpose of this PoA, the start date of the CPA will be when the agreement with a turbine supplier is signed. The start date must be after the date of GSC of the PoA.	Agreement with the turbine supplier.
5	Applicability of methodology (e)	a) Is the CPA connected to the grid and does it supply electricity to the grid? b) Does the CPA involve the installation of a power plant at a site where no power plant was operated prior to the implementation of the project (greenfield plant)?	Feasibility study/EIA/PPA
6	Stakeholder consultation and EIA (g)	a) Has the CPA carried out a local stakeholder consultation? b) The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations?	a) local stakeholder consultation report b) EIA report
7	ODA (h)	Has the CPA confirmed that it has not received funding from Annex I parties that results in a diversion of official development assistance?	Confirmation letter from the CPA or Annex I country



Eligibility criteria for the demonstration of additionality – Solar PV		
	PoA additionality-related eligibility criteria	Means of verification
Add-01	Is the installed capacity of the CPA below 75 MW?	Feasibility study report/environment impact assessment report
Add-02	Is the plant load factor of the CPA below 35%?	(a) The plant load factor provided to banks and/or equity financiers while applying the project activity for project financing, or to the government while applying the project activity for implementation approval; (b) The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company);
Add-03	Is the tariff below 2,850 ZAR/MWh?	Power Purchase Agreement/bidding documents
Add-04	Is the CPA not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the <i>Tool for the demonstration and assessment of additionality</i> (version 6.0.0)?	Financial model and benchmark analysis
Add-05	Is the CPA not financially viable when the expected electricity generation is 10% higher?	Financial model and benchmark analysis
Add-06	Is the CPA not financially viable when the equipment cost is 10% lower?	Financial model and benchmark analysis
Add-07	Is the CPA not financially viable when the operating cost is 10% lower?	Financial model and benchmark analysis
Add-08	Can it be concluded that the CPA is not common practice as per the <i>Tool for demonstration and assessment of additionality</i> (version 06.0.0), i.e. F is lower than 0.2 and/or $N_{all} - N_{diff}$ is lower than 3?	Common practice assessment

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.

A programme officer will be appointed by the CME with working experience in CDM and excellent knowledge of CDM modalities and procedures. The programme officer will have the following responsibilities:

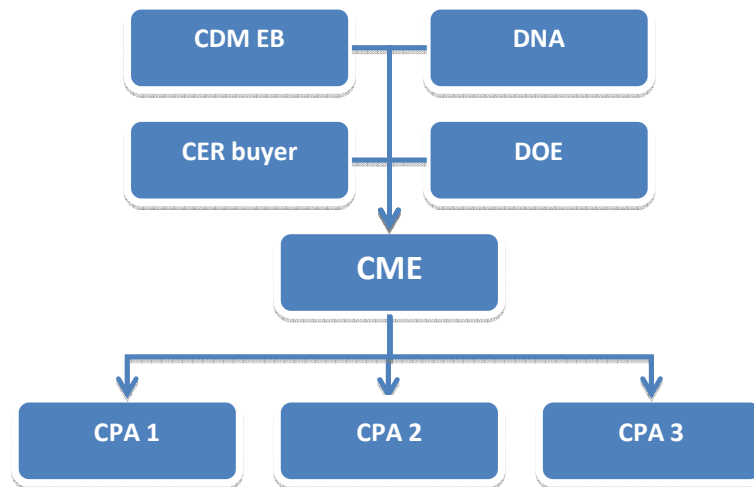
- a) Development of the PoA Design Document (CDM-PoA-DD) and CDM Programme Activity (CPA) Design Documents (CDM-CPA-DD) for CPAs that are developed under the Programme of Activities;
- b) Carry out a quality check on CPAs to be included in the Programme of Activities ensure that the CPA meets all the eligibility criteria as formulated in the PoA-DD;
- c) Collect and compile supporting evidence that are required for the inclusion and validation of the CPA in the PoA
- d) Verify that the CPA has not yet been developed as a single CDM project or been included in another PoA. Collect, compile and store data and information regarding each CPA
- e) Preparing the monitoring report and implementation of a monitoring database
- f) Obtaining a Letter of Approval for the implementation of the PoA from the host country;
- g) Obtaining a Letter of Authorization of the coordination of the PoA from the host country;
- h) Liaise with the Designated National Authority (DNA) on matters related to the implementation of the PoA and inclusion of CPAs
- i) Act as the focal point with the CDM Executive Board for matters related to the PoA;
- j) 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;
- k) Coordinate monitoring activities and data management during the lifetime of the PoA;
- l) Collect and compile monitoring records from all the CPA entities;
- m) Prepare and submit monitoring reports and facilitate the verification of the same;
- n) Contract a DOE for validation and verification purposes
- o) Training the monitoring personnel

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

- 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 and provide hard and 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

Individual CPAs will be developed and implemented by CPA entities. The CPA entities will be responsible for the operation and maintenance (including calibration) of the renewable energy power plant and will enter into a power purchase agreement or similar contractual agreement with the electricity off-taker for the supply of electricity. A CPA entity will also enter into a PoA Participation Agreement with the CME for participation in the proposed Programme of Activities. The CPA will be responsible to provide the CME and DOE with required documents and access to sites as needed.

Figure 2: PoA Management structure



The CME will establish the following operational and management arrangements for the implementation of the PoA:

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.



Procedure to avoid double accounting

The following procedure will be established to avoid double accounting and avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA:

1. Entities implementing a CPA will sign a confirmation, confirming that the project has not yet been included in another Programme of Activities or has not yet been registered as a single CDM project activity or any voluntary carbon offsetting scheme.
2. Before inclusion of a CPA, the CME will check the UNFCCC CDM project database² for registered projects applying the same technology and methodology, and implemented in the same location. In case similar projects are found in the same location, the available project documentation will be further scrutinized to confirm that the registered project is different from the proposed CPA.

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 terms (version 06), the start date of the PoA is 01/01/2013 which is the start date of the first CPA included to this PoA. The start date of any future CPA is not, or will not be, 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 the Host Country 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.

² <http://cdm.unfccc.int/Projects/projsearch.html>

**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, the Letters of approval were not available.

PART II. Generic component project activity (CPA)**SECTION A. General description of a generic CPA****A.1. Purpose and general description of generic CPAs**

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

The project activity is being pursued as a component of the PoA "Renewable Energy Carbon Programme for Africa" with Carbon Africa as the CME.

