PROGRAMME DESIGN DOCUMENT FORM FOR SMALL-SCALE CDM PROGRAMMES OF ACTIVITIES (F-CDM-SSC-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: Small Scale Renewable Energy Carbon Programme (SRECP)
Version: Version 03
Date: 30/11/2012

A.2. Purpose and general description of the PoA

Policy/measure or stated goal of the PoA

The purpose of the Small Scale Renewable Energy Carbon Programme - SRECP (hereafter referred as the PoA) is to support the development and implementation of small-scale renewable energy projects in South Africa, and potentially in other countries in the future, in order to displace grid-connected, fossil fuel based electricity generation, thereby reducing greenhouse gas (GHG) emissions. Renewable energy technologies implemented under the programme may include hydro (either run-of-river or an accumulated reservoir), wind and solar photovoltaic.

CPAs will not include any combination of both renewable and non-renewable components (e.g. a wind/diesel unit).

Despite the energy sector reforms that have taken place in South Africa during the last 10 years, small-scale, renewable energy projects with an installed capacity of smaller than or equal to 15 MW continue to face considerable barriers, including lack of finance, inadequate tariffs and high cost of capital. This is especially relevant for Independent Power Producers (IPPs), who represent only 3% of the total installed capacity in South Africa.

Most projects have also found it difficult to access the opportunities provided by the Clean Development Mechanism (CDM) because of the high transaction cost and long development times.

This PoA is meant to support the development of renewable energy projects connected to the South African national electricity grid system by facilitating the access to carbon credits in order to overcome some of the key barriers that those projects have been facing. CPAs included under this PoA will follow South Africa's IPP bidding process or any future applicable renewable energy policy framework as the applicable legal and regulatory framework for the development of renewable energy projects by Independent Power Producers (IPP).

Renewable energy projects can still be considered as high-risk projects due to technological risks, foreign exchange risks and market risks among others.

Due to the fact that the renewable energy industry is still a young market, the general technology risk can be considered as higher than the technology risks related to conventional energy projects. It also revealed that most technologies are imported, as South Africa does not currently produce any itself. As a result, the country adopts most of the international standards and certification. Owing to the fact that the South

African renewable energy industry is in its infancy, relevant skills and expertise are scarce.

In addition, since most of the renewable energy technologies are imported, projects that need capital for these technologies are exposed to foreign currency risks and, consequently, investors expect higher returns. With the price of electricity being controlled and capped, it is difficult for any investor to influence and manage a return on their investment. Currently, however, the cost of producing clean energy is not as competitive as conventional technologies especially since South Africa is one of the cheapest coal producer's in the world and thus the price of energy has until recently been the cheapest in the world.

In addition, raising capital in the South African economy is another constraint, as the amount of capital needed is substantially higher than for conventional energy projects.

Those barriers lead to the situation that by 2011 the 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 in South Africa. Other energy sources like hydro, biogases etc. are negligible. By March 2011, there were also no grid connected solar powered systems.

Taking the stated above into consideration, it can be considered that the development of renewable energies in South Africa depends on a stable political/legal framework to support the development of renewable energies e.g. Feed-in-tariffs, tax incentives etc.

However, recent policies and regulations surrounding the energy industry have been unclear and have therefore increased the uncertainties for investors. For instance, changes in the South African regulatory environment is one of the main barriers that limit the development of projects and increase development and associate costs.

The Renewable Energy Feed-In Tariff (REFIT) guidelines, issued by the National Energy Regulator of South Africa (NERSA) in March 2009, were designed to promote renewable energy development in South Africa. As elsewhere, REFIT essentially would pay a guaranteed fixed rate for a prescribed number of years to renewable energy generators for supplying electricity to the power grid. However, REFIT has encountered several barriers to implementation.

One barrier has been a persistent wariness concerning the role and influence of Eskom, the state-owned electricity utility, which has enjoyed a virtual monopoly on electricity generation and distribution. Potential independent power producers (IPPs) were concerned that they would not receive fair treatment as a result of the conflict of interest apparent in Eskom's position as the national utility and its role as buyer of electricity from IPPs.

In early 2011, NERSA announced its intention to review and probably decrease the tariffs set in March 2009, even though no power had yet been purchased at these initial rates.

Even before NERSA approved the new tariffs, an intervention by National Treasury has overturned wide acceptance of the lawfulness of REFIT's simplified bidding system for renewable energy PPAs and licenses. Therefore the government implemented 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.

Those changes in the legislation also increase the risk perception for investors towards the projects. Carbon credits are expected to alleviate those barriers by creating an extra source of revenue and

enhancing the financial viability for the projects. For more details on the legislation and baseline see section B.1.

All CPAs under this PoA will therefore apply the small-scale baseline and monitoring methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17) as the installed capacity will be equal or below 15 MW. The CPAs will be classified within sectoral scope 1: “Energy industries (renewable - / non-renewable sources)”.

The first Component Project Activity (CPA) will be a concentrated solar photovoltaic project with a rated capacity of 9.52 MW, which will be located approximately 4 km north-west of Noupoort, Northern Cape Province, South Africa.

The establishment of the programme of activities will help small-scale renewable energy projects in South Africa connected to the national electricity grid 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 PoA is expected to support the national policy goal of achieving 10% penetration for wind and solar PV technologies as a share of total installed capacity in 2020, and 20% in 2030[1].
- The CPAs included under this PoA are expected to provide local employment opportunities during the construction and operation phase.
- The CPAs included under this PoA are expected to contribute to South Africa’s fiscal revenues through payment of taxes and attract foreign direct investment.
- The CPAs included under this PoA will have a positive impact on the transfer solar 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 PoA will reduce South Africa’s CO_2 footprint meanwhile increasing the electricity generation capacity of the country.

Framework for the implementation of the proposed PoA

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

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

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

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

a) Implement technologies and measures as described in the 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;
e) Train personnel involved in inclusion and monitoring of CPA.

The CME will enter into agreements with all CPA entities. The contractual agreements will summarize roles and responsibilities regarding the implementation of the individual projects as CPAs. 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, which avoid double counting of the proposed CPA.

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

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

A.3. CMEs and participants of PoA

Carbon Africa will act as the coordinating/managing entity and is thus a project participant.

Climate Corporation Emissions Trading GmbH will also be a project participant.

A.4. Party(ies)

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

A.5. Physical/ Geographical boundary of the PoA

The geographical area within which small-scale Component Project Activities (SSC-CPAs) included in the PoA will be implemented is defined by the national boundaries of the host country, South Africa.

The geographic coordinates of South Africa are provided in the figure and table below.

Figure 1: Map of South Africa

Table 1. Coordinates of 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 version 02.1 of the *CDM Project Standard* (EB 70, Annex 2) and the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 02.1, EB 70, Annex 5) the programme boundary might be amended post-registration to include additional host parties.

A.6. Technologies/measures

SSC-CPAs under the PoA will use renewable energy technologies to generate electricity which will be supplied to the South African national grid. Renewable energy technologies and measures to be employed by a SSC-CPA might include:

- Hydro power plant/unit (either with a run-of-river or an accumulation reservoir);
- Wind power plant/unit;
- Solar photovoltaic power plant/unit.

Projects using renewable biomass, geothermal, tidal-wave technologies are excluded from the programme. Installed capacities of individual SSC-CPAs will be below or equal to 15 MW and CPAs will not include the combination of both renewable and non-renewable components (e.g. a wind/diesel unit).

The following table shows the typical information that a CPA will need to provide to clarify that the CPA belongs to the type of CPAs applicable to the PoA as below:

- Type I: Greenfield wind power projects

- Type II: Greenfield solar PV power projects
- Type III: Greenfield hydro power project (with reservoirs)
- Type IV: Greenfield hydro power project (run-of-river)

Table 2: Technological specifications Wind and Solar PV CPAs

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

Table 3: Technological specifications hydro power CPAs

Greenfield hydro power project (run-of-river)	**Greenfield hydro power project (with reservoirs)**
Installed capacity (MW)	Installed capacity (MW)
Gross head (m)	Gross head (m)
Number of turbines	Number of turbines
Generator model and type	Generator model and type
Number of generators	Number of generators
Annual water flow (m^3/s)	Annual water flow (m^3/s)
Average annual energy yield on an annual basis for the first 20 years of operation or the duration of the PPA	Average annual energy yield on an annual basis for the first 20 years of operation or the duration of the PPA
Plant load factor (%) and plant losses (%)	Plant load factor (%) and plant losses (%)
Equipment lifetime	Equipment lifetime
-	Number of reservoir(s)
-	Reservoir(s) surface area (m^2)
-	Power density (W/m^2)

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.

This PoA will deploy the most common commercially deployed model, the horizontal axis one, although it may use a different number of blades depending on energy resources and economic issues. Generally, electricity is generated as the turning rotor spins a generator by means of the wind that passes through the blades. The higher amount of wind and a higher speed that moves the blades of the wind turbines, the more electricity the wind turbine will generate, therefore the more CO2 emission reductions will be able achieved potentially. Figure 2 represents the average wind speed in South Africa.

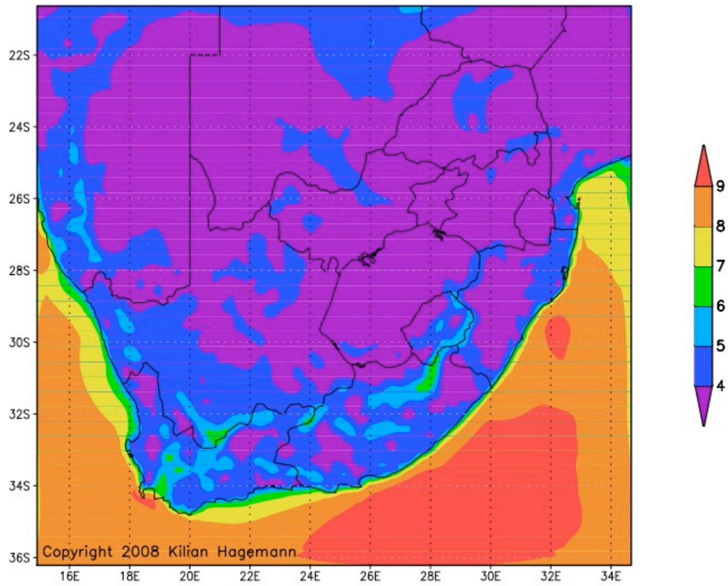


Figure 2. Average annual wind speeds at 10m above ground in m/s[2]

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.

There are several slightly different technologies using solar PV cells, being the most widely used the solar crystalline modules with 36 to 72 cells as per Figure 3. However, variations such as concentrated solar photovoltaic (CPV) are also available technologies less widely used, but also accepted in this PoA and in South Africa as per the same conditions as the common photovoltaic modules, as in essence, the technology principles are the same. Concentrated solar photovoltaic, see Figure 4, concentrated the solar rays with Fresnel Lenses above the photovoltaic cells, resulting in a much smaller photovoltaic cells for similar relative efficiencies. The CPV technology is ideal for locations with high amount of direct solar radiation, and common PV technology for places with more diffuse radiation.

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

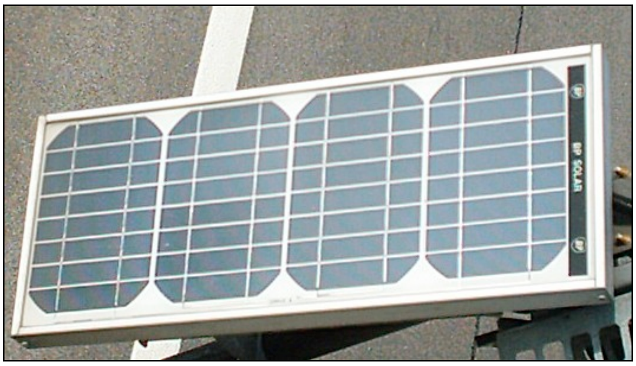


Figure 3. Photovoltaic module

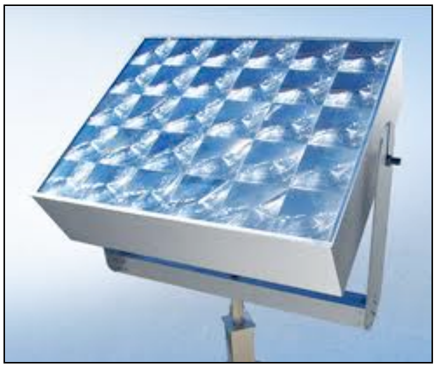


Figure 4. Concentrated solar photovoltaic

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

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

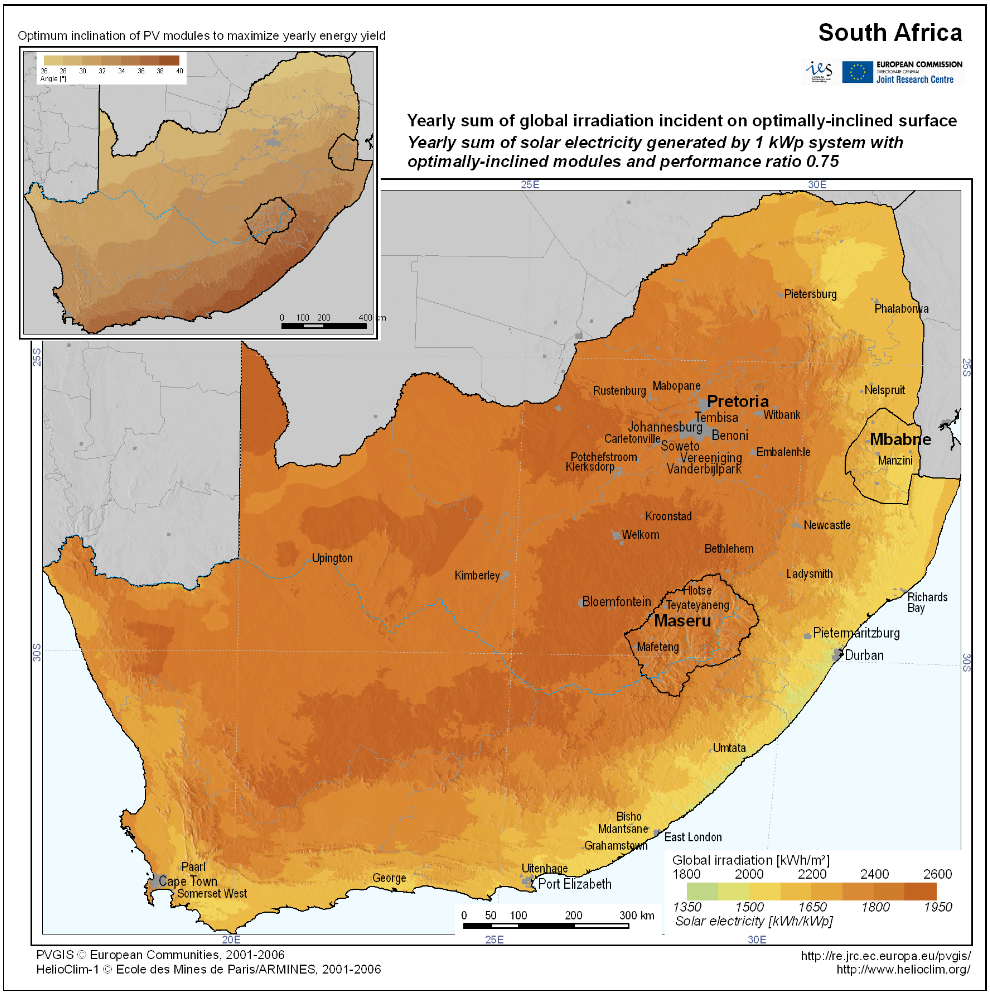


Figure 5. Yearly sum of global irradiation incident on optimally-inclined surface

Hydro power (run-of-river and accumulation reservoir):

A hydroelectric power plant harnesses the energy from a flow of water to generate electricity. There are two types of hydro schemes: accumulation reservoir and run-of-river hydro power. In a hydroelectric accumulation reservoir scheme, a watercourse is dammed and a reservoir forms behind the dam. The turbine is located at the base of the dam. When the turbine valve is opened, water flows across the turbine causing it to spin. This in turn drives the generator to generate electricity. In this process the gravitational potential energy of the stored water is converted into kinetic energy as the water flows down the pipe, then into mechanical energy at the turbine, and finally into electrical energy at the generator. In a 'run-of-river' scheme, a proportion of the flow in the watercourse is diverted directly into a pipe, which runs down to the turbine. There is no, or minimal, storage of water.

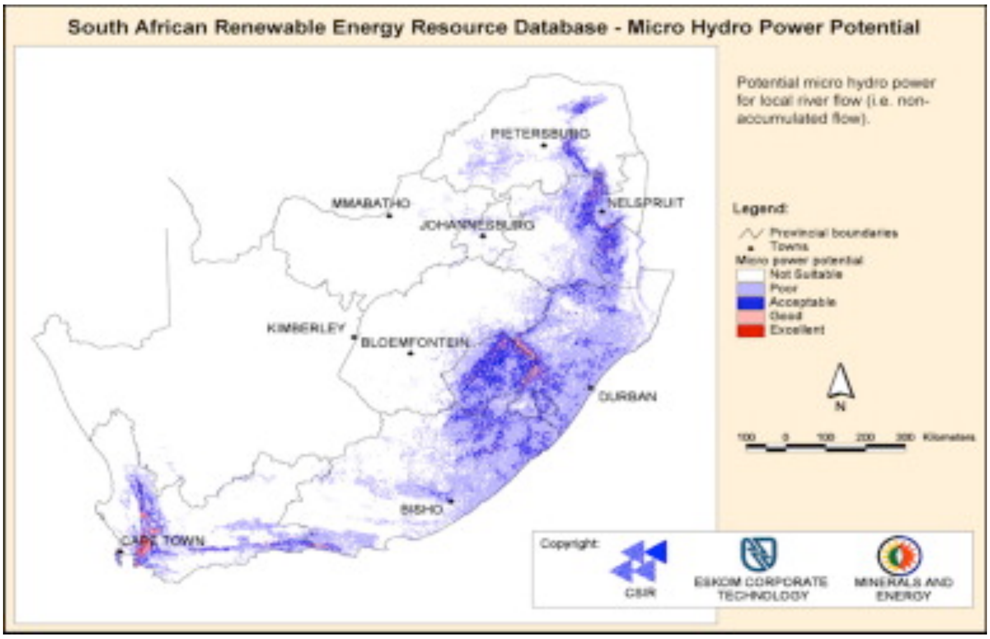


Figure 6: Micro hydro power potential

Figure 7: Hydro power (accumulation reservoir)

Figure 8: Hydro power (run-of-river)

In addition to the main equipment, the CPAs will require additional equipment for the collection of the electricity generated and for the connection to South Africa's national electricity grid. An electrical network connecting all the solar modules, wind turbines or hydro turbines will be installed to collect the electricity. Where applicable the CPA will also involve the implementation of inverters (solar PV), transformers in order to change the voltage of the electricity and transmission lines in order to connect to

the national electricity system. Electricity will be transformed at the project substation to the required connection voltage before the delivery point with the national electricity grid. The installation of a metering system is also required for CDM purposes and for electricity sales. The main metering system (facility metering system) is normally installed at the project substation at the delivery point just before connecting with the South African electricity grid. The back-up meter (system metering system), is installed by Eskom for back-up purposes at the delivery point, adjacent to facility metering system. Main and back-up meter should therefore present same measurements. However, it is only accessible by Eskom for comparison against the facility metering installation data. The following diagram shows a typical equipment layout of a CPA:

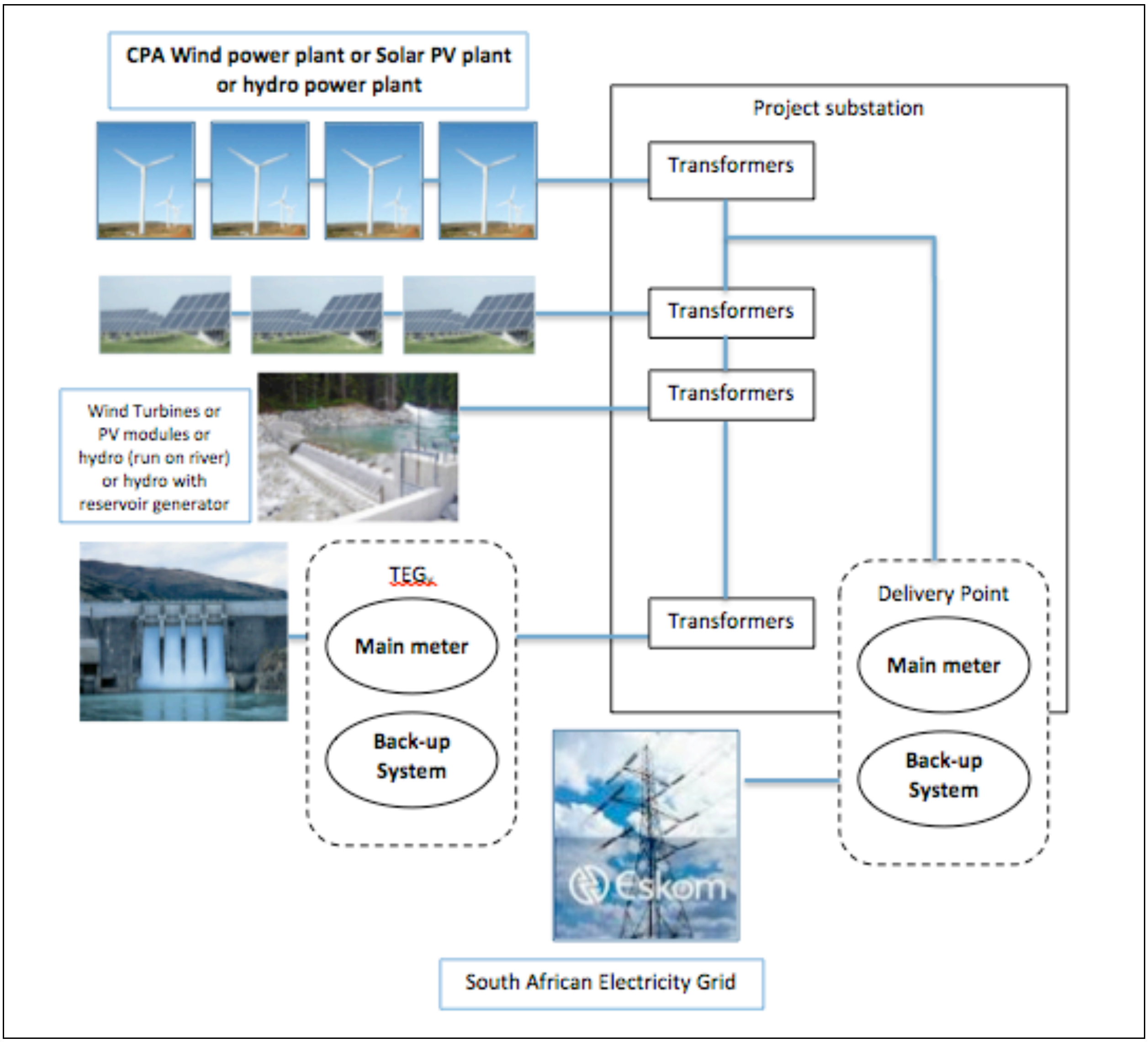


Figure 9: Monitoring equipment

In accordance with simplified baseline and monitoring methodology AMS-I.D *Grid connected renewable electricity generation* (version 17), the baseline scenario 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 into the grid".

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%). However, the pumped

storage power plants are not considered as power plants for the calculation of the grid emission factor in line with the approved *Tool to calculate the emission factor for an electricity system* (version 02.2.1). Pumped storage plants are net consumers of electricity, which pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas etc. are negligible.

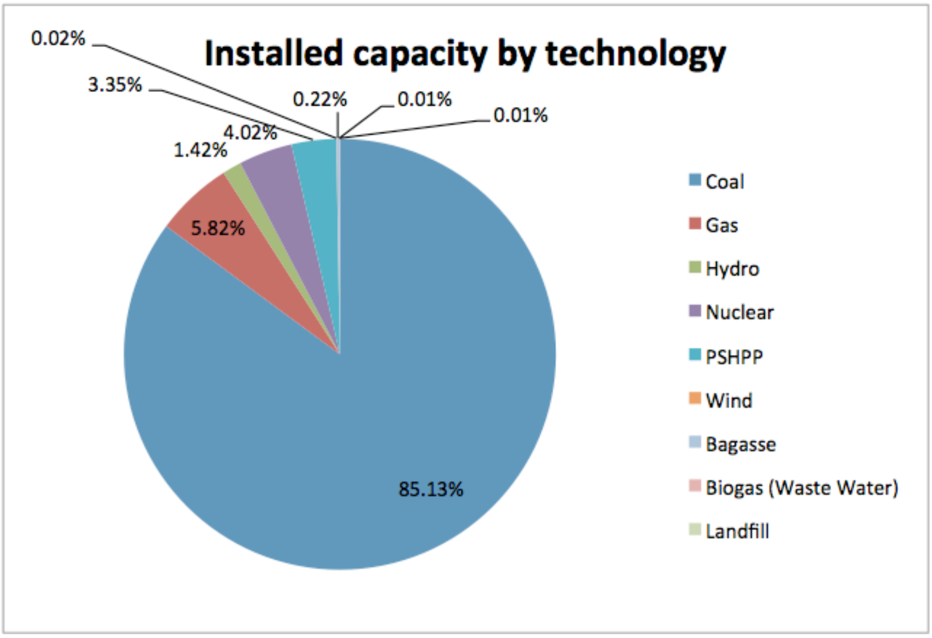


Figure 10: Installed capacity by technology

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: [3]

Table 4. 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 baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity.

[3] 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

More detailed information of the description of the baseline is provided in section B.4 of part II of the PoA-DD.

In addition to the above-mentioned equipment, the CPAs will require additional equipment for the connection and transmission of the electricity generated to the electricity grid. For instance, an electrical network to collect the electricity will be installed, and where applicable, inverters and transformation boxes. Electricity will be transformed to the required voltage at the Point of Utility with the electricity grid. In some cases, the CPA may be required to also construct a substation, but in most cases the CPA will be connected to an existing substation. The installation of a metering system is also required for both monitoring records for CDM purposes and for electricity sales.

The following technical information will be provided by specific CPAs that will be included in the PoA:

- The installed capacity
- Technical specifications of the equipment that will be installed
- Plant load factor, including the relevant losses internal consumption, and net electricity supply to the grid
- Details about the electricity collection and transmission infrastructure
- Details about the metering system

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

Detailed information about the exact technology and measures applied by the individual SSC-CPAs will be provided in the relevant section of the specific SSC-CPA-DD. The section will also include a description of how environmentally safe and sound technology and know-how is being applied by the specific SSC-CPA *inter alia* technology transfer to the host party for application in the SSC-CPA.

A.7. Public funding of PoA

There is no public funding involved in this programme of activities.

SECTION B. Demonstration of additionality and development of eligibility criteria

B.1. Demonstration of additionality for PoA

Historically, South Africa has relied heavily on coal-based electricity generation. By 2011 installed capacity of coal power plants amounted to 85%, followed by gas power plants (6%), nuclear (4%) and pumped storage hydro power plants (3%). Currently, there are only 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 in South Africa. Other energy sources like hydro, biogases etc. are negligible. By March 2011, there were no grid connected solar powered systems.

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 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 energy projects in South Africa still face many barriers, including technological, institutional and financial.

In this context, the additionality for the PoA will be demonstrated by establishing that each SSC-CPA is additional through the eligibility criteria on section B.2 using either the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) or *Guidelines for demonstrating additionality of microscale project activities* (version 04.0, EB 68, Annex 26).

As each SSC-CPA will comply with the eligibility criteria on additionality, it can be concluded that in the absence of this PoA and CDM, none of the proposed SSC-CPAs would occur.

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

As per the *Clean Development Mechanism Project Standard* (version 02.1 paragraph 151, the CME has developed eligibility criteria for inclusion of SSC-CPAs under the PoA. The eligibility criteria consists of two sets of criterion: (1) general eligibility criteria as provided in the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities* (version 02.1) 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 *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) or *Guidelines for demonstrating additionality of microscale project activities* (version 04.0, EB 68, Annex 26).

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

- Documentation that has been prepared by an experienced third party
- Documentation that has been approved or issued by South African governmental authorities
- Documentation that carries an official signature from the CPA implementing entity, CME or project participant. This will only be valid for the following criteria:
    - Double counting. The nature of these criteria can only be evidenced by signed confirmations from the CME and the CPA implementing entity. However, the veracity of those are easily demonstrable by the DOE.
    - Technology. In those cases where the non-deployment of non-renewable energy sources, the transfer of generation equipment from another project and or the fact that no renewable energy plant has been operated at the site before is not explicitly/sufficiently descripted in the feasibility study, PPA, or EIA report, a letter from the CPA implementing entity may suffice as supporting confirmation as the non-mention of those is already evidencing it.
    - Investment decision date. The investment decision is taken by the project developer and therefore its proof is normally based on Board Resolution or Board Minutes. However, this decision can be backed up by independent third party studies such as energy resource assessments.
    - Stakeholder consultation. When the stakeholder consultation is held strictly for CDM purposes, the consultation and its reports are normally taken by the CME and therefore it must be accepted. Signed participation lists and pictures should support those reports.
    - ODA diversion. When there is no use of public funding by the project developer, its non-existence can only be evidenced by a signed confirmation by the project developer.

- The agreement between the CME and the CPA for participation in the PoA is a legally binding document and therefore it can be used for confirmation purposes.

- Documentation that has been submitted to or received from financing institutions like banks and equity providers
- Documentation submitted for official purposes such as documents submitted to South African authorities

	Topic	PoA eligibility criteria	Documentary evidence
1)	Geographical boundary (a)	The geographical boundary of the SSC-CPA including any time-induced boundary is consistent with the geographical boundary set in section A.5 of the PoA-DD.	The geographical boundary of the CPA is consistent with the geographical boundary set in in section A.5 of the PoA DD since it is located in South Africa. EIA report, feasibility study or project description
2)	Double counting (b)	The SSC-CPA has not yet been included in another programme of activities or has not yet been registered as a single CDM project activity.	Agreement between CME and CPA where the CPA legally confirms its unique adhesion to this PoA as CDM component project activity; and evidence that the CME has cross-checked the information available on the UNFCCC website on the non existence of similar CDM project activities/component project activity, as described in the management system, section C. For the purpose of identification, each CPA will have a unique name, which will at least refer to the location of the CPA and the installed capacity of the project. The CME will also confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type as described in the management system, section C.
3)	Technology (c)	The SSC-CPA involves the implementation of a grid-connected renewable energy technology including solar PV, wind and hydro (run-of-river or with water accumulation reservoirs), which will only supply electricity to the national grid. SSC-CPAs involving the use of renewable biomass, geothermal, solar thermal and tidal/wave technologies for generating electricity are excluded	Feasibility study/technical description, PPA and/or EIA report by certified EIA specialist.

		from this programme of activities.	
		In terms of compliance with testing/certification, the project will comply with the relevant standards as referred to in the Request for Qualification and Proposals for New Generation Capacity under the IPP Procurement Programme or other relevant policy guideline. In the current IPP Procurement Programme guidelines, no specific certification is required for hydro projects.	Certificate or evidence for the certification provided by the technology supplier. If at the time of the inclusion of the CPA the relevant certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificate before the start of construction.
		CPAs will not include the combination of both renewable and non-renewable components (e.g. a wind/diesel unit).	Feasibility study/technical description, and/or EIA report by certified EIA specialist. In case the above mentioned documentation does not specify explicitly the non-deployment of non-renewable components, a confirmation letter that the CPA will not involve the use of non-renewable components and or on site fossil fuel consumption will be provided by the CPA implementing entity.
		The proposed SSC-CPA is the installation of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant).	Feasibility study/technical description, and/or EIA report by certified EIA specialist. In case the mentioned documentation does not clarify sufficiently that there was no renewable power plant operated at the project site before, a confirmation letter that no renewable power plant has been operated at the project site so far will be provided by the CPA implementing entity.
		CPAs will not involve energy generating equipment that is transferred from another activity	Feasibility study/technical description, and/or EIA report by certified EIA specialist . In case the above mentioned documentation does not specify explicitly the non-deployment of generating equipment transferred from another activity, a confirmation letter that the CPA will not involve the use of generating equipment transferred from another activity will be provided by the CPA implementing entity.

		If the proposed SSC-CPA is a hydropower plant: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; or • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m^2; or • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m^2.	In case the CPA is implemented in an existing reservoir with no change in the volume of reservoir, this will be evidenced by feasibility study/technical description, PPA and/or EIA report prepared by a certified EIA specialist.. In case the CPA is implemented in an existing reservoir with an increased reservoir volume or the CPA results in new reservoirs, the power density will be calculated in the specific CPA-DD based on information provided in the feasibility study/technical description, PPA and/or EIA report prepared by a certified EIA specialist.
4)	Start date (d)	The start of the SSC-CPA occurs is not, or will not be prior 12/06/2012 which is the commencement of the validation of the proposed CDM PoA, i.e. the date on which the PoA-DD is first published for global stakeholder consultation The start date will be defined as the earliest date on which a contract has been signed for equipment, construction or operation services required for the CPA. If the none of contracts for the equipment, construction or operation services required for the CPA are available at the time of inclusion of the CPA, the CPA start date will automatically be after 12/06/2012 since the start date of the CPA could not have taken place before.	Contract with party providing equipment/construction/operation services.
5)	Applicability of methodology (e)	The SSC-CPA meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation* as per section B.2, part II of the PoA-DD.	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* is explained in section D.2 of the specific CPA-DD.

6)	Additionality (f)	The SSC-CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below (Additionality related eligibility criteria).	Additionality check carried out in D.5 of each CPA-DD in line with additionality-related eligibility criteria.
7)	Stakeholder consultation and EIA (g)	(a) The SSC-CPA has carried out a local stakeholder consultation. (b) The SSC-CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations	a) Evidence that a local stakeholder consultation was carried out. These evidences may include a summary of concerns raised and clarification provided and other information such as attendance sheet, invitations and photographs. (b) Environmental Impact Assessment (EIA) report and/or EIA license.
8)	ODA (h)	The SSC-CPA has not received funding from Annex I parties that results in a diversion of official development assistance	In case no ODA is involved, confirmation letter from CPA implementing entity that the CPA has not received funding from Annex I parties. In case ODA is involved, confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
9)	Target group (g)	The SSC-CPA supplies electricity to the South African national grid or supplies electricity to an identified consumer facility via the national grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation proving that the CPA supplies electricity to a national grid; or supplies electricity to an identified consumer facility via national grid through a contractual arrangement such as wheeling.
10)	Installed capacity limits (k)	The installed capacity of the SSC-CPA is smaller than or equal to 15 MW. However, if a CPA is applying the additionality Option A for microscale project activities, the installed capacity of the SSC-CPA will be smaller than or equal to 5 MW.	Feasibility study/technical description
11)	Debundling (l)	The SSC-CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* (version 03).	Debundling check carried out in line with the latest approved version of the *Guidelines on assessment of debundling for SSC project activities* (version 03).

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

In case the CPA is microscale, the following criteria apply:

Option A: Microscale additionality	
Criteria	*Means of verification*
Installed capacity of the SSC-CPA is smaller than or equal to 5 MW	Feasibility study or other relevant project documentation.
The geographic location of the CPA is in a special underdeveloped zone (SUZ) of the host country, South Africa. or The CPA employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	Geographical coordinates of the CPA South African government official notification delineating special underdeveloped zones (SUZs) for development assistance including planning, management, and investment satisfying the following condition: - The portion of the population with income less than USD 2 per day (PPP) in the region is greater than 50% Or, those areas have been approved by the Executive Board of the CDM based on recommendations or Documentation from the CDM Executive Board recognizing the specific renewable energy technology used by the SSC-CPA.
Rationale	
In case the SSC-CPA is a microscale CPA, i.e. CPAs up to five megawatts that employ renewable energy technology, additionality will be demonstrated using the *Guidelines for demonstrating additionality of microscale project activities* (version 04.0). SSC-CPAs under the PoA follow the methodology AMS-I.D, therefore eligible SSC-CPAs will have to follow paragraph 2 (a) or paragraph 2 (d) of the guidelines as they are grid-connected renewable energy technologies, in order to demonstrate microscale additionality.	

In case the SSC-CPA is not a microscale CPA, additionality will be demonstrated using *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) and the *Non binding best practice examples to demonstrate additionality for SSC project activities* (version 01).