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

CPAs included in the PoA 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 06.0.0)*
- *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)*

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
<p>This methodology is applicable to grid connected renewable power generation project activities that: (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).</p>	<p>CPAs under the Programme will consist of grid-connected wind or solar PV projects 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)</p>
<p>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;</p>	<p>The CPA will install wind or solar PV technologies both of which are eligible under this methodology.</p>
<p>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 $EG_{PJ,y}$): 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;</p>	<p>n/a, CPAs under this PoA are greenfield projects,</p>
<p>In case of hydro power plants at least one of the following conditions must apply:</p> <ul style="list-style-type: none"> • The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the 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 	<p>n/a. CPAs under the PoA consist of wind or solar PV projects.</p>



<p>the definitions given in the project emissions section, is greater than 4 W/m².</p>	
<p>In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m² after the implementation of the project activity all of the following conditions must apply:</p> <ul style="list-style-type: none"> • The power density calculated for the entire project activity using equation 5 is greater than 4W/m²; • 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/m², 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/m², is less than 10% of the total installed capacity of the project activity from multiple reservoirs. 	<p>n/a. CPAs under the PoA consist of wind or solar PV projects.</p>
<p>The methodology is not applicable to the following:</p> <ul style="list-style-type: none"> • Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; • Biomass fired power plants; • 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/m² 	<p>n/a. CPAs under the PoA do not consist of:</p> <ul style="list-style-type: none"> (i) switching from fossil fuels to renewable energy sources at the site of the project activity, neither (ii) biomass fired power plants, nor (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/m².
<p>In the case of retrofits, replacements, or</p>	<p>n/a, CPAs under this PoA are greenfield projects,</p>



capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance.	
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In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) 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 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 located in South Africa. South Africa is not an annex I country.

B.3. Sources and GHGs

Source		Gas	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 ₂ O	No	Minor emission source
Project Activity	CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO ₂	No	Main emission source
		CH ₄	No	Minor emission source
		N ₂ O	No	Minor emission source
	For hydro power plants, emissions of CH4 from the reservoir	CO ₂	No	Minor emission source
		CH ₄	No	Main emission source
		N ₂ O	No	Minor emission source

The figures below present a flow diagram physically delineating each CPA type.

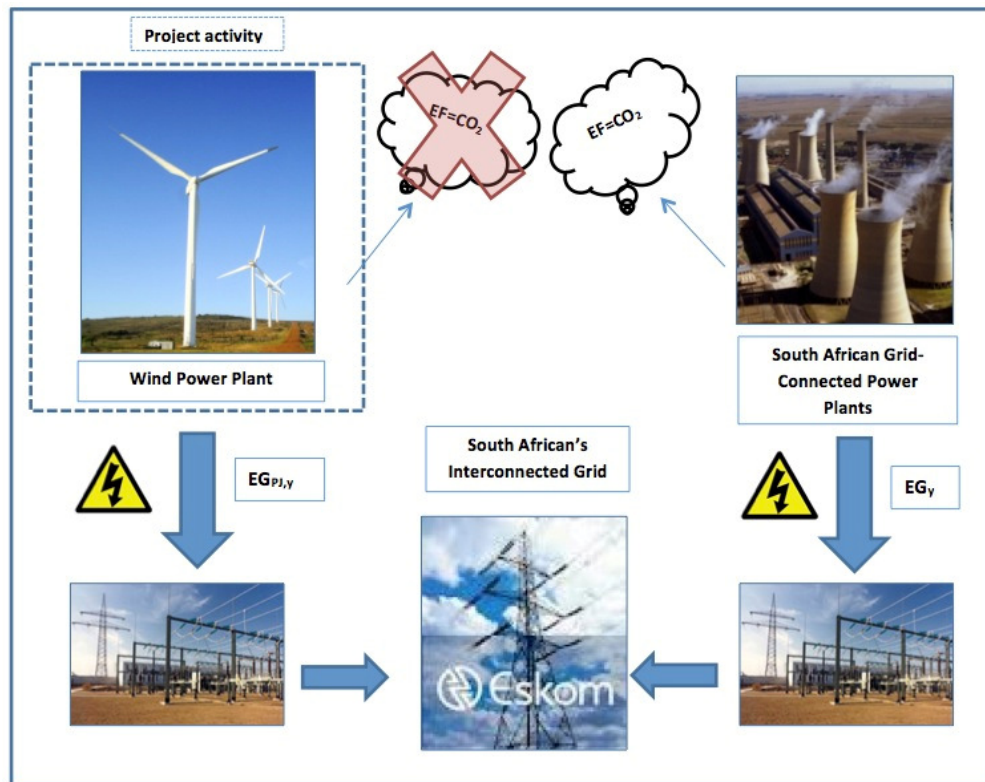


Figure 3: Flow diagram for wind power project

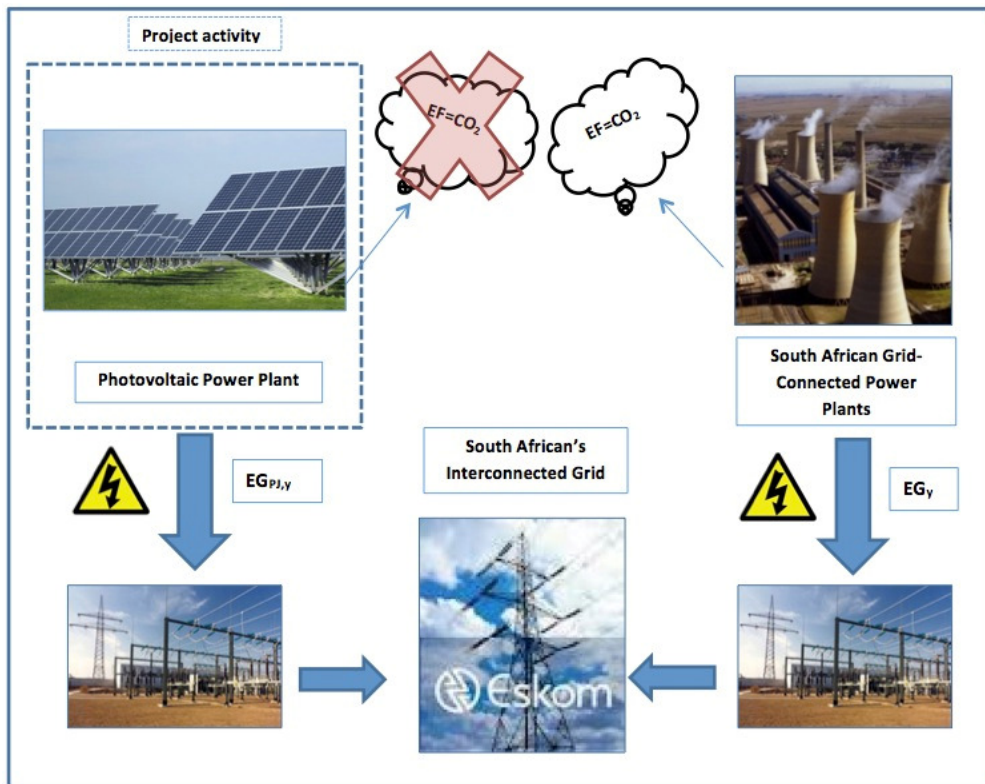


Figure 4: Flow diagram for solar PV project



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 calculate 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 determined by the *National Energy Act of 2008 (No.34 of 2008)*³.

Specifically for the electricity sector of South Africa, the *Electricity Regulation Act of 2006 (No. 4 of 2006)*⁴ determines the framework of the electricity sector. In May 2011, the Department of Energy, acting as the legislative entity, put into force the *Electricity Regulations on New Generation Capacity*⁵ under the *Electricity Regulation Act of 2006*. According to the new 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).⁶ 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 regulator 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*”⁷ under the *Electricity Regulation Act No. 4 of 2006*. In its current version, from the year 2010, 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.

³ Department of Energy (2008), National Energy Act of 2008
<http://www.info.gov.za/view/DownloadFileAction?id=92826>, accessed on 30.12.2011

⁴ Department of Energy (2006), Electricity Regulation Act of 2006,
<http://www.info.gov.za/view/DownloadFileAction?id=67855>, accessed on 30.12.2011

⁵ Department of Energy (2010), Electricity Regulations on New Generation Capacity,
<http://www.info.gov.za/view/DownloadFileAction?id=136320>, accessed on 30.12.2011

⁶ Department of Energy, http://www.energy.gov.za/files/electricity_frame.html, accessed on 30.12.2011

⁷ 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

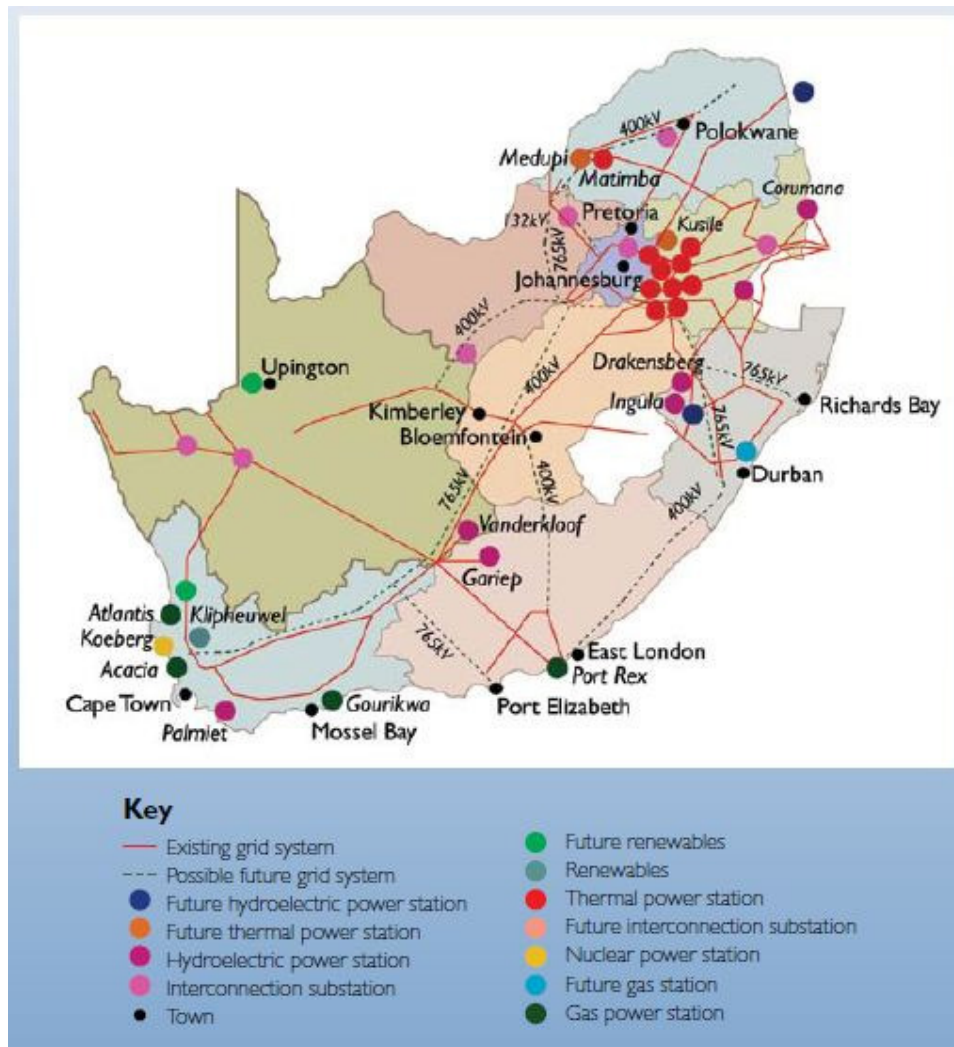


Figure 5. South African Power Sector

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.⁸

Detailed description of the installed capacity for each technology is presented in the following tables. Data from Eskom's power plants is dated from 2011.⁹ The latest published data for IPPs and municipal generation is from 2006¹⁰.