Option B.1 Investment Barrier (Paragraph 1 (a) of EB 68, Annex 27)	
Criteria	*Means of verification*
Without the CDM revenue of the SSC-CPA, a financially more viable alternative to the CPA would have led to higher emissions. In order to evidences that SSC-CPA is less financially attractive than the baseline scenario, a benchmark analysis will show that the CPA financial indicator is less favourable than the benchmark applied. Therefore, the following steps will be taken in line with paragraph 12 of the *Guidelines on the assessment of investment analysis* (version 05): Step 1: CPAs will apply one of the following two benchmark indicators based on parameters which are standard in the market at the time of investment decision of the SSC-CPA:	Investment analysis spread sheet and appropriate evidences for benchmark calculation and all relevant input parameters in accordance with *Guidelines on the assessment of investment analysis* (version 05). 1. The Return on Equity will be based on the default value as provided in the latest version of the *Guidelines on the assessment of investment analysis* for Group 1 projects in South Africa (i.e. 10.9%). 2. Standard market commercial lending rates for CPAs will be used in order to determine the cost of debt. This will be evidenced by applicable lending term sheets, confirmation from experienced third party or publicly available rates issued by credible

• Pre-tax nominal Weighted Average Cost of Capital (WACC) • Post-tax nominal Return on Equity The pre-tax, nominal Weighted Average Cost of Capital is an appropriate benchmark because it circumvents the impact of loan interest on income tax calculations (see also paragraph 11 in the *Guidelines on the assessment of investment analysis* (version 05). The post-tax nominal Return on Equity is considered an appropriate benchmark because equity investors and shareholders are mostly interested in after tax cash flows.	entities e.g. South African Reserve Bank. 3. The inflation will be based on one of the following options: • The inflation forecast of the South African Reserve Bank for the duration of the CPA crediting period • The target inflation of the South African Reserve Bank • The average forecasted inflation rate for South Africa published by the IMF or the World Bank for the next five years after start of the project activity 4. The tax rate used in line with the South African corporate tax legislation, currently being 28%. 5. The relevant debt/equity ratio observed for the CPA in South Africa will be applied. This will be based on publicly available data issued by credible entities e.g. NERSA or by written confirmation of a experienced third party,
Step 2: CPAs will apply one of the following two financial indicators based on parameters which are standard in the market at the time of investment decision of the SSC-CPA: • Pre-tax Project IRR, based on nominal cash-flows • Post-tax equity IRR, based on nominal cash-flows The WACC will be the benchmark for the Project IRR and the Return on Equity will be the benchmark for the Equity IRR in accordance with paragraph 12 of *Guidelines on the assessment of investment analysis* (version 05). The calculation of the financial indicator will be carried out in accordance with all provisions outlined in the *Guidelines on the assessment of investment analysis* (version 05).	Investment analysis spread sheet and appropriate credible evidences for IRR calculation and all input parameter in accordance with *Guidelines on the assessment of investment analysis* (version 05). Credible evidences for the input parameter are: • Documentation that has been prepared by an experienced third party • Documentation that has been approved or issued by South African governmental authorities • Documentation that has been submitted to or received from financing institutions like banks and equity providers • Documentation submitted for official purposes such as documents submitted to South African authorities. • Documentation that carries an official signature from the CPA implementing entity, CME or project participant. This is only applicable if the CPA implementing entity can provide evidence that the values used are considered standard in the market.
Step 3: A sensitivity analysis carried out in line with the *Guidelines on the assessment of investment analysis* (version 05) will demonstrate in which scenarios the CPA would pass the benchmark. The sensitivity analysis will show that a deviation of +10% and -10% of the parameters as shown below will not lead to a scenario that the	Investment analysis spread sheet and CPA-DD.

CPA crosses the benchmark: • Electricity generation • Tariff • Investment cost • Operating and maintenance cost Step 4: The sensitivity analysis will also demonstrate in which scenarios the CPA would pass the benchmark and demonstrate the non-likelihood of occurrence of those scenarios.	
Rationale	
Investment barrier: a financially more viable alternative to the CPA would have led to higher emissions. The investment barrier shall be demonstrated using benchmark analysis in accordance with the provisions of the *Non-binding best practice examples to demonstrate additionality for SSC project activities* (EB35, Annex34) and the *Guidelines on the assessment of investment analysis* (version 05).	

Option B.2 Access-to-capital Barrier (Par 1 (d) "other barriers" of EB 68, Annex 27)	
Criteria	*Means of verification*
The CPA implementing entity has signed a loan agreement/term sheet with a company that also buys the CERs. The loan agreement/term sheet explicitly mentions that it requires the transfer of CERs to the facilitating entity since this shows that the loan was assured due to the benefit of the CDM. or, The CPA implementing entity has received a significant part of the project investment as a pre-payment for expected CERs. **and,**	Loan agreement or Emission Reduction Purchase Agreement (ERPA)
The CPA implementing entity has provided information about the ownership of the project which shows that, at the time the of equity investment/loan agreement based on the CERs is made, there is no significant shareholding by multinational companies, state-owned companies or companies listed on the Johannesburg Stock Exchange and, The project has provided its financial statements for the most recent year prior to the of equity investment/loan agreement based on the CERs, which shows that raising finance off is difficult, as per its balance sheet.	Incorporation documents of the entity implementing the SSC-CPA. and, Financial statements for the most recent year prior to the investment based on the CERs.

Rationale	
Access-to-capital barrier: the CPA could not access appropriate capital without consideration of the CDM revenues. The access-to-capital shall be demonstrated by referring to guidelines 1 and 6 of the *Guidelines for objective demonstration and assessment of barriers* (version 01.0), as follows: 1. While demonstrating barriers related to the lack of access to capital, information should include nature of company, organization and its ownership and, financial information. A company that is a subsidiary of a multinational group may have different access to capital, technologies or skilled labour than a local SME company. 2. The project proponent should demonstrate in the PDD that the financing of the project was assured only due to the benefit of the CDM. Therefore, it should be demonstrated that the loan approval (or other significant financing decision(s)) by the lender takes explicitly the CDM registration into account. For the cases where the investment is done by a company which also purchases the CERs and the loan agreement mentions that, there is an objective demonstration that the CDM facilitated the lending. The rationale behind this demonstration is that CPA implementing entities had raised finance thanks to the expected CERs. This evidence will be supported by demonstrating that without CDM, the project would have had difficulties to raise that finance as there is no multinational company, state-owned company, or company listed in the Johannesburg Stock Exchange with a significant share of the project which would have had facilitated the raising of financing. The financial statements will back it up by, for instance, showing that there is a lack of sufficient assets to work as collateral.	

Option B.3 Barrier due to prevailing practice (Paragraph (c) of EB 68, Annex 27)	
Criteria	*Means of verification*
The project is first-of-its kind in the applicable geographical area if: a) The CPA is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document is published for global stakeholder consultation or before the start date of the proposed CPA, whichever is earlier; b) The CPA implements a power generation based on renewable energy measure as included in the *Guidelines on additionality of first-of-its-kind project activities* (version 02.0)[4] c) The project participants selected a crediting period for the project activity that is "a maximum of 10 years with no option of renewal".	Demonstration of first-of-its kind following the approach provided in the *Guidelines on additionality of first-of-its-kind project activities* (version 02.0)[5] by providing evidence that the CPA will apply a measure in accordance with the guidelines as above. This will be evidenced by a Feasibility study/technical description. In addition the CME will confirm that the CPA is the first in South Africa that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the CPA-DD has been submitted to the DOE for inclusion or before the start date of the proposed CPA, whichever is earlier;
Rationale	
Barrier due to prevailing practice: prevailing practice would have led to implementation of a technology	

[4] All definitions of terms e.g. applicable geographical area, measure etc. will be as provided in the Guidelines on additionality of first-of–its-kind project activities version 02.0

[5] All definitions of terms e.g. applicable geographical area, measure etc. will be as provided in the Guidelines on additionality of first-of–its-kind project activities version 02.0

with higher emissions. Best practice examples include but are not limited to, the demonstration that the project is among the first of its kind in terms of technology, geography, sector, type of investment and investor, market etc. The approach as provided in the *Guidelines on additionality of first-of-its-kind project activities* (version 02.0) will be used to demonstrate that the project is among the first of its kind. In case the project proponent applies the Barrier due to prevailing practice argument, the crediting period will be limited to a 10-year crediting period which will be not renewable.

Option C: Automatic additionality (Paragraph 2 (a) of EB 68, Annex 27)	
Criteria	*Means of verification*
The CPA uses a technology which is on the positive list of grid-connected renewable electricity generation technologies as specified in *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27).	Project feasibility study or other relevant project documentation
Rationale	
In case the CPA involves a technology, which is on the positive list of grid-connected renewable electricity generation technologies defined in the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) the project will be automatically additional.	

B.3. Application of methodologies

This PoA will include grid-connected renewable power generation units of the following technologies types: wind, hydro (run-of-river and accumulation reservoir) and photovoltaic. The project activities will consist of the installation of new power plants at sites where no renewable energy power plant was operated prior to the implementation of the CPA (greenfield plants).

CPAs will not include the combination of both renewable and non-renewable components (e.g. a wind/diesel unit).

All SSC-CPAs implemented under this PoA will apply the approved small-scale baseline and monitoring methodology AMS-I.D *Grid connected renewable electricity generation* (version 17).

Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA. An electronic database will be established that contains general information regarding each SSC-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 SSC-CPA. The database will be accessible at any time for verification.

SECTION C. Management system

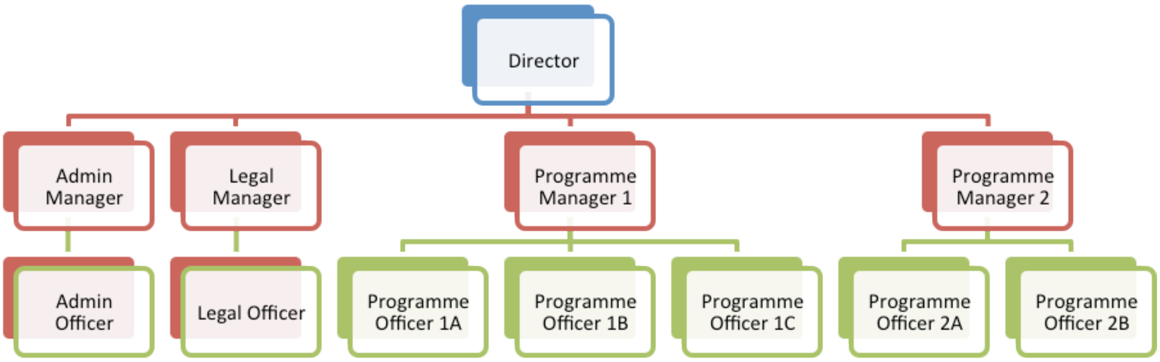
Roles and responsibilities of personnel involved in the process of inclusion of CPAs, including a review of their competencies;

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

Carbon Africa will assign one director-level staff member with signing authority to have overall responsibility for the management of the CME. The director will be supported by one or more Programme Managers and the legal and administrative managers of Carbon Africa. Programme Officers

will in turn support the manager-level positions and undertake much of the direct work relating to the SRECP PoA Management and CPA Inclusion Manual.

An organogram of the CME management structure is show below:



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

Records of arrangements for training and capacity development for personnel;

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

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

Procedures for technical review of inclusion of CPAs;

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

A procedure to avoid double counting

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

In with the PoA-DD, in order to avoid double counting, the CME will take the following measures:

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

- A signed confirmation letter from the CPA implementing entity that it was not yet included in another Programme of Activities or has been registered or intends to be registered as a single

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

2. The CME will confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type through:
- A project area map, including geographic coordinates, provided by the CPA Implementer. This will be in the form of a map in the EIA report, feasibility study/technical description or other relevant documentation (e.g. GIS map).
- A check by the CME on the CDM website that the location of the CPA does not overlap with other CDM projects (CPAs or single CDM projects) in the area in line with the procedures as outlined in section and the CME management manual. The check by the CME will be presented in a signed confirmation letter from the CME.

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

In order to facilitate the avoidance of double counting, the Programme Officer will put in place, maintain and update a database of other Programme of Activities and single CDM project activities within the geographical boundary of SRECP. The database will include:
- Name of the PoA or single CDM project activity
- Geographical boundary of the PoA
- Geographical location of the CDM projects including geographical coordinates
- Technology applied and installed capacity of single CDM projects
- List of CPAs included in the PoA, with the name of the CPA, technology applied, installed capacity and geographical location of the CPA including geographical coordinates of the project location or project area

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

Measures for continuous improvements of the PoA management system

In the course of the PoA lifetime, it is likely that some of those procedures included in the PoA Management and CPA Inclusion Manual will result in insufficient control of the CME management system. Therefore, the CME will its processes and procedures with a view to improving them for better management system control. Any such improvements will be incorporated as soon as is reasonably possible and this Manual will be updated accordingly. This may include but is not limited to:
- Improved CME organization and structure
- Better personnel development and training procedures
- Updated document and data management and control processes
- Better internal and external communication

Quality control improvement

The CME shall also continually improve the effectiveness of the quality control system by:
- Communicating to staff the importance of meeting statutory and regulatory requirements

- Ensuring that quality objectives are established and putting in place more stringent procedures as required
- Conducting management reviews
- Ensuring the availability of resources

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

External review and feedback

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

CME management system improvement plan

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

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

SECTION D. Duration of PoA
D.1. Start date of PoA

In line with the *Glossary of CDM terms* (version 07.0), the start date of the PoA is 12/06/2012 which is the date when the PoA has been uploaded for Global Stakeholder Consultation (GSC). The start date of any future SSC-CPA is not, or will not be, prior to 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 CPA, 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.

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 SSC-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

The letter of approval and authorization has been issued on the 29/10/2012 by the South African DNA..

PART II. Generic component project activity (CPA)

CPA TYPE: Wind energy project

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

The small-scale component project activity (SSC-CPA), which will be implemented under the Small Scale Renewable Energy Carbon Programme (SRECP) is a grid-connected wind power project.

The generic SSC-CPA comprises the implementation and operation of a wind power plant implemented at a site where no renewable power plant was operated prior to the implementation of the CPA.

CPAs will not include the combination of both renewable and non-renewable components (e.g. a wind/diesel unit).

The CPA will generate electricity, which will be fed into to South Africa's national electricity grid or be supplied to an identified consumer facility via national grid through a contractual arrangement such as wheeling. By replacing fossil-fuel based electricity, the CPA will lead to emission reductions.

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

SSC-CPAs included in the PoA will apply approved baseline and monitoring methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17).

AMS-I.D. (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

CPAs included under this PoA will not apply the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02),* since no on-site fossil fuel consumption will take place.

B.2. Application of methodology(ies)

The CPA qualifies as small-scale Type I component project activity because the maximum output capacity achieved by individual SSC-CPAs will not exceed 15MW in each year of the crediting period. The CPA falls under category AMS-I.D. *Grid connected renewable electricity generation* (version 17) because the CPA meets the applicability criteria as follows:

Applicability criteria	**Generic CPA justification**
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	The generic SSC-CPA under the programme will use grid-connected wind power generation that will supply electricity to a national grid, or to an identified consumer facility via national grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) 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); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (greenfield plant).
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	Not applicable. This CPA includes wind energy projects, not hydro power plants.
If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only	Not applicable. The programme of activities will not use both, renewable and non-renewable components.

to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	
Combined heat and power (co-generation) systems are not eligible under this category.	Not applicable. The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable. The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable. The programme of activities does not include retrofits or replacements.

The following conditions apply for use of this methodology in a project activity under a programme of activities:

In the specific case of biomass project activities the applicability of the methodology is limited to either project activities that use biomass residues only or biomass from dedicated plantations complying with the applicability conditions of AM0042.	Not applicable. This programme of activities does not involve CPAs including biomass.
In the specific case of biomass project activities the determination of leakage shall be done following the general guidance for leakage in small-scale biomass project activities (attachment C of Appendix B16 of simplified modalities and procedures for small-scale clean development mechanism project activities; decision 4/CMP.1) or following the procedures included in the leakage section of AM0042.	Not applicable. This programme of activities does involve CPAs including biomass.
In case the project activity involves the replacement of equipment, and the leakage from the use of the replaced equipment in another activity is neglected because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond	Not applicable. This programme of activities does involve the replacement of equipment.

with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.	

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).	This tool is applicable since the generic CPA involves the generation of electricity from wind and its supply to the South African grid system.
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

According to the approved SSC-methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to."

The project power plant and all power plants physically connected to the South African national grid system constitute the project boundary for this project.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the tables below. The figures below provide flow charts of the equipment and systems, emissions sources and gases included in the project boundary as well as the monitoring variables in the project boundary of the different CPAs eligible under this PoA.

<u>**Wind CPAs**</u>

Source		**Gas**	**Included?**	**Justification/Explanation**
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
		CH_4	No	Minor emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*

		N_2O	No	Minor emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
Project Activity	CO_2 emissions from combustion of fossil fuels for electricity generation in the case of a combination of non-renewable and wind units/plants.	CO_2	No	No on-site fossil fuel consumption will take place. Therefore no emissions as per AMS-I.D and the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*
		CH_4	No	
		N_2O	No	
	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Geothermal power plants are not included in this PoA and the CPA is a wind power plant/unit
		CH_4	No	
		N_2O	No	
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Geothermal power plants are not included in this PoA and the CPA is a wind power plant/unit
		CH_4	No	
		N_2O	No	
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	No emissions since the CPA is a wind power plant/unit
		CH_4	No	No emissions since the CPA is a wind power plant/unit
		N_2O	No	No emissions since the CPA is a wind power plant/unit

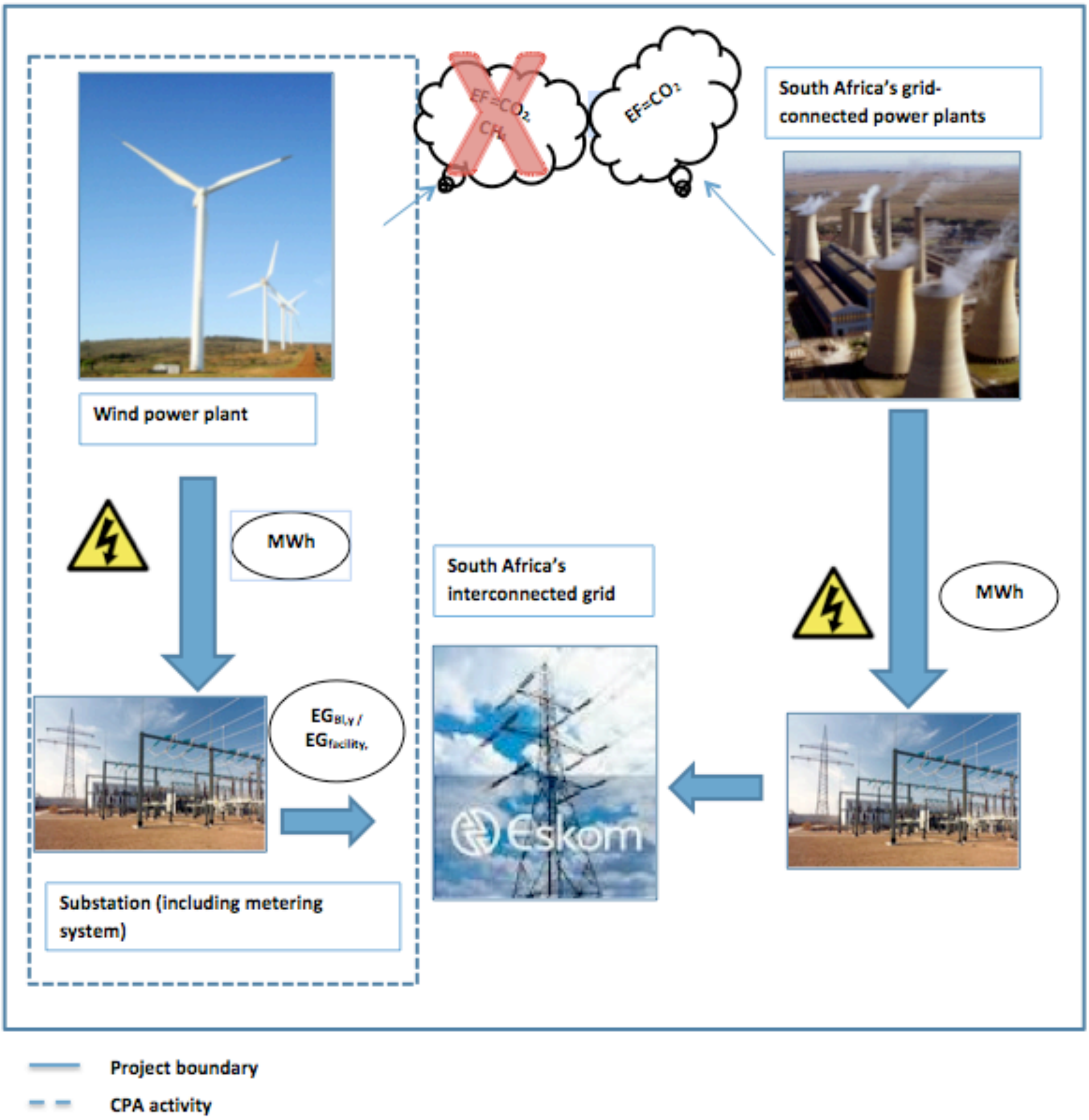


Figure 11: Wind power CPA

A detailed project description can be found for each CPA in the CPA-DD, section A.5.

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), the baseline scenario 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 into the grid".

The South African baseline scenario is described as follows:

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)*[6].

Specifically for the electricity sector of South Africa, the *Electricity Regulation Act of 2006 (No. 4 of 2006)*[7] determines the framework of the electricity sector. In May 2011, the Department of Energy, acting as the legislative entity, amended the *Electricity Regulations on New Generation Capacity*[8] under the *Electricity Regulation Act of 2006.* According to the new the current regulation, 70% of the new generation capacity must be implemented by the state-owned utility company Eskom, and 30% by Independent Power Producers (IPPs).[9] 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 *Electricity Regulation on New Generation Capacity* replaced the former *Renewable Energy Feed-in Tariff (REFIT)*[10]*,* which came into force on the 26 of March 2009.

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"*[11] 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.

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[6] Department of Energy (2008), National Energy Act of 2oo8 http://www.info.gov.za/view/DownloadFileAction?id=92826, accessed on 30.12.2011

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

[8] Department of Energy (2011), Electricity Regulations on New Generation Capacity, http://www.sapvia.co.za/electricity-regulations-on-new-generation-capacity-4-may-2011/, accessed on 30.12.2011

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

[10] NERSA (2009), South Africa Renewable Energy Feed-in Tariff (REFIT), http://www.info.gov.za/view/DownloadFileAction?id=99318 , accessed on 30.12.2011

[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

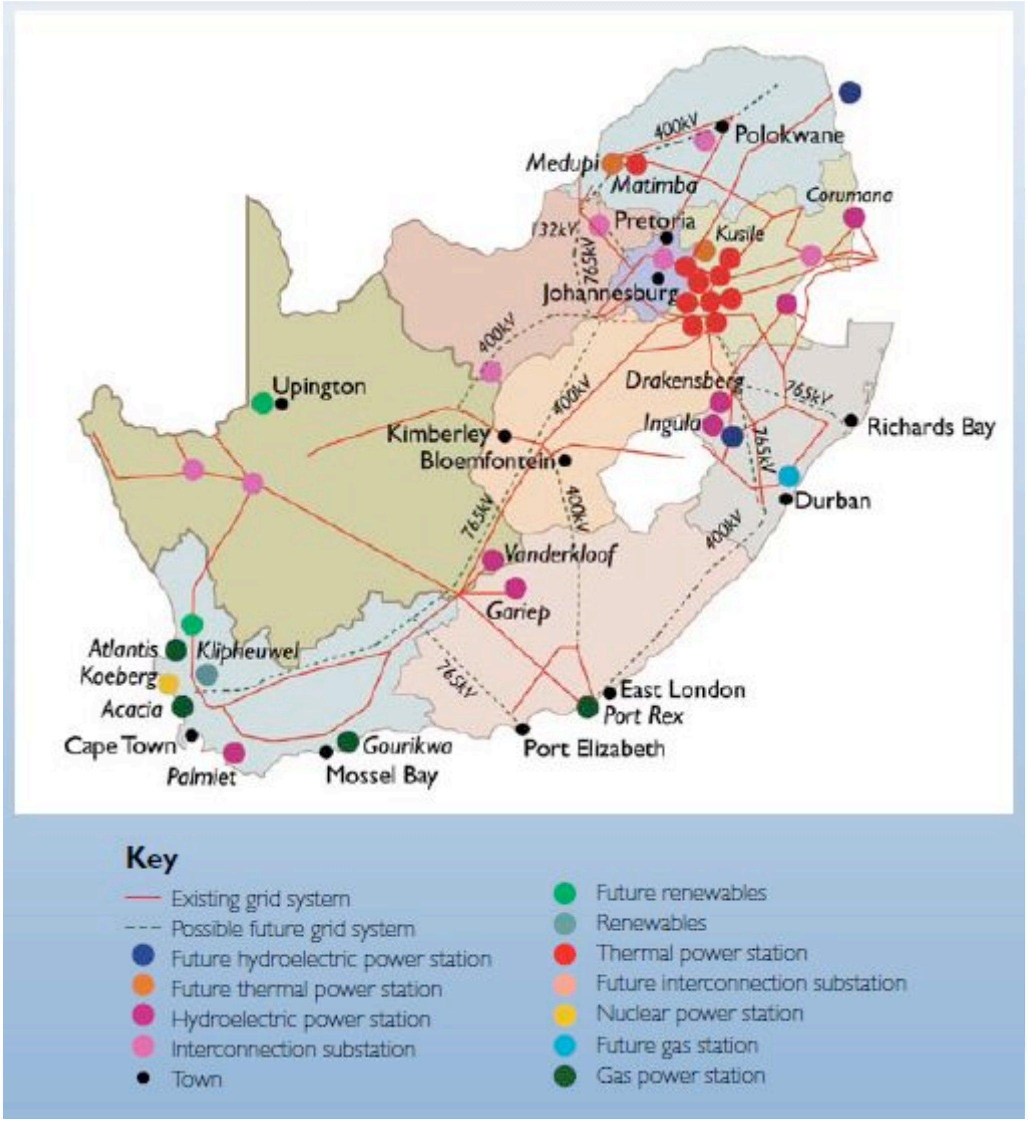

Figure 12. South African Power Sector

<u>Generation</u>

Electricity generation in South Africa is dominated by Eskom, which owns 93% of the installed capacity of 47,463 MW 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.[12]

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.[13] The latest published data for IPPs and municipal generation is from 2006[14].

[12] 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

[14] 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 5. 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
PSHSPP	1,400	1,400
Wind	3	3
Total	**44,145**	**41,294**

Table 6. Municipalities electricity generation capacity

Installed municipal capacity by source 2006	**Nominal Capacity [MW]**	**Net maximum capacity [MW]**
Coal	1,323	240
Gas	334	122
Hydro	4	-
PSHSPP	189	174
Total	**1,850**	**536**

Table 7. 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	7
Wind	5.2	5.2
Waste Water / Biogas	4.25	4.25
Landfill	5	5
Total	**1,468**	**1,020**

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 addtion, at the start of validation of this project, there were no solar PV power plants connected the South African grid.

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 that pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas etc. are negligible.

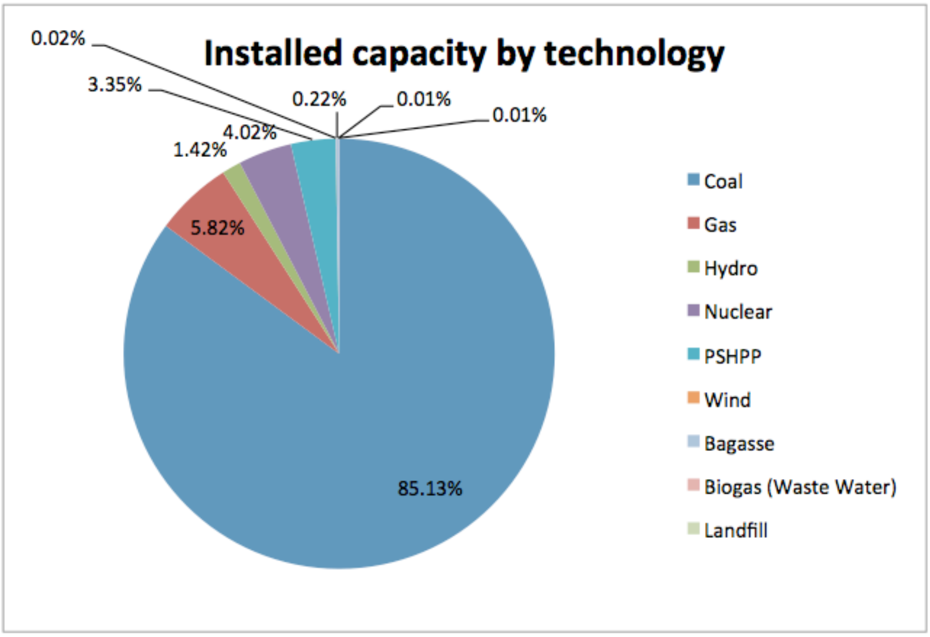

Figure 13: Installed capacity by technology

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: [15]

Table 8. 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 for Electricity 2010-2030* forecasts increasing imports of electricity generated from hydro power plants located in Zambia and Mozambique from 2022 on towards. However, *Integrated Resource Plan*

[15] 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

for Electricity 2010-2030 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.

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

<u>Transmission and Distribution</u>

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).[16] 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: [17]

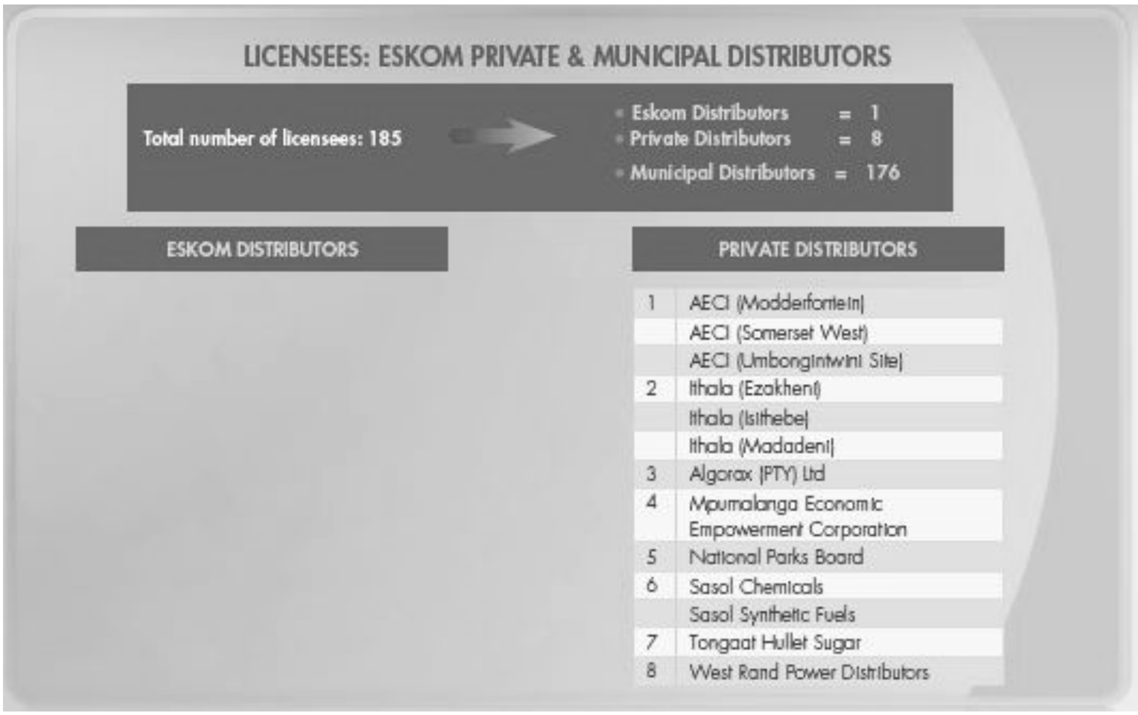

Figure 14. Distribution licenses

The government's policy on the Electricity Distribution Industry (EDI) requires the transmission of electricity to be separated from Eskom and merged with the electricity departments of municipalities to form a number of financially viable regional electricity distributors (REDs)[18]. An interim body, called

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

[17] 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

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

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 December 2010 by the government[19]. 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 for Electricity 2010-2030*, the *"Transmission Ten-Year Development Plan 2012-2021"*[20] published by the Transmission Division of Eskom determines the required additional transmission capacity as follows:

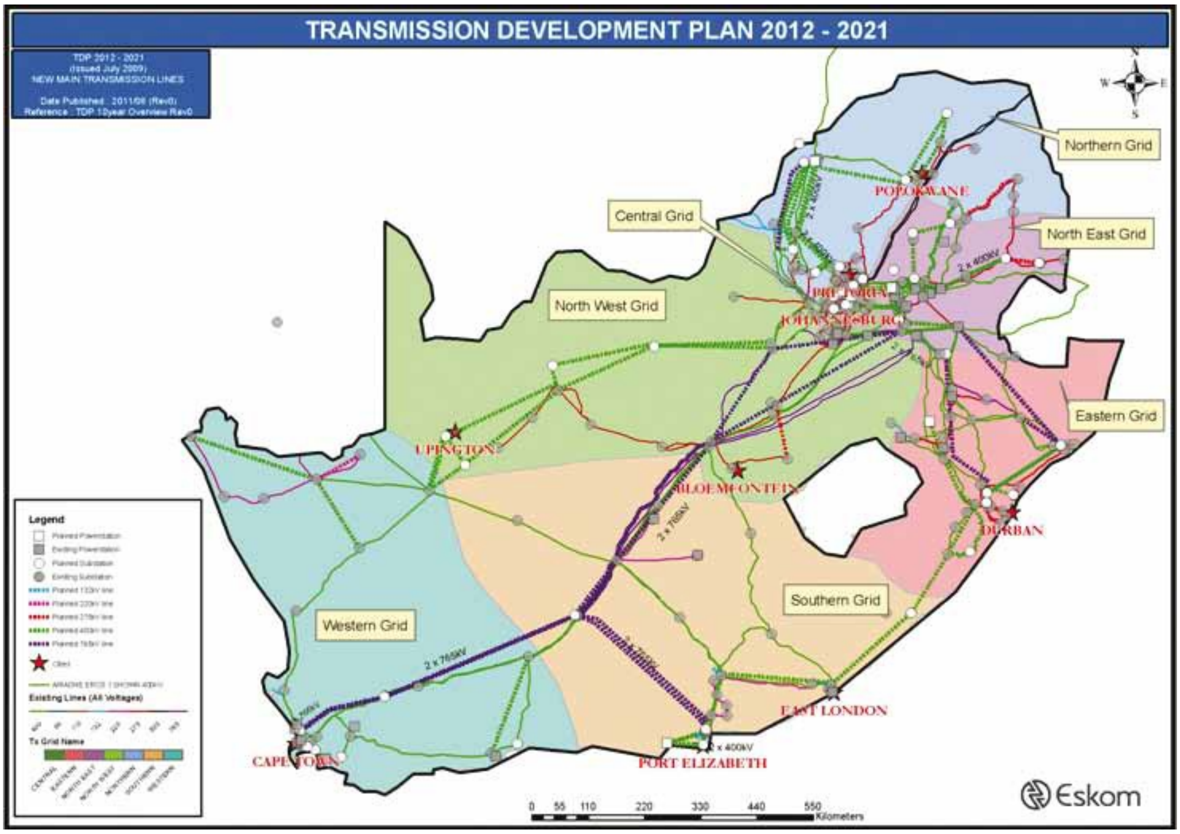

Figure 15. Transmission Development Plan 2012-2021

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

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

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

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 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 16. New grid assets 2022