⁸ 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

¹⁵ ESKOM (2011), Integrated Report 2011, http://financialresults.co.za/2011/eskom_ar2011/index.php, accessed on 30.12.2011

¹⁰ 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 2. 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	3

Table 3. 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

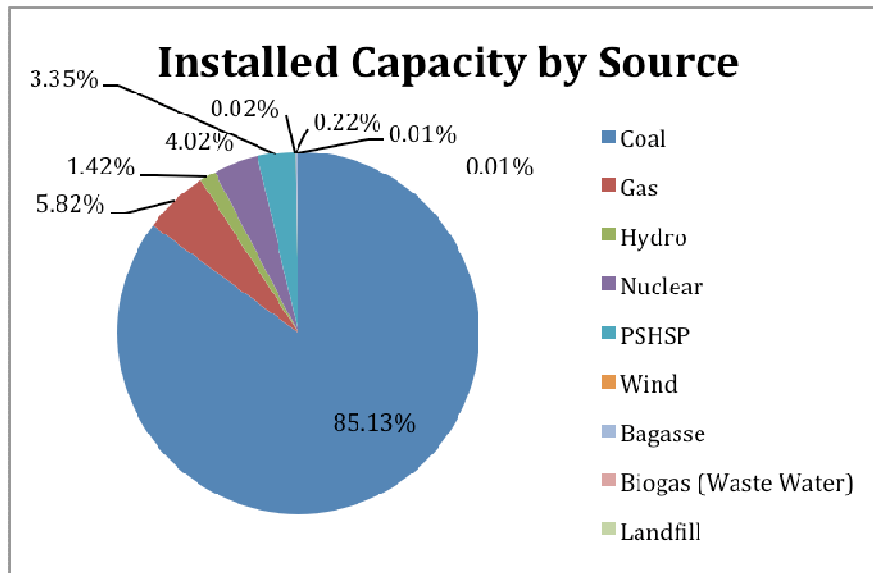
Table 4. IPP Electricity Generation Capacity

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	5.2	5.2
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 two wind power plants connected to the grid. The 3 MW Klipheuwel Wind Farm which is owned by Eskom, and the 5.2 MW Darling Wind Farm which is an IPP 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 2030:¹¹

Table 5. Summary of capacity additions 2010-2030

	Total Capacity		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 47,463 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 on towards. 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.

¹¹ 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. By year 2012 a supply shortfall of 9 TWh is estimated meanwhile for the year 2013 the shortfall is expected to be only 3 TWh.

Transmission and Distribution

Eskom operates the integrated national high-voltage transmission system and supplies electricity directly to large consumers such as mines and other large industries, to commercial farmers and also, through the Integrated National Electrification Programme (INEP), to a large number of residential consumers. Eskom provides electricity directly to about 45% of all end-users in South Africa. The other 55% of end-users have their electricity distributed by redistributors (including municipalities).¹² Eskom sells in bulk to certain municipalities, which distribute to the consumers within their boundaries. Those municipalities, own the distribution lines in their areas, and some also own their own generation power plants. There are also a few private entities that have the licence to distribute electricity as shown below:¹³

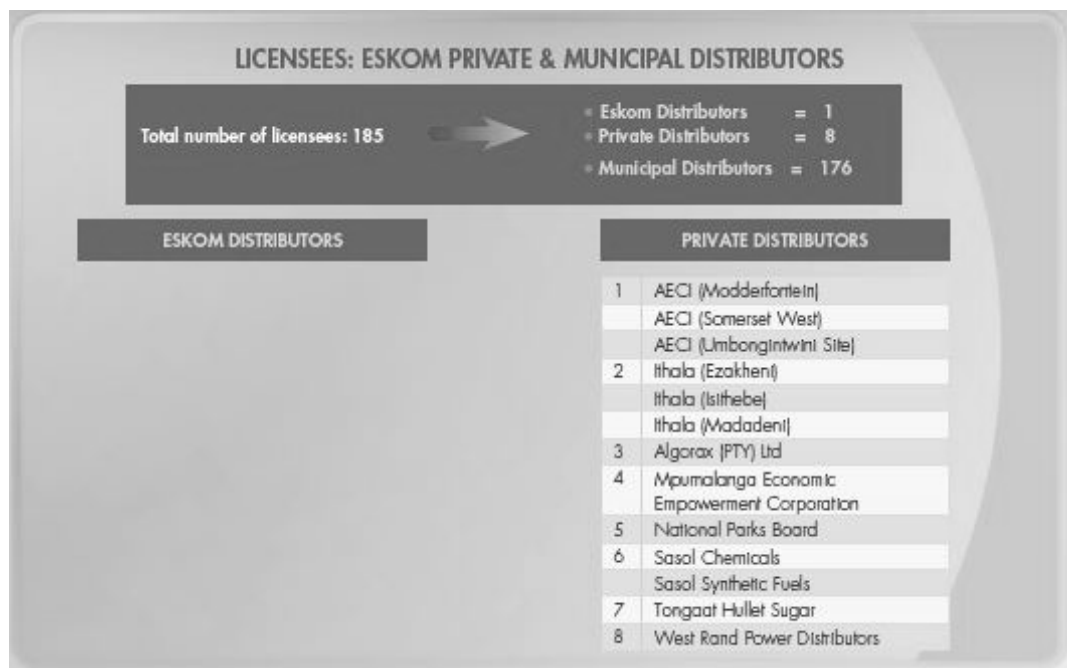


Figure 6. Distribution licenses

The government's policy on the Electricity Distribution Industry (EDI) requires the division to be separated from Eskom and merged with the electricity departments of municipalities to form a number of financially viable regional electricity distributors (REDs)¹⁴. An interim body, called EDI Holdings Company, was intended to oversee the transition period. This plan would have required Eskom to transfer its distribution assets and business to these entities. The restructuring proposal was formally revoked on 8

¹² ESKOM (2011), Integrated Report 2011, http://financialresults.co.za/2011/eskom_ar2011/index.php, accessed on 30.12.2011

¹³ 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

¹⁴ Department of Energy, http://www.energy.gov.za/files/electricity_frame.html, accessed on 30.12.2011

December 2010 by the government¹⁵. Therefore transmission lines are still owned and operated by Eskom.

As for transmission of the electricity, to meet the forecasted additional generation capacity in the *Integrated Resource Plan*, the “*Transmission Ten-Year Development Plan 2012-2021*”¹⁶ published by the Transmission Division of Eskom determines the required additional transmission capacity as follows:



Figure 7. Transmission Development Plan 2012-2021

Significant lengths of new transmission lines are being added to the system: over 4,000 km of 765-kV and over 7,800 km of 400-kV lines have either been approved or proposed over the 10-year *Transmission Development Plan* period. This addition is mainly due to the major network reinforcements required for the supply to the Cape (South and West Grids) and KwaZulu-Natal (East Grid). The integration of the new Medupi Power Station in the developing Limpopo West Power Pool (Medupi is close to Matimba) also requires significant lengths of transmission lines as it is a long distance away from the main load centres. The large length of 400-kV transmission lines is also the result of the development of a more meshed transmission 400-kV network to provide greater reliability and thus improve the levels of network security.

The addition of over 73,000 MVA of transformer capacity to the transmission system is an indication of the increase in load demand and in the capacity requirements of the customers. This figure also includes the transformation capacity required to integrate renewable energy generation. Approximately 2,000 MVars of capacitive support are required to support areas of the network under contingency conditions to

¹⁵ ESKOM (2011), Integrated Report 2011, http://financialresults.co.za/2011/eskom_ar2011/index.php, accessed on 30.12.2011

¹⁶ Eskom (2011), Transmission Ten-Year Development Plan 2012-2021, <http://www.eskom.co.za/content/TDP%20051011%20lowres.pdf>, accessed on 30.12.2011

ensure that the required voltage levels are maintained. They also improve system efficiency by reducing network losses.

TDP New Assets	Total
HVDC Lines (km)	0
765kV Lines (km)	4,430
400kV Lines (km)	7,830
275kV Lines (km)	501
Transformers 250MVA+	119
Transformers <250MVA	25
Total installed MVA	73,985
Capacitors	19
Total installed MVAr	2,094
Reactors	55
Total installed MVAr	12,603

Figure 8. New grid assets 2022

B.5. Demonstration of eligibility for a generic CPA

CPA TYPE I: GREENFIELD WIND POWER PLANTS/UNITS IN SOUTH AFRICA

General eligibility Criteria - Wind			
	Topic	Eligibility criteria	Justification
1	Geographical boundary (a)	Is the CPA located in South Africa?	The CPA is located in South Africa as is evidenced by the feasibility study report/environmental impact assessment report
2	Double counting (b)	a) Has the CPA not yet been included in another Programme of Activities or has the CPA not yet been registered as a single CDM project activity? b) Is the CPA uniquely identified with the geographical co-ordinates of the project location?	a) The CPA has not yet been included in another Programme of Activities nor has it been registered as a single CDM project activity as is evidenced by the agreement between the CME and the CPA b) The CPA is uniquely identified with the geographical co-ordinates of the project



			location as is evidenced in the feasibility study report/environmental impact assessment report
3	Technology (c)	a) Does the CPA involve the implementation of a wind power project?	The CPA involves the implementation of a wind power project as is evidenced by the feasibility study report/environmental impact assessment report or PPA
4	Start date (d)	Does the start of the CPA occur after the start date of the validation of the PoA (date of the start of GSC)? For the purpose of this PoA, the start date of the CPA will be when the agreement with a turbine supplier is signed. The start date must be after the date of GSC of the PoA	The start of the CPA occurs after the start date of the validation of the PoA as is evidenced by the agreement with the turbine supplier
5	Applicability of methodology (e)	a) Is the CPA connected to the grid and does it supply electricity to the grid? b) Does the CPA involve the installation of a power plant at a site where no power plant was operated prior to the implementation of the project (greenfield plant)?	The CPA is connected to the grid and will supply electricity to the grid as is evidenced by the feasibility study report/environmental impact assessment report/PPA
6	Stakeholder consultation and EIA (g)	a) Has the CPA carried out a local stakeholder consultation? b) The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations?	a) The CPA has carried out a local stakeholder consultation as is evidenced by the local stakeholder consultation report b) The CPA has carried out an environmental impact assessment as is evidenced by the environmental impact assessment report
7	ODA (h)	Has the CPA confirmed that it has not received funding from Annex I parties that results in a diversion of official development assistance?	The CPA has confirmed that it has not received funding from Annex I parties that results in a diversion of official development assistance as is evidenced by the confirmation letter from the CPA or Annex I country



Eligibility criteria for the demonstration of additionality - Wind		
	PoA additionality-related eligibility criteria	Means of verification
Add-01	Is the installed capacity of the CPA below 150 MW?	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
Add-02	Is the plant load factor of the CPA for the P50 scenario below 50%?	(a) The plant load factor provided to banks and/or equity financiers while applying the project activity for project financing, or to the government while applying the project activity for implementation approval is [insert] %; (b) The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company) is [insert] %;
Add-03	Is the tariff $\leq 1,150$ ZAR/MWh?	The tariff is [insert] ZAR/MW as is evidenced in the Power Purchase Agreement/bidding documents
Add-04	Is the CPA not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the <i>Tool for the demonstration and assessment of additionality</i> (version 6.0.0)?	The CPA is not financially without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the <i>Tool for the demonstration and assessment of additionality</i> (version 6.0.0)
Add-05	Is the CPA not financially viable when the expected electricity generation (P50) is 10% higher?	The CPA is not financially viable when the expected electricity generation is 10% higher as is evidenced in the benchmark analysis
Add-06	Is the CPA not financially viable when the equipment cost is 10% lower?	The CPA is not financially viable when the expected equipment cost is 10% lower as is evidenced in the benchmark analysis
Add-07	Is the CPA not financially viable when the operating cost is 10% lower?	The CPA is not financially viable when the expected operating cost is 10% lower as is evidenced in the benchmark analysis
Add-08	Can it be concluded that the CPA is not common practice as per the <i>Tool for demonstration and assessment of additionality</i> (version 06.0.0), i.e. F is lower than 0.2 and/or $N_{all} - N_{diff}$ is lower than 3?	It can be concluded that the CPA is not common practice as is concluded in the common practice analysis.