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Documentary evidence
1)	Geographical boundary (a)	The geographical boundary of the SSC-CPA including any time-induced boundary is consistent with the geographical boundary set in section A.5 of the PoA-DD.	The geographical boundary of the CPA is consistent with the geographical boundary set in in section A.5 of the PoA DD since it is located in South Africa. EIA report, feasibility study or project description
2)	Double counting (b)	The SSC-CPA has not yet been included in another programme of activities or has not yet been registered as a single CDM project activity.	Agreement between CME and CPA where the CPA legally confirms its unique adhesion to this PoA as CDM component project activity; and evidence that the CME has cross-checked the information available on the UNFCCC website on the non existence of similar CDM project activities/component project activity, as described in the management system, section C. For the purpose of identification, each CPA will have a unique name, which will at least refer to the location of the CPA and the installed capacity of the

			project. The CME will also confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type as described in the management system, section C.
3)	Technology (c)	The SSC-CPA involves the implementation of a grid-connected renewable energy technology including solar PV, wind and hydro (run-of-river or with water accumulation reservoirs), which will only supply electricity to the national grid. SSC-CPAs involving the use of renewable biomass, geothermal, solar thermal and tidal/wave technologies for generating electricity are excluded from this programme of activities.	Feasibility study/technical description, PPA and/or EIA report by certified EIA specialist.
		In terms of compliance with testing/certification, the project will comply with the relevant standards as referred to in the Request for Qualification and Proposals for New Generation Capacity under the IPP Procurement Programme or other relevant policy guideline. In the current IPP Procurement Programme guidelines, no specific certification is required for hydro projects.	Certificate or evidence for the certification provided by the technology supplier. If at the time of the inclusion of the CPA the relevant certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificate before the start of construction.
		CPAs will also not include the combination of both renewable and non-renewable components (e.g. a wind/diesel unit).	Feasibility study/technical description, and/or EIA report by certified EIA specialist. In case the above mentioned documentation does not specify explicitly the non-deployment of non-renewable components, a confirmation letter that the CPA will not involve the use of non-renewable components and or on site fossil fuel consumption will be provided by the CPA implementing entity.
		The proposed SSC-CPA is the installation of a new power plant at a site where no renewable power plant was operated prior to the	Feasibility study/technical description, and/or EIA report by certified EIA specialist. In case the mentioned documentation does not clarify

		implementation of the project activity (greenfield plant).	sufficiently that there was no renewable power plant operated at the project site before, a confirmation letter that no renewable power plant has been operated at the project site so far will be provided by the CPA implementing entity.
		CPAs will not involve energy generating equipment that is transferred from another activity	Feasibility study/technical description, and/or EIA report by certified EIA specialist . In case the above mentioned documentation does not specify explicitly the non-deployment of generating equipment transferred from another activity, a confirmation letter that the CPA will not involve the use of generating equipment transferred from another activity will be provided by the CPA implementing entity.
		If the proposed SSC-CPA is a hydropower plant: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; or • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2; or • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	Not applicable. The proposed CPA is a wind energy project.
4)	Start date (d)	The start of the SSC-CPA occurs is not, or will not be prior 12/06/2012 which is the commencement of the validation of the proposed CDM PoA, i.e. the date on which the PoA-DD is first published for global stakeholder consultation The start date will be defined as the earliest date on which a contract	Contract with party providing equipment/construction/operation services.

		has been signed for equipment, construction or operation services required for the CPA. If the none of contracts for the equipment, construction or operation services required for the CPA are available at the time of inclusion of the CPA, the CPA start date will automatically be after 12/06/2012 since the start date of the CPA could not have taken place before.	
5)	Applicability of methodology (e)	The SSC-CPA meets all the applicability criteria of version 17 of AMS I.D Grid connected renewable electricity generation as per section B.2, part II of the PoA-DD.	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D Grid connected renewable electricity generation is explained in section D.2 of the specific CPA-DD.
6)	Additionality (f)	The SSC-CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below (Additionality related eligibility criteria).	Additionality check carried out in D.5 of each CPA-DD in line with additionality-related eligibility criteria.
7)	Stakeholder consultation and EIA (g)	(a) The SSC-CPA has carried out a local stakeholder consultation. (b) The SSC-CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations	a) Evidence that a local stakeholder consultation was carried out. These evidences may include a summary of concerns raised and clarification provided and other information such as attendance sheet, invitations and photographs. (b) Environmental Impact Assessment (EIA) report and/or EIA license.
8)	ODA (h)	The SSC-CPA has not received funding from Annex I parties that results in a diversion of official development assistance	In case no ODA is involved, confirmation letter from CPA implementing entity that the CPA has not received funding from Annex I parties. In case ODA is involved, confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
9)	Target group (g)	The SSC-CPA supplies electricity to the South African national grid or supplies electricity to an identified consumer facility via the national grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation proving that the CPA supplies electricity to a national grid; or supplies electricity to an identified consumer facility via national grid through a contractual arrangement such as wheeling.
10)	Installed capacity limits (k)	The installed capacity of the SSC-CPA is smaller than or equal to 15 MW. However, if a CPA is	Feasibility study/technical description

		applying the additionality Option A for microscale project activities, the installed capacity of the SSC-CPA will be smaller than or equal to 5 MW.	
11)	Debundling (l)	The SSC-CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the Guidelines on assessment of debundling for SSC project activities (version 03).	Debundling check carried out in line with the latest approved version of the Guidelines on assessment of debundling for SSC project activities (version 03).

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

In case the CPA is microscale, the following criteria apply:

Option A: Microscale additionality	
Criteria	*Means of verification*
Installed capacity of the SSC-CPA is smaller than or equal to 5 MW	Feasibility study or other relevant project documentation.
The geographic location of the CPA is in a special underdeveloped zone (SUZ) of the host country, South Africa. or The CPA employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	Geographical coordinates of the CPA South African government official notification delineating special underdeveloped zones (SUZs) for development assistance including planning, management, and investment satisfying the following condition: - The portion of the population with income less than USD 2 per day (PPP) in the region is greater than 50% Or, those areas have been approved by the Executive Board of the CDM based on recommendations or Documentation from the CDM Executive Board recognizing the specific renewable energy technology used by the SSC-CPA.
Rationale	
In case the SSC-CPA is a microscale CPA, i.e. CPAs up to five megawatts that employ renewable energy technology, additionality will be demonstrated using the *Guidelines for demonstrating additionality of microscale project activities* (version 04.0). SSC-CPAs under the PoA follow the methodology AMS-I.D, therefore eligible SSC-CPAs will have to follow paragraph 2 (a) or paragraph 2 (d) of the guidelines as they are grid-connected renewable energy technologies, in order to demonstrate microscale additionality.	

In case the SSC-CPA is not a microscale CPA, additionality will be demonstrated using *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) and the *Non binding best practice examples to demonstrate additionality for SSC project activities* (version 01).

Option B.1 Investment Barrier (Paragraph 1 (a) of EB 68, Annex 27)	
Criteria	*Means of verification*

Without the CDM revenue of the SSC-CPA, a financially more viable alternative to the CPA would have led to higher emissions. In order to evidences that SSC-CPA is less financially attractive than the baseline scenario, a benchmark analysis will show that the CPA financial indicator is less favourable than the benchmark applied. Therefore, the following steps will be taken in line with paragraph 12 of the *Guidelines on the assessment of investment analysis* (version 05): Step 1: CPAs will apply one of the following two benchmark indicators based on parameters which are standard in the market at the time of investment decision of the SSC-CPA: • Pre-tax nominal Weighted Average Cost of Capital (WACC) • Post-tax nominal Return on Equity The pre-tax, nominal Weighted Average Cost of Capital is an appropriate benchmark because it circumvents the impact of loan interest on income tax calculations (see also paragraph 11 in the *Guidelines on the assessment of investment analysis* (version 05). The post-tax nominal Return on Equity is considered an appropriate benchmark because equity investors and shareholders are mostly interested in after tax cash flows.	Investment analysis spread sheet and appropriate evidences for benchmark calculation and all relevant input parameters in accordance with *Guidelines on the assessment of investment analysis* (version 05). 1. The Return on Equity will be based on the default value as provided in the latest version of the *Guidelines on the assessment of investment analysis* for Group 1 projects in South Africa (i.e. 10.9%). 2. Standard market commercial lending rates for wind power plants will be used in order to determine the cost of debt. This will be evidenced by applicable lending term sheets, confirmation from experienced third party or publicly available rates issued by credible entities e.g. South African Reserve Bank. 3. The inflation will be based on one of the following options: • The inflation forecast of the South African Reserve Bank for the duration of the CPA crediting period • The target inflation of the South African Reserve Bank • The average forecasted inflation rate for South Africa published by the IMF or the World Bank for the next five years after start of the project activity 4. The tax rate used in line with the South African corporate tax legislation, currently being 28%. 5. The relevant debt/equity ratio observed for the wind power plants in South Africa will be applied. This will be based on publicly available data issued by credible entities e.g. NERSA or by written confirmation of a experienced third party,
Step 2: CPAs will apply one of the following two financial indicators based on parameters which are standard in the market at the time of investment decision of the SSC-CPA: • Pre-tax Project IRR, based on nominal cash-flows • Post-tax equity IRR, based on nominal cash-flows The WACC will be the benchmark for the Project IRR and the Return on Equity will be the benchmark for the Equity IRR in accordance with paragraph 12 of *Guidelines on the assessment of*	Investment analysis spread sheet and appropriate credible evidences for IRR calculation and all input parameter in accordance with *Guidelines on the assessment of investment analysis* (version 05). Credible evidences for the input parameter are: • Documentation that has been prepared by an experienced third party • Documentation that has been approved or issued by South African governmental authorities • Documentation that has been submitted to or received from financing institutions like banks

investment analysis (version 05). The calculation of the financial indicator will be carried out in accordance with all provisions outlined in the *Guidelines on the assessment of investment analysis* (version 05).	and equity providers • Documentation submitted for official purposes such as documents submitted to South African authorities. • Documentation that carries an official signature from the CPA implementing entity, CME or project participant. This is only applicable if the CPA implementing entity can provide evidence that the values used are considered standard in the market.
Step 3: A sensitivity analysis carried out in line with the *Guidelines on the assessment of investment analysis* (version 05) will demonstrate in which scenarios the CPA would pass the benchmark. The sensitivity analysis will show that a deviation of +10% and -10% of the parameters as shown below will not lead to a scenario that the CPA crosses the benchmark: • Electricity generation • Tariff • Investment cost • Operating and maintenance cost Step 4: The sensitivity analysis will also demonstrate in which scenarios the CPA would pass the benchmark and demonstrate the non-likelihood of occurrence of those scenarios.	Investment analysis spread sheet and CPA-DD.
Rationale	
Investment barrier: a financially more viable alternative to the CPA would have led to higher emissions. The investment barrier shall be demonstrated using benchmark analysis in accordance with the provisions of the *Non-binding best practice examples to demonstrate additionality for SSC project activities* (EB35, Annex34) and the *Guidelines on the assessment of investment analysis* (version 05).	

Option B.2 Access-to-capital Barrier (Par 1 (d) "other barriers" of EB 68, Annex 27)	
Criteria	*Means of verification*
The CPA implementing entity has signed a loan agreement/term sheet with a company that also buys the CERs. The loan agreement/term sheet explicitly mentions that it requires the transfer of CERs to the facilitating entity since this shows that the loan was assured due to the benefit of the CDM. or, The CPA implementing entity has received a significant part of the project investment as a pre-payment for expected CERs. **and,**	Loan agreement or Emission Reduction Purchase Agreement (ERPA)

<table>
<tr><td></td><td></td></tr>
<tr><td>The CPA implementing entity has provided information about the ownership of the project which shows that, at the time the of equity investment/loan agreement based on the CERs is made, there is no significant shareholding by multinational companies, state-owned companies or companies listed on the Johannesburg Stock Exchange

and,

The project has provided its financial statements for the most recent year prior to the of equity investment/loan agreement based on the CERs, which shows that raising finance off is difficult, as per its balance sheet.</td><td>Incorporation documents of the entity implementing the SSC-CPA.

and,

Financial statements for the most recent year prior to the investment based on the CERs.</td></tr>
<tr><td colspan="2">Rationale</td></tr>
<tr><td colspan="2">Access-to-capital barrier: the CPA could not access appropriate capital without consideration of the CDM revenues. The access-to-capital shall be demonstrated by referring to guidelines 1 and 6 of the Guidelines for objective demonstration and assessment of barriers (version 01.0), as follows:
3. While demonstrating barriers related to the lack of access to capital, information should include nature of company, organization and its ownership and, financial information. A company that is a subsidiary of a multinational group may have different access to capital, technologies or skilled labour than a local SME company.
4. The project proponent should demonstrate in the PDD that the financing of the project was assured only due to the benefit of the CDM. Therefore, it should be demonstrated that the loan approval (or other significant financing decision(s)) by the lender takes explicitly the CDM registration into account. For the cases where the investment is done by a company which also purchases the CERs and the loan agreement mentions that, there is an objective demonstration that the CDM facilitated the lending.
The rationale behind this demonstration is that CPA implementing entities had raised finance thanks to the expected CERs. This evidence will be supported by demonstrating that without CDM, the project would have had difficulties to raise that finance as there is no multinational company, state-owned company, or company listed in the Johannesburg Stock Exchange with a significant share of the project which would have had facilitated the raising of financing. The financial statements will back it up by, for instance, showing that there is a lack of sufficient assets to work as collateral.</td></tr>
</table>

Option B.3 *Barrier due to prevailing practice*, and Option C *Automatic additionality,* as explained in Part I of this PoA-DD, are not possible for wind energy projects in South Africa. Therefore, they have not being included.

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

The generic CPA will focus on grid-connected renewable electricity generation from wind. The generic CPA 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 CPA (greenfield plant).

CPAs will not include the combination of both renewable and non-renewable components (e.g. a wind/diesel unit).

The emission factor of the grid is 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 described in the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).

Baseline emissions

The baseline emissions for CPAs involving wind power are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year y (t CO_2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2grid,y}$	=	CO_2 emission factor of the grid in year y (t CO_2/MWh)

As per AMS-I.D (version 17):

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

Calculation of $EF_{CO2,grid,y}$

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

The grid emission factor will be calculated for the South African electricity system 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 are not spot markets in the South African grid system
- Although the South African grid is connected to a number of its neighboring countries' grids including Lesotho, Namibia, Swaziland, Botswana and Mozambique, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary.

- Finally, South Africa does not have a layered dispatch system and 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.[21]
- 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 base load 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:

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

$EF_{grid,OM-ave,y}$	=	Average operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year *y* (tCO_2/MWh)
m	=	All grid power units serving the grid in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

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

$EG_{m,y}$ for CDM projects have been estimated based on the existing monitoring reports on the CDM website. Although the monitoring reports are not available for three years, it is considered to be more conservative to include an estimate for the electricity generation for the CDM projects for the calculation of the emission factor (both the operating margin and the build margin) than to assume that there was no electricity generation by the CDM projects for the years during which no data was available. Based on the number of months and the electricity generation reported in the monitoring report, the electricity generated per month was first calculated. This was then multiplied by twelve to get the generation per year.

		Generation Data (*MWh*)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Arnot	Coal	11,987,281	13,227,864	12,194,878
Camden	Coal	6,509,079	7,472,070	7,490,836
Duvha	Coal	21,769,489	22,581,228	20,267,508
Grootvlei	Coal	1,249,556	2,656,230	3,546,952
Hendrina	Coal	12,296,687	12,143,292	11,938,206
Kendal	Coal	23,841,401	23,307,031	25,648,258
Komati	Coal	-	1,016,023	2,060,141
Kriel	Coal	18,156,686	15,906,816	18,204,910
Lethabo	Coal	23,580,232	25,522,698	25,500,366
Majuba	Coal	22,676,924	22,340,081	24,632,585
Matimba	Coal	26,256,068	27,964,141	28,163,040
Matla	Coal	21,863,400	21,954,536	21,504,422
Tutuka	Coal	21,504,122	19,847,894	19,067,501
Acacia	Gas (Jet kerosene)	-	971.00	992.00
Port Rex	Gas (Jet kerosene)	-	322.00	5,507.00
Ankerlig	Gas/Diesel Oil	-	6,303.00	-
Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-

Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,756,730**	**228,828,053**	**232,394,838**

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:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/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:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

$EF_{CO2,m,i,y}$ = Average CO_2 emission factor of fossil fuel type *i* in power unit *m* in year *y* (tCO_2/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	30%	0.84
Port Rex	0.0697	30%	0.84
Ankerlig	0.0726	39.5%	0.66
Gourikwa	0.0726	39.5%	0.66

The default value for open cycle gas turbines that began generation after the year 2000 in Annex 1 in the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) has been used for Ankerlig and Gourikwa whereas the default value for the years before 2000 have been used for Acacia and Port Rex.

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 CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/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 (mm/dd/yy)
1	Bethlehem hydroelectric project	Hydro	11/11/09
2	Durban landfill gas Bisasar Road project	Land Fill Project	03/01/08
3	PetroSA biogas to energy	Waste water	09/01/07
4	Gourikwa	Gas fuel	03/30/07
5	Ankerlig	Gas fuel	03/29/07
6	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006
7	Klipheuwel	Wind	08/01/02
8	Majuba	Coal	04/01/96
9	Kendal	Coal	10/01/88
10	Palmiet	Pumped storage	04/18/88
11	Matimba	Coal	12/04/87
12	Lethabo	Coal	12/22/85
13	Tutuka	Coal	06/01/85
14	Colleywobbles	Hydropower	01/01/85
15	Koeberg	Nuclear	07/21/84
16	Ncora	Hydropower	03/01/83
17	Drakensberg	Pumped storage	06/17/81
18	Duvha	Coal	01/18/80
19	Matla	Coal	09/29/79
20	Second Falls	Hydropower	04/01/79
21	First Falls	Hydropower	02/01/79
22	Vanderkloof	Hydropower	01/01/77
23	Port Rex	Gas fuel	09/30/76
24	Acacia	Gas fuel	05/13/76
25	Kriel	Coal	05/06/76

26	Arnot	Coal	09/21/71
27	Gariep	Hydropower	09/08/71
28	Hendrina	Coal	05/12/70
29	Grootvlei	Coal	06/30/69
30	Camden	Coal	12/21/66
31	Komati	Coal	11/06/61

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 %**	***EGm,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 $SET_{sample\text{-}CDM}$ was calculated.

	Name	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,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	09/01/07	0.028%	23,286
CDM	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006	0.030%	3,744
	Total	***AEG*** $SET_{sample\text{-}CDM}$			***69,736***

AEG $SET_{sample\text{-}CDM}$ 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 ($SET_{sample\text{-}CDM>10years}$) was as follows:

Number	Name	Technology	Year of Commissioning	Cumulative %	*EGm,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	09/01/07	0.0%	23,285.54
	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006	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** $_{SETsample-CDM>10years}$*			***50,350,579***

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

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

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,,y}$	=	Average CO_2 emission factor of fuel type *i* used in power plant *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	The power *units* included in the build margin
y	=	The relevant year as per the data vintage chosen in Step 5

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

Name	*Technology*	***EFCO₂,m,i,y (tCO_2/GJ)***	***ηm,y***	***EFEL,m,y***
Gourikwa	Gas fuel	0.0726	39.5%	0.66
Ankerlig	Gas fuel	0.0726	39.5%	0.66

Klipheuwel	Wind	0.0000	-	-
Bethlehem hydroelectric project	Hydro	0.0000	-	-
Durban landfill gas Bisasar Road project	Land fill	0.0000	-	-
PetroSA biogas to energy	Waste water	0.0000	-	-
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	0.0000	-	-
Majuba	Coal	0.0895	35.5%	0.91
Kendal	Coal	0.0895	35.5%	0.91
	AEG SETsample-CDM>10years			

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

Name	***Technology***	***EFel,m,y (tCO_2/MWh)***	***EGm,y (MWh/y)***
Gourikwa	Gas fuel	0.66	-
Ankerlig	Gas fuel	0.66	-
Klipheuwel	Wind	-	2,000.00
Bethlehem hydroelectric project	Hydro	-	8983
Durban landfill gas Bisasar Road project	Land fill	-	31723
PetroSA biogas to energy	Waste water	-	23286
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	-	3744
Majuba	Coal	0.91	24,632,585
Kendal	Coal	0.91	25,648,258
Total	***AEG SETsample-CDM>10years***		***50,350,579***

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

Step 6: Calculate the Combined Margin

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

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 CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,CM,y}$	=	Operating margin CO_2 emission factor in year y (tCO2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

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

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

$$EF_{grid,CM,y} = EF_{CO2,grid,y}$$

Project emissions

For most renewable energy projects, such as wind energy project activities, $PE_y = 0$. As per the provisions in AMS-I.D (version 17), project emissions will be considered following the procedures described in ACM0002 (version 13.0.0) using **equation (1)**:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year y (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year y (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year y (tCO_2e/yr)

Project emissions from fossil fuel consumption ($PE_{FF,y}$)

This CPA involves wind power plants, which does not comprise fossil fuel consumption.. Therefore there are no emissions from consumption of fossil fuels.

Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$)

This CPA involves wind power plants, not geothermal power plants. Therefore there are no emissions of non-condensable gases from the operation of geothermal power plants.

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

This CPA involves wind power plants, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

This CPA, which involves a wind power project, has project emissions (PE_y) considered 0.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2/y)
BE_y	=	Baseline Emissions in year *y* (t CO_2/y)
PE_y	=	Project emissions in year *y* (t CO_2/y)
LE_y	=	Leakage emission in year *y* (t CO_2/y)

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

SPECIFIC PARAMETERS FOR GRID EMISSION FACTOR CALCULATIONS

Data / Parameter	**$NCV_{i,y}$**
Unit	GJ/kg
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	<table><tr><th>Fuel Type</th><th>NCV (GJ/kg)</th></tr><tr><td>Coal (other bituminous coal)</td><td>0.0199</td></tr><tr><td>Gas/Jet kerosene</td><td>0.042</td></tr><tr><td>Gas/Diesel Oil</td><td>0.0414</td></tr></table>
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also 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 (*ex ante* option) BM: For the first crediting period, once *ex ante*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

Data / Parameter	**$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$**
Unit	tCO_2/GJ
Description	CO_2 emission factor 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 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	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	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 (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

Fuel Type	EFCO$_2$ (tCO_2/GJ)
Coal (other bituminous coal)	0.0895
Gas/Jet kerosene	0.0697
Gas/Diesel Oil	0.0726

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

Type of turbine	**Efficiency**
Open cycle gas turbines built before and in 2000	30%
Open cycle gas turbines built after 2000	39.5%
(FBS) coal generation technology for units built before and in 2000	35.5%

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

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

B.6.3. Ex-ante calculations of emission reductions

Baseline emissions

The baseline emissions for CPAs involving wind power are to be calculated as follows:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

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

Calculation of $EG_{facility,y}$

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

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for wind power SSC-CPAs:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	0.9063	tCO_2/MWh	GEF calculations
w_{BM}	0.25		Default value
$EF_{grid,OM-DD,y}$	0.9585	tCO_2/MWh	GEF calculations
w_{OM}	0.75		Default value
$EF_{grid,CM,y}$	0.9454	tCO_2/MWh	GEF calculations

Therefore:

For CPAs involving wind power, $EF_{CO2,grid,y}$ = 0.9454 tCO_2/MWh

For CPAs involving wind power. BE_y = [Insert] * 0.9454 = [Insert] tCO_2/year

Project emissions

For CPAs involving wind power, project emissions (PE_y) are considered 0.

$PE_y = 0$

Leakage emissions

The CPA does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Therefore, emission reductions equal:

For CPAs including wind power: [insert value of BE_y] - 0 - 0 = [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

GENERAL PARAMETERS

<table>
<tr><td>Data / Parameter</td><td>$EG_{facility,y}$</td></tr>
<tr><td>Unit</td><td>MWh/yr</td></tr>
<tr><td>Description</td><td>Quantity of net electricity generation supplied by the project plant/unit to the grid in year y</td></tr>
<tr><td>Source of data</td><td>Electricity meter(s)</td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Measurement methods and procedures</td><td>The following parameters shall be measured:
(i) The quantity of electricity supplied by the project plant/unit to the grid; and
(ii) The quantity of electricity delivered to the project plant/unit from the grid

Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards and the Code of practice of electricity metering SANS 474:2009/NRS 057:2009.

The electricity supplied to the grid and delivered to the project plant/unit from the grid will be measured continuously (hourly measurement and at least monthly recording) by a main (facility metering installation) and a back-up meter (system metering installation). The facility meter is installed at the Delivery Point with the electricity grid as agreed with the national transmission company (NTC) or distributor, as applicable. The system meter will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.</td></tr>
<tr><td>Monitoring frequency</td><td>The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with PPA and SANS 474:2009/NRS 057:2009.</td></tr>
<tr><td>QA/QC procedures</td><td>Cross-check measurements results with records of sold electricity.

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

<table>
<tr><th>Size of project</th><th>Accuracy Class</th><th>Interval for period calibration (years)</th></tr>
<tr><td>10 MVA to < 100 MVA</td><td>0.5S</td><td>5</td></tr>
<tr><td>1 MVA to < 10 MVA</td><td>1</td><td>10</td></tr>
</table>
</td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

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

Overall authority and responsibility for monitoring will rest with the CME, which will also be responsible for managing the emission reduction monitoring and verification process.

In order to enable verification of emission reductions the CPA must maintain credible, transparent and adequate data measurement, collection, estimation and tracking systems. The following monitoring procedures and responsibilities will apply.

CPA implementing entity

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

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

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPAs monitoring responsibilities as described above.

The following parameters will be monitored:

Parameter	Description	Type of CPA
$EG_{facility,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All

CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid as a result of the implementation of the CDM CPA in year y ($EG_{facility,y}$). CPA implementing entity will be responsible for preparing invoices for the sales of electricity to the national transmission company (NTC) or the distribution company, as applicable. The quantity of electricity supplied to the grid will be reported to the CME on a quarterly basis for the previous three months and will be accompanied by supporting evidence for cross-checking purposes. CPA implementing entity will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

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

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

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

The national transmission company (NTC) or the distribution company, as applicable, will be responsible for the System Metering Installation (back up meter) procurement, installation, testing, commissioning and its operation and maintenance. This meter cannot be accessed by the CPA implementing entity and

the NTC or distributor only uses it for comparison purposes against the data provide by the CPA entity's Facility Metering Installation.

The Facility Metering Installation will be installed at the Delivery Point, which defines the commercial boundary between the licensee and the customer. The System Metering Installation will be also installed at the Delivery Point at the NTC or distributor side, as applicable.
The Facility Metering Installation readings will be crosschecked with the copies of invoices sent by the CPA implementing entity to the NTC or distributor, and the proof of payment of those invoices. If there is a difference between the values, the most conservative value will be used.

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

Table 9. Metering accuracy and calibration frequency

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

Emergency procedure: In case there is disagreement between the NTC and the CPA implementing entity with regard to the meter readings because the readings of the Facility Metering Installation and the System Metering Installation are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 9 above then the Facility Metering Installation and the System Metering Installation shall both be tested. Should the Facility Metering Installation be found to have a level of inaccuracy beyond the tolerance as described above, then the Facility Metering Installation shall be recalibrated and the electricity output will be based on the readings registered by the System Metering Installation from the date of the last previous test of the Facility Metering Installation.

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

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

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

Carbon Africa - Coordinating/managing entity

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

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

The CME will carry out a quality control on the data received as described below and store them in the

electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

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

The database contains the following information:

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

Training

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

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

PART II. Generic component project activity (CPA)

CPA TYPE: Solar PV power plants

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

The small-scale component project activity (SSC-CPA), which will be implemented under the Small Scale Renewable Energy Carbon Programme (SRECP) is a grid-connected solar PV project.

The generic SSC-CPA comprises the implementation and operation solar PV power plant implemented at a site where no renewable power plant was operated prior to the implementation of the CPA.

CPAs will not include the combination of both renewable and non-renewable components (e.g. a solar PV/diesel unit).

The CPA will generate electricity, which will be fed into to South Africa's national electricity grid or be supplied to an identified consumer facility via national grid through a contractual arrangement such as

wheeling. By replacing fossil-fuel based electricity, the CPA will lead to emission reductions.

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

SSC-CPAs included in the PoA will apply approved baseline and monitoring methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17).

AMS-I.D. (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

CPAs included under this PoA will not apply the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02),* since no on-site fossil fuel consumption will take place.

B.2. Application of methodology(ies)

The CPA qualifies as small-scale Type I component project activity because the maximum output capacity achieved by individual SSC-CPAs will not exceed 15MW in each year of the crediting period. The CPA falls under category AMS-I.D. *Grid connected renewable electricity generation* (version 17) because the CPA meets the applicability criteria as follows:

Applicability criteria	**Generic CPA justification**
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	The generic SSC-CPA under the programme will use grid-connected solar PV power generation that will supply electricity to a national grid, or to an identified consumer facility via national grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) 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); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (greenfield plant).
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an	Not applicable. This CPA includes solar PV energy projects, not hydro power plants.

existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	
If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	Not applicable. The programme of activities will not use both, renewable and non-renewable components.
Combined heat and power (co-generation) systems are not eligible under this category.	Not applicable. The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable. The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable. The programme of activities does not include retrofits or replacements.

The following conditions apply for use of this methodology in a project activity under a programme of activities:

In the specific case of biomass project activities the applicability of the methodology is limited to either project activities that use biomass residues only or biomass from dedicated plantations complying with the applicability conditions of AM0042.	Not applicable. This programme of activities does not involve CPAs including biomass.
In the specific case of biomass project activities the determination of leakage shall be done following the general guidance for leakage in small-scale biomass project activities (attachment C of Appendix B16 of simplified modalities and procedures for small-scale clean	Not applicable. This programme of activities does involve CPAs including biomass.

development mechanism project activities; decision 4/CMP.1) or following the procedures included in the leakage section of AM0042.	
In case the project activity involves the replacement of equipment, and the leakage from the use of the replaced equipment in another activity is neglected because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.	Not applicable. This programme of activities does involve the replacement of equipment.

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).	This tool is applicable since the generic CPA involves the generation of electricity from solar and and its supply to the South African grid system.
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

According to the approved SSC-methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to."

The project power plant and all power plants physically connected to the South African national grid system constitute the project boundary for this project.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the tables below. The figures below provide flow charts of the equipment and systems, emissions sources and gases included in the project boundary as well as the monitoring variables in the project boundary of the different CPAs eligible under this PoA.

Solar PV CPA

Source		Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
		CH_4	No	Minor emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
		N_2O	No	Minor emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
Project Activity	CO_2 emissions from combustion of fossil fuels for electricity generation in the case of a combination of non-renewable and Solar PV units/plants.	CO_2	No	No on-site fossil fuel consumption will take place. Therefore no emissions as per AMS-I.D and the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*
		CH_4	No	
		N_2O	No	
	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Geothermal power plants are not included in this PoA and the CPA is a solar PV
		CH_4	No	
		N_2O	No	
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Geothermal power plants are not included in this PoA and the CPA is a solar PV
		CH_4	No	
		N_2O	No	
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	No emissions since the CPA is a solar PV project
		CH_4	No	No emissions since the CPA is a solar PV project
		N_2O	No	No emissions since the CPA is a solar PV project

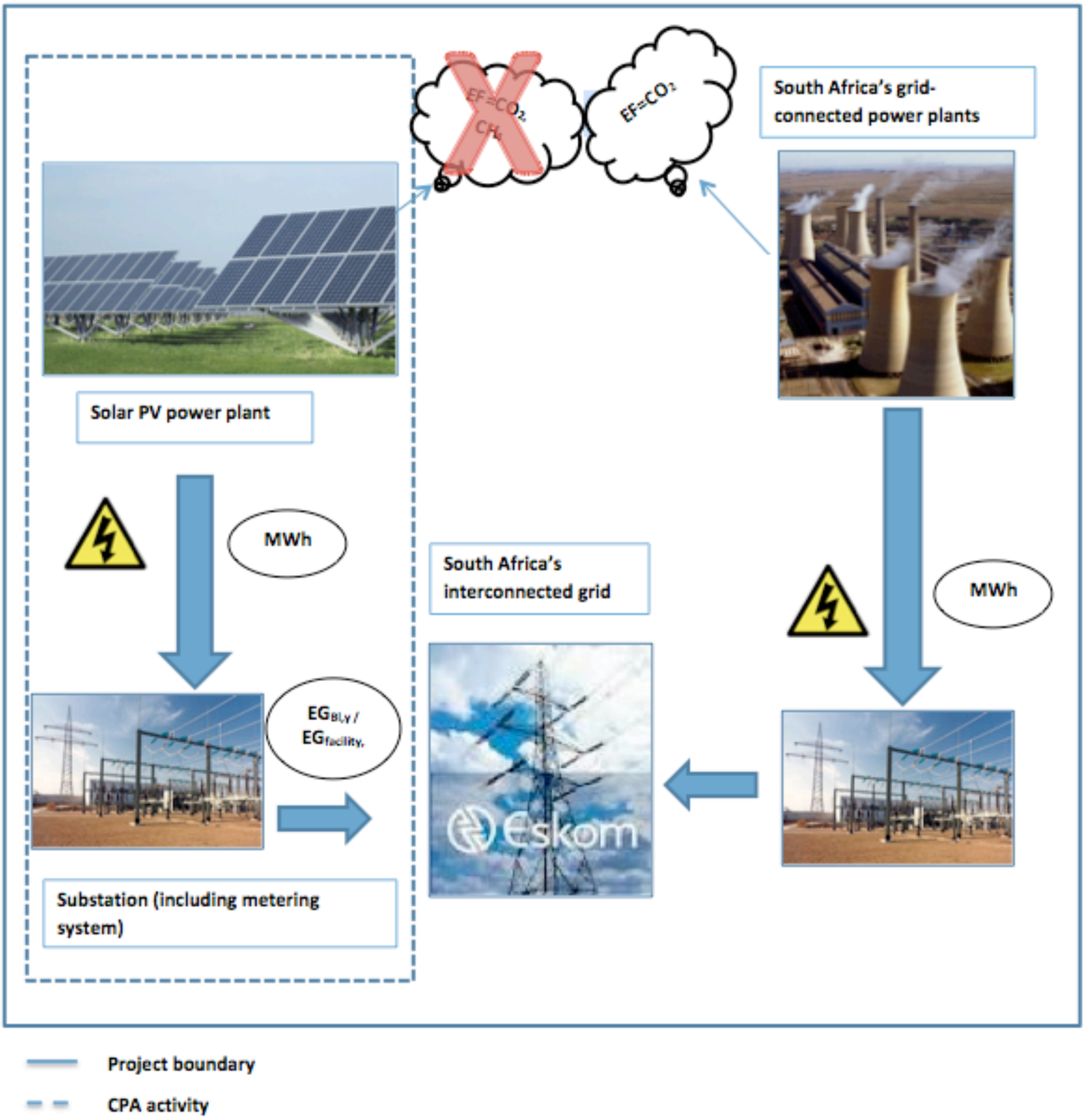

Figure 17: Solar PV CPA

A detailed project description can be found for each CPA in the CPA-DD, section A.5.

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), the baseline scenario 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 into the grid".

The South African baseline scenario is described as follows:

<u>Structure of the South African power sector</u>

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)*[22].

Specifically for the electricity sector of South Africa, the *Electricity Regulation Act of 2006 (No. 4 of 2006)*[23] determines the framework of the electricity sector. In May 2011, the Department of Energy, acting as the legislative entity, amended the *Electricity Regulations on New Generation Capacity*[24] under the *Electricity Regulation Act of 2006.* According to the new the current regulation, 70% of the new generation capacity must be implemented by the state-owned utility company Eskom, and 30% by Independent Power Producers (IPPs).[25] 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 *Electricity Regulation on New Generation Capacity* replaced the former *Renewable Energy Feed-in Tariff (REFIT)*[26]*,* which came into force on the 26 of March 2009.

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"*[27] 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.

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[22] Department of Energy (2008), National Energy Act of 2oo8 http://www.info.gov.za/view/DownloadFileAction?id=92826, accessed on 30.12.2011
[23] Department of Energy (2006), Electricity Regulation Act of 2006, http://www.info.gov.za/view/DownloadFileAction?id=67855, accessed on 30.12.2011
[24] Department of Energy (2011), Electricity Regulations on New Generation Capacity, http://www.sapvia.co.za/electricity-regulations-on-new-generation-capacity-4-may-2011/, accessed on 30.12.2011
[25] Department of Energy, http://www.energy.gov.za/files/electricity_frame.html, accessed on 30.12.2011
[26] NERSA (2009), South Africa Renewable Energy Feed-in Tariff (REFIT), http://www.info.gov.za/view/DownloadFileAction?id=99318 , accessed on 30.12.2011
[27] 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

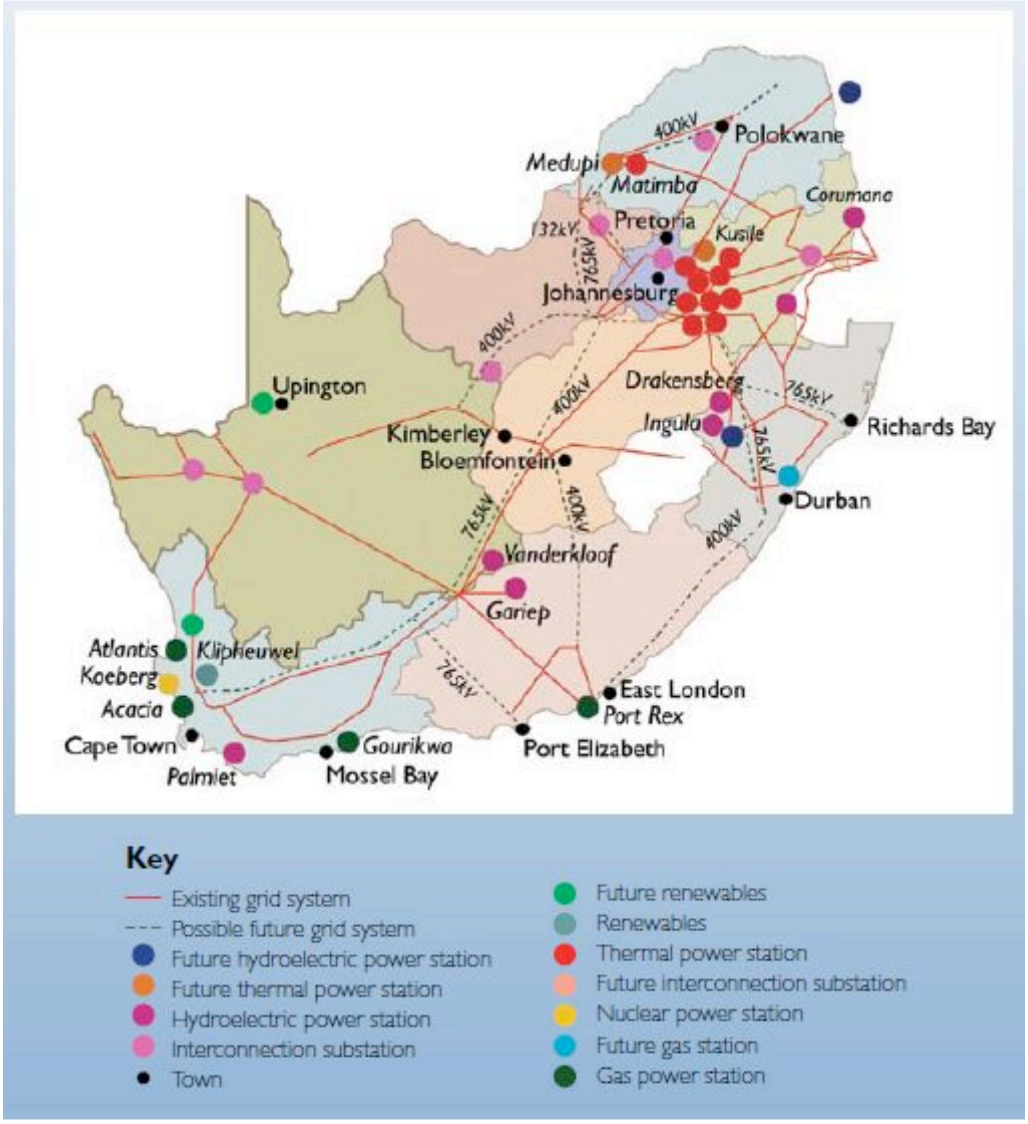

Figure 18. South African Power Sector

Generation

Electricity generation in South Africa is dominated by Eskom, which owns 93% of the installed capacity of 47,463 MW 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.[28]

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.[29] The latest published data for IPPs and municipal generation is from 2006[30].