CPA TYPE II: GREENFIELD SOLAR PV PLANTS/UNITS IN SOUTH AFRICA

General eligibility criteria – solar PV			
	Topic	Eligibility criteria	Justification
1	Geographical boundary (a)	Is the CPA located in South Africa?	The CPA is located in South Africa as is evidenced by the feasibility study



			report/environmental impact assessment report
2	Double counting (b)	<p>a) Has the CPA not yet been included in another Programme of Activities or has the CPA not yet been registered as a single CDM project activity?</p> <p>b) Is the CPA uniquely identified with the geographical co-ordinates of the project location?</p>	<p>a) The CPA has not yet been included in another Programme of Activities nor has it been registered as a single CDM project activity as is evidenced by the agreement between the CME and the CPA</p> <p>b) The CPA is uniquely identified with the geographical co-ordinates of the project location as is evidenced in the feasibility study report/environmental impact assessment report</p>
3	Technology (c)	a) Does the CPA involve the implementation of a solar PV project?	The CPA involves the implementation of a solar PV project as is evidenced by the feasibility study report/environmental impact assessment report or PPA
4	Start date (d)	Does the start of the CPA occur after the start date of the validation of the PoA (date of the start of GSC)? For the purpose of this PoA, the start date of the CPA will be when the agreement with a turbine supplier is signed. The start date must be after the date of GSC of the PoA	The start of the CPA occurs after the start date of the validation of the PoA as is evidenced by the agreement with the turbine supplier
5	Applicability of methodology (e)	<p>a) Is the CPA connected to the grid and does it supply electricity to the grid?</p> <p>b) Does the CPA involve the installation of a power plant at a site where no power plant was operated prior to the implementation of the project (greenfield plant)?</p>	The CPA is connected to the grid and will supply electricity to the grid as is evidenced by the feasibility study report/environmental impact assessment report/PPA
6	Stakeholder consultation and EIA (g)	<p>a) Has the CPA carried out a local stakeholder consultation?</p> <p>b) The CPA has carried out an Environmental Impact Assessment in line with host country laws and</p>	a) The CPA has carried out a local stakeholder consultation as is evidenced by the local stakeholder consultation



		regulations?	report b) The CPA has carried out an environmental impact assessment as is evidenced by the environmental impact assessment report
7	ODA (h)	Has the CPA confirmed that it has not received funding from Annex I parties that results in a diversion of official development assistance?	The CPA has confirmed that it has not received funding from Annex I parties that results in a diversion of official development assistance as is evidenced by the confirmation letter from the CPA or Annex I country

Eligibility criteria for the demonstration of additionality – Solar PV		
	PoA additionality-related eligibility criteria	Means of verification
Add-01	Is the installed capacity of the CPA below 75 MW?	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment.
Add-02	Is the plant load factor of the CPA below 35%?	(a) The plant load factor provided to banks and/or equity financiers while applying the project activity for project financing, or to the government while applying the project activity for implementation approval is [insert] %; (b) The plant load factor determined by a third party contracted by the project participants (e.g. an engineering company) is [insert] %;
Add-03	Is the tariff below 2,850 ZAR/MWh?	The tariff is [insert] ZAR/MW as is evidenced in the Power Purchase Agreement/bidding documents
Add-04	Is the CPA not financially viable without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the <i>Tool for the demonstration and assessment of additionality</i> (version 6.0.0)?	The CPA is not financially without the revenues from the CERs as demonstrated by the benchmark analysis carried out following the guidelines in the <i>Tool for the demonstration and assessment of additionality</i> (version 6.0.0)
Add-05	Is the CPA not financially viable when the expected electricity generation is 10% higher?	The CPA is not financially viable when the expected electricity generation is 10% higher as is evidenced in the benchmark analysis
Add-06	Is the CPA not financially viable when the equipment cost is 10% lower?	The CPA is not financially viable when the expected equipment cost is 10% lower as is

		evidenced in the benchmark analysis
Add-07	Is the CPA not financially viable when the operating cost is 10% lower?	The CPA is not financially viable when the expected operating cost is 10% lower as is evidenced in the benchmark analysis
Add-08	Can it be concluded that the CPA is not common practice as per the <i>Tool for demonstration and assessment of additionality</i> (version 06.0.0), i.e. F is lower than 0.2 and/or $N_{all} - N_{diff}$ is lower than 3?	It can be concluded that the CPA is not common practice as is concluded in the common practice analysis.

B.6. Estimation of emission reductions of a generic CPA

B.6.1. Explanation of methodological choices

The PoA will focus on grid-connected renewable electricity generation from solar photovoltaic and 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).

The emission factor of the grid will be calculated in a transparent and conservative manner using the combined margin (CM) consisting of the 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).

Project emissions

The PoA includes wind power and solar PV projects. Therefore, project emissions are zero ($PE_y = 0$).

Baseline Emissions

Baseline emissions include only CO₂ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The 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)
- $EG_{PJ,y}$ = 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)
- $EF_{grid,CM,y}$ = Combined margin CO₂ 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 power plants/units 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 (**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)
- $EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

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 South African electricity system are described as shown below and will be updated after every seven years 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 is no 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 the country has only one grid system that 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, 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.¹⁷
- 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

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

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

¹⁷ The future of South African coal; Market Investment and Policy changes –Anton Eberhard



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.

Name	Type	Generation Data (MWh)		
		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	31,723	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.

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)	0.042	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	39.5%	0.64
Port Rex	0.0697	39.5%	0.64
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 the four power stations.

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.

Number	Project Name	Type	Commissioning Date
1	Bethlehem hydroelectric project	Hydro	11/11/09
2	Durban landfill gas Bisasar Road project	Land Fill Project	3/1/08
3	PetroSA biogas to energy	Waste water	1/10/08
4	Gourikwa	Gas fuel	3/30/07
5	Ankerlig	Gas fuel	3/29/07
6	Durban Landfill-gas-to-electricity project – Mariannahill and La Mercy Landfills	Land Fill Project	1/7/06
7	Klipheuwel	Wind	Aug-02