[28] 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
[30] 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 10. 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
PSHSPP	1,400	1,400
Wind	3	3
Total	**44,145**	**41,294**

Table 11. Municipalities electricity generation capacity

Installed municipal capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,323	240
Gas	334	122
Hydro	4	-
PSHSPP	189	174
Total	**1,850**	**536**

Table 12. 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	7
Wind	5.2	5.2
Waste Water / Biogas	4.25	4.25
Landfill	5	5
Total	**1,468**	**1,020**

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 addtion, at the start of validation of this project, there were no solar PV power plants connected the South African grid.

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 that pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas etc. are negligible.

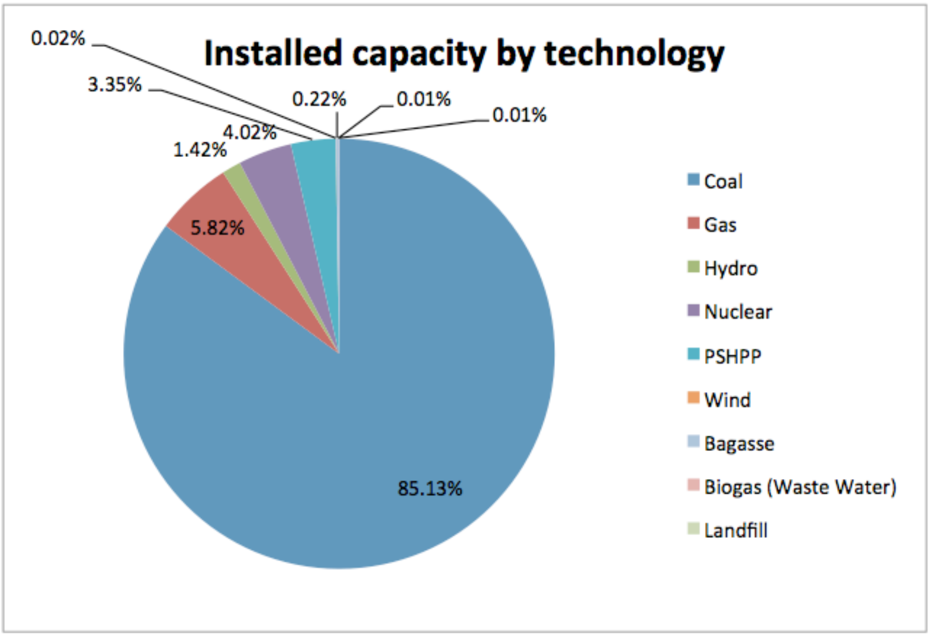

Figure 19: Installed capacity by technology

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: [31]

Table 13. 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 for Electricity 2010-2030* forecasts increasing imports of electricity generated from hydro power plants located in Zambia and Mozambique from 2022 on towards. However, *Integrated Resource Plan*

[31] 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

for Electricity 2010-2030 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.

The *Integrated Resource Plan for Electricity 2010-2030* also forecasts the continuation of the current power shortage until the year 2016 when newly installed power plants in line with *Integrated Resource Plan for Electricity 2010-2030* 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).[32] 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: [33]

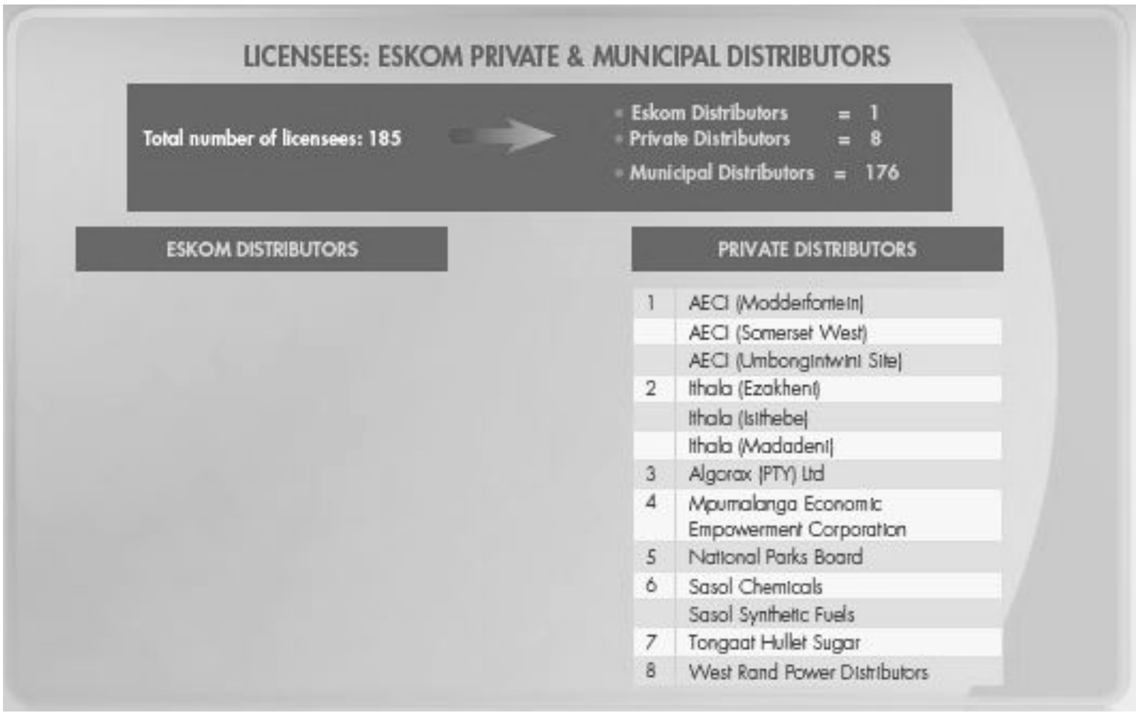

Figure 20. Distribution licenses

The government's policy on the Electricity Distribution Industry (EDI) requires the transmission of electricity to be separated from Eskom and merged with the electricity departments of municipalities to form a number of financially viable regional electricity distributors (REDs)[34]. An interim body, called

[32] ESKOM (2011), Integrated Report 2011, http://financialresults.co.za/2011/eskom_ar2011/index.php, accessed on 30.12.2011
[33] 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
[34] Department of Energy, http://www.energy.gov.za/files/electricity_frame.html, accessed on 30.12.2011

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 December 2010 by the government[35]. 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 for Electricity 2010-2030*, the *"Transmission Ten-Year Development Plan 2012-2021"*[36] published by the Transmission Division of Eskom determines the required additional transmission capacity as follows:

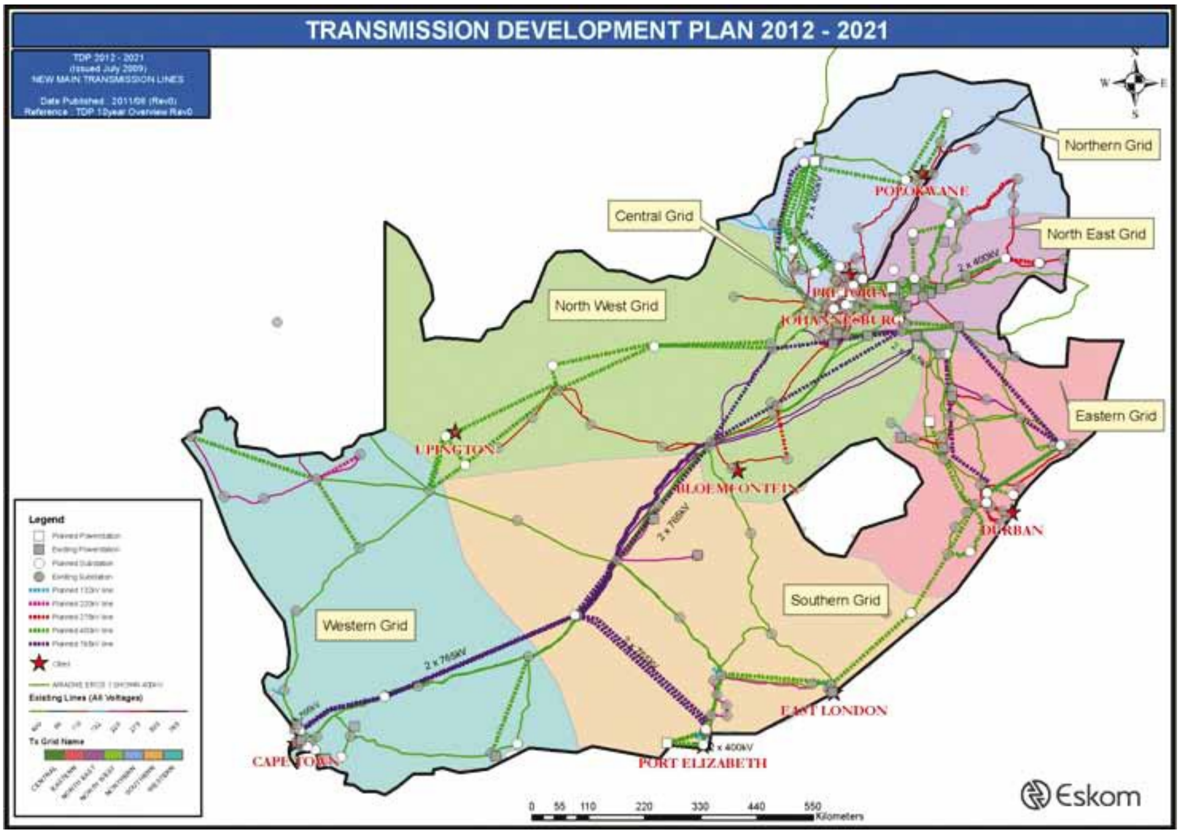

Figure 21. Transmission Development Plan 2012-2021

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

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

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

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

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

Figure 22. New grid assets 2022

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Documentary evidence
1)	Geographical boundary (a)	The geographical boundary of the SSC-CPA including any time-induced boundary is consistent with the geographical boundary set in section A.5 of the PoA-DD.	The geographical boundary of the CPA is consistent with the geographical boundary set in in section A.5 of the PoA DD since it is located in South Africa. EIA report, feasibility study or project description
2)	Double counting (b)	The SSC-CPA has not yet been included in another programme of activities or has not yet been registered as a single CDM project activity.	Agreement between CME and CPA where the CPA legally confirms its unique adhesion to this PoA as CDM component project activity; and evidence that the CME has cross-checked the information available on the UNFCCC website on the non existence of similar CDM project activities/component project activity, as described in the management system, section C. For the purpose of identification, each CPA will have a unique name, which will at least refer to the location of the CPA and the installed capacity of the

			project. The CME will also confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type as described in the management system, section C.
3)	Technology (c)	The SSC-CPA involves the implementation of a grid-connected renewable energy technology including solar PV, wind and hydro (run-of-river or with water accumulation reservoirs), which will only supply electricity to the national grid. SSC-CPAs involving the use of renewable biomass, geothermal, solar thermal and tidal/wave technologies for generating electricity are excluded from this programme of activities.	Feasibility study/technical description, PPA and/or EIA report by certified EIA specialist. .
		In terms of compliance with testing/certification, the project will comply with the relevant standards as referred to in the Request for Qualification and Proposals for New Generation Capacity under the IPP Procurement Programme or other relevant policy guideline. In the current IPP Procurement Programme guidelines, no specific certification is required for hydro projects	Certificate or evidence for the certification provided by the technology supplier. If at the time of the inclusion of the CPA the relevant certificate is not yet available, the CPA will have signed an agreement with the CME that it will make available the relevant certificate before the start of construction.
		CPAs will also not include the combination of both renewable and non-renewable components (e.g. a wind/diesel unit).	Feasibility study/technical description, and/or EIA report by certified EIA specialist. In case the above mentioned documentation does not specify explicitly the non-deployment of non-renewable components, a confirmation letter that the CPA will not involve the use of non-renewable components and or on site fossil fuel consumption will be provided by the CPA implementing entity.
		Thereby the proposed SSC-CPA is the installation of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant).	Feasibility study/technical description, and/or EIA report by certified EIA specialist. In case the mentioned documentation does not clarify sufficiently that there was no renewable power plant operated at the project site

			before, a confirmation letter that no renewable power plant has been operated at the project site so far will be provided by the CPA implementing entity.
		CPAs will not involve energy generating equipment that is transferred from another activity	Feasibility study/technical description, and/or EIA report by certified EIA specialist . In case the above mentioned documentation does not specify explicitly the non-deployment of generating equipment transferred from another activity, a confirmation letter that the CPA will not involve the use of generating equipment transferred from another activity will be provided by the CPA implementing entity.
		If the proposed SSC-CPA is a hydropower plant: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; or • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2; or • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	Not applicable. The proposed CPA is a solar PV energy project.
4)	Start date (d)	The start of the SSC-CPA occurs is not, or will not be prior 12/06/2012 which is the commencement of the validation of the proposed CDM PoA, i.e. the date on which the PoA-DD is first published for global stakeholder consultation The start date will be defined as the earliest date on which a contract has been signed for equipment, construction or operation services	Contract with party providing equipment/construction/operation services.

		required for the CPA. If the none of contracts for the equipment, construction or operation services required for the CPA are available at the time of inclusion of the CPA, the CPA start date will automatically be after 12/06/2012 since the start date of the CPA could not have taken place before.	
5)	Applicability of methodology (e)	The SSC-CPA meets all the applicability criteria of version 17 of AMS I.D Grid connected renewable electricity generation as per section B.2, part II of the PoA-DD.	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D Grid connected renewable electricity generation is explained in section D.2 of the specific CPA-DD.
6)	Additionality (f)	The SSC-CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below (Additionality related eligibility criteria).	Additionality check carried out in D.5 of each CPA-DD in line with additionality-related eligibility criteria.
7)	Stakeholder consultation and EIA (g)	(a) The SSC-CPA has carried out a local stakeholder consultation. (b) The SSC-CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations	a) Evidence that a local stakeholder consultation was carried out. These evidences may include a summary of concerns raised and clarification provided and other information such as attendance sheet, invitations and photographs. (b) Environmental Impact Assessment (EIA) report and/or EIA license.
8)	ODA (h)	The SSC-CPA has not received funding from Annex I parties that results in a diversion of official development assistance	In case no ODA is involved, confirmation letter from CPA implementing entity that the CPA has not received funding from Annex I parties. In case ODA is involved, confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
9)	Target group (g)	The SSC-CPA supplies electricity to the South African national grid or supplies electricity to an identified consumer facility via the national grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation proving that the CPA supplies electricity to a national grid; or supplies electricity to an identified consumer facility via national grid through a contractual arrangement such as wheeling.
10)	Installed capacity limits (k)	The installed capacity of the SSC-CPA is smaller than or equal to 15 MW. However, if a CPA is applying the additionality Option A for microscale project activities, the	Feasibility study/technical description

		installed capacity of the SSC-CPA will be smaller than or equal to 5 MW.	
11)	Debundling (l)	The SSC-CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the Guidelines on assessment of debundling for SSC project activities (version 03).	Debundling check carried out in line with the latest approved version of the Guidelines on assessment of debundling for SSC project activities (version 03).

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

In case the CPA is microscale, the following criteria apply:

Option A: Microscale additionality	
Criteria	*Means of verification*
Installed capacity of the SSC-CPA is smaller than or equal to 5 MW	Feasibility study or other relevant project documentation.
The geographic location of the CPA is in a special underdeveloped zone (SUZ) of the host country, South Africa. or The CPA employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	Geographical coordinates of the CPA South African government official notification delineating special underdeveloped zones (SUZs) for development assistance including planning, management, and investment satisfying the following condition: - The portion of the population with income less than USD 2 per day (PPP) in the region is greater than 50% Or, those areas have been approved by the Executive Board of the CDM based on recommendations or Documentation from the CDM Executive Board recognizing the specific renewable energy technology used by the SSC-CPA.
Rationale	
In case the SSC-CPA is a microscale CPA, i.e. CPAs up to five megawatts that employ renewable energy technology, additionality will be demonstrated using the *Guidelines for demonstrating additionality of microscale project activities* (version 04.0). SSC-CPAs under the PoA follow the methodology AMS-I.D, therefore eligible SSC-CPAs will have to follow paragraph 2 (a) or paragraph 2 (d) of the guidelines as they are grid-connected renewable energy technologies, in order to demonstrate microscale additionality.	

In case the SSC-CPA is not a microscale CPA, additionality will be demonstrated using *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) and the *Non binding best practice examples to demonstrate additionality for SSC project activities* (version 01).