8	Majuba	Coal	4/1/96
9	Kendal	Coal	10/1/88
10	Palmiet	Pumped storage	4/18/88
11	Matimba	Coal	12/4/87
12	Lethabo	Coal	12/22/85
13	Tutuka	Coal	6/1/85
14	Colleywobbles	Hydropower	1/1/85
15	Koeberg	Nuclear	7/21/84
16	Ncora	Hydropower	3/1/83
17	Drakensberg	Pumped storage	6/17/81
18	Duvha	Coal	1/18/80
19	Matla	Coal	9/29/79
20	Second Falls	Hydropower	4/1/79
21	First Falls	Hydropower	2/1/79
22	Vanderkloof	Hydropower	1/1/77
23	Port Rex	Gas fuel	9/30/76
24	Acacia	Gas fuel	5/13/76
25	Kriel	Coal	5/6/76
26	Amot	Coal	9/21/71
27	Gariiep	Hydropower	9/8/71
28	Hendrina	Coal	5/12/70
29	Grootvlei	Coal	6/30/69
30	Camden	Coal	12/21/66
31	Komati	Coal	11/6/61

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 %	EG _{m,y} (MWh/y)
1	Gourikwa	Gas fuel	3/30/07	0%	0
2	Ankerlig	Gas fuel	3/29/07	0%	0
3	Klipheuwel	Wind	8/1/02	0%	2,000
4	Majuba	Coal	4/1/96	11%	24,632,585
5	Kendal	Coal	10/1/88	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 $SET_{\text{sample-CDM}}$ was calculated.

	Name	Technology	Year of Commissioning	Cumulative %	EG _{m,y} (MWh/y)
1	Gourikwa	Gas fuel	3/30/07	0.000%	0.00
2	Ankerlig	Gas fuel	3/29/07	0.000%	0.00



3	Klipheuwel	Wind	8/1/02	0.001%	2,000
CDM	Bethlehem hydroelectric project	Hydro	11/11/09	0.005%	8,983
CDM	Durban landfill gas Bisasar Road project	Land Fill Project	3/1/08	0.018%	31,723
CDM	PetroSA biogas to energy	Waste water	1/10/08	0.028%	23,286
CDM	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	1/7/06	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 %	EG _{m,y} (MWh/y)
1	Gourikwa	Gas fuel	3/30/07	0.0%	-
2	Ankerlig	Gas fuel	3/29/07	0.0%	-
3	Klipheuwel	Wind	8/1/02	0.0%	2,000.00
	Bethlehem hydroelectric project	Hydro	11/11/09	0.0%	8,983.13
	Durban landfill gas Bisasar Road project	Land Fill Project	3/1/08	0.0%	31,723.20
	PetroSA biogas to energy	Waste water	1/10/08	0.0%	23,285.54
	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	1/7/06	0.0%	3,744.00
4	Majuba	Coal	4/1/96	10.6%	24,632,585
5	Kendal	Coal	10/1/88	21.7%	25,648,258
	Total	AEG SET_{sample-CDM>10years}			50,350,579

The CO₂ 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 (2)** under option A1 and using for y the most recent historical year for which grid power generation data is available, in this case 2010-2011, and using for m the power units included in the build margin.

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

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	=	The power <i>units</i> included in the build margin
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

<i>Name</i>	<i>Technology</i>	$EF_{el,m,y}$ (tCO2/MWh)	$EG_{m,y}$ (MWh/y)
Gourikwa	Gas/Diesel Oil	-	-
Ankerlig	Gas/Diesel Oil	-	-
Klipheuwel	Wind	-	2,000
Bethlehem hydroelectric project	Hydro	0	8,983
Durban landfill gas Bisasar Road project	Land fill	0	31,723
PetroSA biogas to energy	Waste water	0	23,286
Durban Landfill-gas-to-electricity project – Mariannahill and La Mercy Landfills	Land fill	0	3,744
Majuba	Coal	0.94	24,632,585
Kendal	Coal	1.05	25,648,258

Step 6: Calculate the Combined Margin

Option A i.e. the weighted average combined margin is used.

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 (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;

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:

$$ER_y = BE_y - PE_y$$

Where:

ER_y = Emission reductions in year y (tCO₂e)

BE_y = Baseline Emissions in year y (tCO₂)

PE_y = Project emissions in year y (tCO₂e)

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 border="1"> <thead> <tr> <th>Fuel Type</th> <th>NCV (GJ/kg)</th> </tr> </thead> <tbody> <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> </tbody> </table>		Fuel Type	NCV (GJ/kg)	Coal (other bituminous coal)	0.0199	Gas/Jet kerosene	0.042	Gas/Diesel Oil	0.0414
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 not 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 (<i>ex ante</i> option) BM: For the first crediting period, once <i>ex ante</i> . For the second and third crediting period, only once <i>ex ante</i> at the start of the second crediting period									
Purpose of data	Calculation of baseline emissions									
Additional comment	Applicable only to grid emission factor calculations									



Data / Parameter	$EF_{CO_2,i,y}$ and $EF_{CO_2,m,i,y}$								
Unit	tCO ₂ /GJ								
Description	CO ₂ emission factor of fossil fuel type <i>i</i> in year <i>y</i>								
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	<table border="1"> <thead> <tr> <th>Fuel Type</th> <th>EFCO₂ (tCO₂/GJ)</th> </tr> </thead> <tbody> <tr> <td>Coal (other bituminous coal)</td> <td>0.0895</td> </tr> <tr> <td>Gas/Jet kerosene</td> <td>0.0697</td> </tr> <tr> <td>Gas/Diesel Oil</td> <td>0.0726</td> </tr> </tbody> </table>	Fuel Type	EFCO ₂ (tCO ₂ /GJ)	Coal (other bituminous coal)	0.0895	Gas/Jet kerosene	0.0697	Gas/Diesel Oil	0.0726
Fuel Type	EFCO ₂ (tCO ₂ /GJ)								
Coal (other bituminous coal)	0.0895								
Gas/Jet kerosene	0.0697								
Gas/Diesel Oil	0.0726								
Choice of data or Measurement methods and procedures	<p>IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values.</p> <p>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 (<i>ex ante</i> option)</p> <p>BM: For the first crediting period, once <i>ex ante</i> following the guidance included in Step 5. For the second and third crediting period, only once <i>ex ante</i> at the start of the second crediting period</p>								
Purpose of data	Calculation of baseline emissions								
Additional comment	-								

Data / Parameter	$\eta_{m,y}$
Unit	%
Description	Average net conversion efficiency of power unit <i>m</i> in year <i>y</i>
Source of data	Default value for open cycle gas turbines built after 2000 is used as per Annex 1 of the <i>Tool to calculate the emission factor for an electricity system</i> .
Value(s) applied	39.5
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 <i>Tool to calculate the emission factor for an electricity system</i> shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	-



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	<p>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.</p> <p>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 (<i>ex ante</i> option)</p> <p>BM: For the first crediting period, once <i>ex ante</i> following the guidance included in Step 5 of the <i>Tool to calculate the emission factor for an electricity system</i>. For the second and third crediting period, only once <i>ex ante</i> at the start of the second crediting period.</p>
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	<p>Data on fuel consumption has been obtained from Eskom, the main utility company in South Africa and owner of the power plants.</p> <p>The values provided for the coal plants are in tonnes. These values were converted to kg by multiplying by 1000.</p> <p>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.</p> <p>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 (<i>ex ante</i> option)</p> <p>BM: For the first crediting period, once <i>ex</i> For the second and third crediting period, only once <i>ex ante</i> at the start of the second crediting period</p>
Purpose of data	Calculation of baseline emissions
Additional comment	-

**B.6.3. Ex-ante calculations of emission reductions*****Project emissions***

Project Emission 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)
- $EG_{PJ,y}$ = 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)
- $EF_{grid,CM,y}$ = Combined margin CO₂ 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 PoA includes projects that install 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)
- $EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y (MWh)

Parameter	Value	Unit	Source
$EG_{facility,y}$	[insert value]	[insert unit]	[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 and solar CPAs are:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	1.00	tCO2/MWh	GEF calculations
W_{BM}	0.25		
$EF_{grid,OM-DD,y}$	0.96	tCO2/MWh	GEF calculations
W_{OM}	0.75		

Therefore:

$$EF_{grid,CM,y} = 0.97 \text{ tCO2/MWh}$$

$$BE_y = [\text{Insert}] * 0.97 = [\text{Insert}] \text{ tCO2/year}$$

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

$$ER_y = BE_y - PE_y$$

Where:

ER_y	=	Emission reductions in year y (tCO2e)
BE_y	=	Baseline Emissions in year y (tCO2)
PE_y	=	Project emissions in year y (tCO2e)

Therefore, emission reductions equal:

$$[\text{insert value of } BE_y] - 0 = [\text{insert value of } ER_y]$$

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	$EG_{\text{facility},y}$
Unit	MWh
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	<p>The following parameters shall be measured:</p> <p>(i) The quantity of electricity supplied by the project plant/unit to the grid; and</p> <p>(ii) The quantity of electricity delivered to the project plant/unit from the grid</p> <p>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 and back-up meter owned Eskom. The meter is installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements. The equipment will be calibrated and tested according to recognized standards as agreed with the grid operator. If values differ, the values from the meter with a higher precision will be used.</p>
Monitoring frequency	The quantity of electricity supplied to the grid will be measured continuously and recorded monthly. The basic measurement period shall be carried out in line with PPA.
QA/QC procedures	Cross-check measurements results with records of sold electricity.
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. The following monitoring procedures and responsibilities will apply:

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.

Monitoring period

The monitoring period will start from the date of commissioning of the CPA. An annual monitoring report will be produced.

Parameters monitored



Quantity of net electricity generation supplied by the project plant/unit to the grid in year 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* 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.

ESKOM Distribution as the National Transmission Company will be responsible for:

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

ESKOM will provide a Main Metering System and Back-Up Metering System on-site. The metering equipment will be installed at the point of supply which defines the commercial boundary between the licensee and the customer.

ESKOM shall be responsible for managing and collecting metering information. ESKOM shall also transmit the data to the project proponent who is responsible to storage the collected data in line with the monitoring plan.

QA/QC

The meter(s) readings will be crosschecked with actual invoices sent by project owners to the grid company or with the registries provided to the project owners by the grid company of the energy delivered by the project to the interconnection substation, depending on the generation modality under which each CPA is operating.

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 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

Operational and management structure

Each entity implementing a CPA 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
- Collecting metering information from Eskom

Eskom, as the National Transmission Company will be responsible for:

- Calibration and maintenance of metering equipment
- Continuous measurement of electricity generated by the project activity

Each month/quarter, the CPA will submit monthly electricity generation records to the CME accompanied by the respective invoices.

The CME will carry out a quality control on the data received and store them in the electronic database.

Once a year, the CME will prepare a monitoring report for submission to a DOE for verification

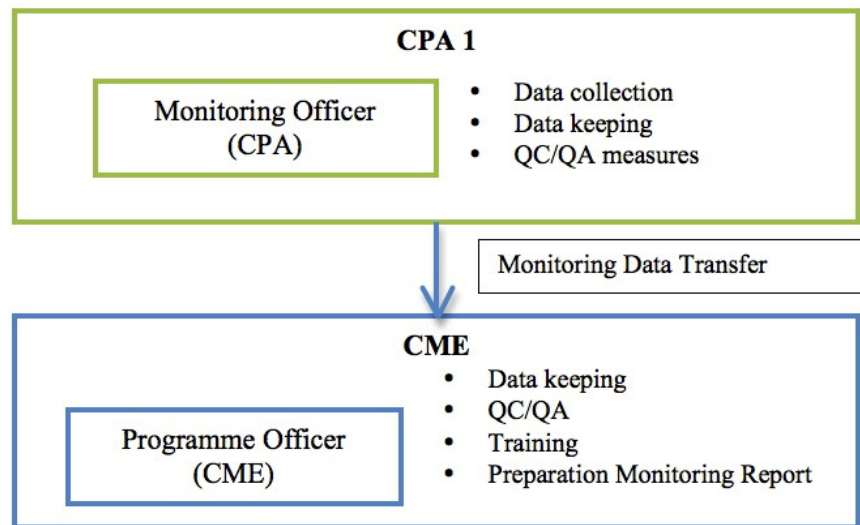


Figure 9. Monitoring organization

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

**Appendix 1: Contact information on entity/individual responsible for the PoA**

Organization	Carbon Africa Ltd.
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

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* ($EG_{m,y}$)

Name	Type	Generation Data (MWh)		
		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	31,723	31,723	31,723
Total		224,764,661	228,828,053	232,394,838

Amount of fossil fuel type *i* consumed by power plant/unit *m* in year *y*

Name	Type	FC _{i,m,y} (kg/year)		
		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

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		