Option B.1 Investment Barrier (Paragraph 1 (a) of EB 68, Annex 27)	
Criteria	*Means of verification*
Without the CDM revenue of the SSC-CPA, a financially more viable alternative to the CPA	Investment analysis spread sheet and appropriate evidences for benchmark calculation and all

would have led to higher emissions. In order to evidences that SSC-CPA is less financially attractive than the baseline scenario, a benchmark analysis will show that the CPA financial indicator is less favourable than the benchmark applied. Therefore, the following steps will be taken in line with paragraph 12 of the *Guidelines on the assessment of investment analysis* (version 05): Step 1: CPAs will apply one of the following two benchmark indicators based on parameters which are standard in the market at the time of investment decision of the SSC-CPA: • Pre-tax nominal Weighted Average Cost of Capital (WACC) • Post-tax nominal Return on Equity The pre-tax, nominal Weighted Average Cost of Capital is an appropriate benchmark because it circumvents the impact of loan interest on income tax calculations (see also paragraph 11 in the *Guidelines on the assessment of investment analysis* (version 05). The post-tax nominal Return on Equity is considered an appropriate benchmark because equity investors and shareholders are mostly interested in after tax cash flows.	relevant input parameters in accordance with *Guidelines on the assessment of investment analysis* (version 05). 1. The Return on Equity will be based on the default value as provided in the latest version of the *Guidelines on the assessment of investment analysis* for Group 1 projects in South Africa (i.e. 10.9%). 2. Standard market commercial lending rates for solar PV power plants will be used in order to determine the cost of debt. This will be evidenced by applicable lending term sheets, confirmation from experienced third party or publicly available rates issued by credible entities e.g. South African Reserve Bank. 3. The inflation will be based on one of the following options: • The inflation forecast of the South African Reserve Bank for the duration of the CPA crediting period • The target inflation of the South African Reserve Bank • The average forecasted inflation rate for South Africa published by the IMF or the World Bank for the next five years after start of the project activity 4. The tax rate used in line with the South African corporate tax legislation, currently being 28%. 5. The relevant debt/equity ratio observed for the solar PV power plants in South Africa will be applied. This will be based on publicly available data issued by credible entities e.g. NERSA or by written confirmation of a experienced third party,
Step 2: CPAs will apply one of the following two financial indicators based on parameters which are standard in the market at the time of investment decision of the SSC-CPA: • Pre-tax Project IRR, based on nominal cash-flows • Post-tax equity IRR, based on nominal cash-flows The WACC will be the benchmark for the Project IRR and the Return on Equity will be the benchmark for the Equity IRR in accordance with paragraph 12 of *Guidelines on the assessment of investment analysis* (version 05).	Investment analysis spread sheet and appropriate credible evidences for IRR calculation and all input parameter in accordance with *Guidelines on the assessment of investment analysis* (version 05). Credible evidences for the input parameter are: • Documentation that has been prepared by an experienced third party • Documentation that has been approved or issued by South African governmental authorities • Documentation that has been submitted to or received from financing institutions like banks and equity providers • Documentation submitted for official purposes

The calculation of the financial indicator will be carried out in accordance with all provisions outlined in the *Guidelines on the assessment of investment analysis* (version 05).	such as documents submitted to South African authorities. • Documentation that carries an official signature from the CPA implementing entity, CME or project participant. This is only applicable if the CPA implementing entity can provide evidence that the values used are considered standard in the market.
Step 3: A sensitivity analysis carried out in line with the *Guidelines on the assessment of investment analysis* (version 05) will demonstrate in which scenarios the CPA would pass the benchmark. The sensitivity analysis will show that a deviation of +10% and -10% of the parameters as shown below will not lead to a scenario that the CPA crosses the benchmark: • Electricity generation • Tariff • Investment cost • Operating and maintenance cost Step 4: The sensitivity analysis will also demonstrate in which scenarios the CPA would pass the benchmark and demonstrate the non-likelihood of occurrence of those scenarios.	Investment analysis spread sheet and CPA-DD.
Rationale	
Investment barrier: a financially more viable alternative to the CPA would have led to higher emissions. The investment barrier shall be demonstrated using benchmark analysis in accordance with the provisions of the *Non-binding best practice examples to demonstrate additionality for SSC project activities* (EB35, Annex34) and the *Guidelines on the assessment of investment analysis* (version 05).	

Option B.2 Access-to-capital Barrier (Par 1 (d) "other barriers" of EB 68, Annex 27)	
Criteria	*Means of verification*
The CPA implementing entity has signed a loan agreement/term sheet with a company that also buys the CERs. The loan agreement/term sheet explicitly mentions that it requires the transfer of CERs to the facilitating entity since this shows that the loan was assured due to the benefit of the CDM. or, The CPA implementing entity has received a significant part of the project investment as a pre-payment for expected CERs. **and,**	Loan agreement or Emission Reduction Purchase Agreement (ERPA)
The CPA implementing entity has provided	Incorporation documents of the entity

information about the ownership of the project which shows that, at the time the of equity investment/loan agreement based on the CERs is made, there is no significant shareholding by multinational companies, state-owned companies or companies listed on the Johannesburg Stock Exchange and, The project has provided its financial statements for the most recent year prior to the of equity investment/loan agreement based on the CERs, which shows that raising finance off is difficult, as per its balance sheet.	implementing the SSC-CPA. and, Financial statements for the most recent year prior to the investment based on the CERs.
Rationale	
Access-to-capital barrier: the CPA could not access appropriate capital without consideration of the CDM revenues. The access-to-capital shall be demonstrated by referring to guidelines 1 and 6 of the *Guidelines for objective demonstration and assessment of barriers* (version 01.0), as follows: 5. While demonstrating barriers related to the lack of access to capital, information should include nature of company, organization and its ownership and, financial information. A company that is a subsidiary of a multinational group may have different access to capital, technologies or skilled labour than a local SME company. 6. The project proponent should demonstrate in the PDD that the financing of the project was assured only due to the benefit of the CDM. Therefore, it should be demonstrated that the loan approval (or other significant financing decision(s)) by the lender takes explicitly the CDM registration into account. For the cases where the investment is done by a company which also purchases the CERs and the loan agreement mentions that, there is an objective demonstration that the CDM facilitated the lending. The rationale behind this demonstration is that CPA implementing entities had raised finance thanks to the expected CERs. This evidence will be supported by demonstrating that without CDM, the project would have had difficulties to raise that finance as there is no multinational company, state-owned company, or company listed in the Johannesburg Stock Exchange with a significant share of the project which would have had facilitated the raising of financing. The financial statements will back it up by, for instance, showing that there is a lack of sufficient assets to work as collateral.	

Option B.3 Barrier due to prevailing practice (Paragraph (c) of EB 68, Annex 27)	
Criteria	*Means of verification*
The project is first-of-its kind in the applicable geographical area if: a) The CPA is the first in the applicable geographical area that applies a technology that is different from technologies that are implemented by any other project, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the project design document (CDM-PDD) is published for global stakeholder	Demonstration of first-of-its kind following the approach provided in the *Guidelines on additionality of first-of-its-kind project activities* (version 02.0)[38] by providing evidence that the CPA will apply a measure in accordance with the guidelines as above. This will be evidenced by a Feasibility study/technical description. In addition the CME will confirm that the CPA is the first in South Africa that applies a solar project that is different from other solar projects that are

[38] All definitions of terms e.g. applicable geographical area, measure etc. will be as provided in the Guidelines on additionality of first-of–its-kind project activities version 02.0

consultation or before the start date of the proposed project activity, whichever is earlier; b) The CPA implements a power generation based on renewable energy measure as included in the *Guidelines on additionality of first-of-its-kind project activities* (version 02.0)[37] c) The project participants selected a crediting period for the project activity that is "a maximum of 10 years with no option of renewal".	implemented by any other project developer, which are able to deliver the same output and have started commercial operation in the applicable geographical area before the CPA-DD has been submitted to the DOE for inclusion or before the start date of the proposed CPA, whichever is earlier;
Rationale	
Barrier due to prevailing practice: prevailing practice would have led to implementation of a technology with higher emissions. Best practice examples include but are not limited to, the demonstration that the project is among the first of its kind in terms of technology, geography, sector, type of investment and investor, market etc. The approach as provided in the *Guidelines on additionality of first-of-its-kind project activities* (version 02.0) will be used to demonstrate that the project is among the first of its kind. In case the project proponent applies the Barrier due to prevailing practice argument, the crediting period will be limited to a 10-year crediting period which will be not renewable.	

Option C: Automatic additionality (Paragraph 2 (a) of EB 68 Annex 27)	
Criteria	*Means of verification*
The CPA uses solar PV which is on the positive list of grid-connected renewable electricity generation technologies as specified in *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27).	Project feasibility study or other relevant project documentation
Rationale	
In case the CPA involves a technology, which is on the positive list of grid-connected renewable electricity generation technologies defined in the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) the project will be automatically additional.	

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

The generic CPA will focus on grid-connected renewable electricity generation from solar photovoltaic. The generic CPA 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 CPA (greenfield plant).

CPAs will not include the combination of both renewable and non-renewable components (e.g. a solar PV/diesel unit).

The emission factor of the grid is 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 described in the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).

Baseline emissions

[37] All definitions of terms e.g. applicable geographical area, measure etc. will be as provided in the Guidelines on additionality of first-of–its-kind project activities version 02.0

The baseline emissions for CPAs involving solar PV are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year y (t CO_2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2grid,y}$	=	CO_2 emission factor of the grid in year y (t CO_2/MWh)

As per AMS-I.D (version 17):

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

Calculation of $EF_{CO2,grid,y}$

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

The grid emission factor will be calculated for the South African electricity system 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 are not spot markets in the South African grid system
- Although the South African grid is connected to a number of its neighboring countries' grids including Lesotho, Namibia, Swaziland, Botswana and Mozambique, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary.
- Finally, South Africa does not have a layered dispatch system and 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):

e) Simple OM
f) Simple adjusted OM
g) Dispatch data analysis OM
h) Average OM

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

- Coal used in South African power plants is a cheap resource compared to other technologies e.g. natural gas/kerosene because South Africa is the 6th largest producer of coal in the world with one of the lowest coal prices in the world.[39]
- 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 base load 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 CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)

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

m = All grid power units serving the grid in year *y*

y = The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

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

$EG_{m,y}$ for CDM projects have been estimated based on the existing monitoring reports on the CDM website. Although the monitoring reports are not available for three years, it is considered to be more conservative to include an estimate for the electricity generation for the CDM projects for the calculation of the emission factor (both the operating margin and the build margin) than to assume that there was no electricity generation by the CDM projects for the years during which no data was available. Based on the number of months and the electricity generation reported in the monitoring report, the electricity generated per month was first calculated. This was then multiplied by twelve to get the generation per year.

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

PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,756,730**	**228,828,053**	**232,394,838**

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:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

$FC_{i,m,y}$ = Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/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:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fossil fuel type *i* in power unit *m* in year *y* (tCO_2/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	30%	0.84
Port Rex	0.0697	30%	0.84
Ankerlig	0.0726	39.5%	0.66
Gourikwa	0.0726	39.5%	0.66

The default value for open cycle gas turbines that began generation after the year 2000 in Annex 1 in the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) has been used for Ankerlig and Gourikwa whereas the default value for the years before 2000 have been used for Acacia and Port Rex.

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 CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/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 (mm/dd/yy)
1	Bethlehem hydroelectric project	Hydro	11/11/09
2	Durban landfill gas Bisasar Road project	Land Fill Project	03/01/08
3	PetroSA biogas to energy	Waste water	09/01/07
4	Gourikwa	Gas fuel	03/30/07
5	Ankerlig	Gas fuel	03/29/07
6	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006
7	Klipheuwel	Wind	08/01/02
8	Majuba	Coal	04/01/96
9	Kendal	Coal	10/01/88
10	Palmiet	Pumped storage	04/18/88
11	Matimba	Coal	12/04/87
12	Lethabo	Coal	12/22/85
13	Tutuka	Coal	06/01/85
14	Colleywobbles	Hydropower	01/01/85
15	Koeberg	Nuclear	07/21/84
16	Ncora	Hydropower	03/01/83
17	Drakensberg	Pumped storage	06/17/81
18	Duvha	Coal	01/18/80
19	Matla	Coal	09/29/79
20	Second Falls	Hydropower	04/01/79
21	First Falls	Hydropower	02/01/79
22	Vanderkloof	Hydropower	01/01/77
23	Port Rex	Gas fuel	09/30/76
24	Acacia	Gas fuel	05/13/76
25	Kriel	Coal	05/06/76
26	Arnot	Coal	09/21/71
27	Gariep	Hydropower	09/08/71
28	Hendrina	Coal	05/12/70
29	Grootvlei	Coal	06/30/69

30	Camden	Coal	12/21/66
31	Komati	Coal	11/06/61

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 %**	***EGm,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 $SET_{sample\text{-}CDM}$ was calculated.

	Name	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,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	09/01/07	0.028%	23,286
CDM	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006	0.030%	3,744
	Total	***AEG*** $\boldsymbol{SET_{sample\text{-}CDM}}$			***69,736***

AEG $SET_{sample\text{-}CDM}$ 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 ($SET_{sample\text{-}CDM>10years}$) was as follows:

Number	**Name**	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,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	09/01/07	0.0%	23,285.54
	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006	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** $_{SETsample-CDM>10years}$*			***50,350,579***

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

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

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,,y}$	=	Average CO_2 emission factor of fuel type *i* used in power plant *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	The power *units* included in the build margin
y	=	The relevant year as per the data vintage chosen in Step 5

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

Name	***Technology***	***EFCO₂,m,i,y (tCO₂/GJ)***	***ηm,y***	***EFEL,m,y***
Gourikwa	Gas fuel	0.0726	39.5%	0.66
Ankerlig	Gas fuel	0.0726	39.5%	0.66
Klipheuwel	Wind	0.0000	-	-
Bethlehem hydroelectric project	Hydro	0.0000	-	-
Durban landfill gas Bisasar Road project	Land fill	0.0000	-	-

PetroSA biogas to energy	Waste water	0.0000	-	-
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	0.0000	-	-
Majuba	Coal	0.0895	35.5%	0.91
Kendal	Coal	0.0895	35.5%	0.91
	AEG SETsample-CDM>10years			

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

Name	***Technology***	***EFel,m,y (tCO_2/MWh)***	***EGm,y (MWh/y)***
Gourikwa	Gas fuel	0.66	-
Ankerlig	Gas fuel	0.66	-
Klipheuwel	Wind	-	2,000.00
Bethlehem hydroelectric project	Hydro	-	8983
Durban landfill gas Bisasar Road project	Land fill	-	31723
PetroSA biogas to energy	Waste water	-	23286
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	-	3744
Majuba	Coal	0.91	24,632,585
Kendal	Coal	0.91	25,648,258
Total	***AEG SETsample-CDM>10years***		***50,350,579***

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

Step 6: Calculate the Combined Margin
Option A i.e. the weighted average combined margin is used.

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 CO_2 emission factor in year *y* (tCO_2/MWh)

$EF_{grid,CM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO2/MWh)

w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

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

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

$$EF_{grid,CM,y} = EF_{CO2,grid,y}$$

Project emissions

For most renewable energy projects, such as solar PV energy project activities, PE_y = 0. As per the provisions in AMS-I.D (version 17), project emissions will be considered following the procedures described in ACM0002 (version 13.0.0) using **equation (1):**

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

Project emissions from fossil fuel consumption ($PE_{FF,y}$)

This CPA involves solar PV power plants, which does not comprise fossil fuel consumption. Therefore there are no emissions from consumption of fossil fuels.

Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$)

This CPA involves solar PV power plants, not geothermal power plants. Therefore there are no emissions of non-condensable gases from the operation of geothermal power plants.

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

This CPA involves solar PV power plants, not hydro power plants with water reservoirs. Therefore there are no emissions form hydro power plants.

This CPA, which involves a solar PV power project, has project emissions (PE_y) considered 0.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2/y)
BE_y	=	Baseline Emissions in year *y* (t CO_2/y)
PE_y	=	Project emissions in year *y* (t CO_2/y)
LE_y	=	Leakage emission in year *y* (t CO_2/y)

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

SPECIFIC PARAMETERS FOR GRID EMISSION FACTOR CALCULATIONS

Data / Parameter	$\mathbf{NCV_{i,y}}$
Unit	GJ/kg
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	Fuel Type: NCV (GJ/kg) Coal (other bituminous coal): 0.0199 Gas/Jet kerosene: 0.042 Gas/Diesel Oil: 0.0414
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also 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 (*ex ante* option) BM: For the first crediting period, once *ex ante*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

Data / Parameter	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor 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 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	<table><tr><th>Fuel Type</th><th>$EFCO_2$ (tCO_2/GJ)</th></tr><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></table>
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also 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 (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

Data / Parameter	$\eta_{m,y}$
Unit	-
Description	Average net conversion efficiency of power unit *m* in year *y*
Source of data	Default value for open cycle gas turbines built before and after 2000 and Fluidised Bed System (FBS) coal generation technology for units built before and in 2000 is used as per Annex 1 of the *Tool to calculate the emission factor for an electricity system.*
Value(s) applied	<table><tr><th>Type of turbine</th><th>Efficiency</th></tr><tr><td>Open cycle gas turbines built before and in 2000</td><td>30%</td></tr><tr><td>Open cycle gas turbines built after 2000</td><td>39.5%</td></tr><tr><td>(FBS) coal generation technology for units built before and in 2000</td><td>35.5%</td></tr></table>
Choice of data or Measurement methods and procedures	There is no data published on the efficiency of Eskom's gas power plants, therefore default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

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

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

B.6.3. Ex-ante calculations of emission reductions

Baseline emissions

The baseline emissions for CPAs involving solar PV are to be calculated as follows:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

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

Calculation of $EG_{facility,y}$

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

Calculation of $EF_{CO2,grid,y}$
The combined margin emission factor for the grid is calculated using the following equations:

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for solar PV SSC-CPAs:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	0.9063	tCO_2/MWh	GEF calculations
w_{BM}	0.25		Default value
$EF_{grid,OM-DD,y}$	0.9585	tCO_2/MWh	GEF calculations
w_{OM}	0.75		Default value
$EF_{grid,CM,y}$	0.9454	tCO_2/MWh	GEF calculations

Therefore:

For CPAs involving solar PV $EF_{CO2,grid,y}$ = 0.9454 tCO_2/MWh

For CPAs involving solar PV BE_y = [Insert] * 0.9454 = [Insert] tCO_2/year

Project emissions

For CPAs involving solar PV, project emissions (PE_y) are considered 0.

$PE_y = 0$

Leakage emissions

The CPA does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Therefore, emission reductions equal:

For CPAs including solar PV: [insert value of BE_y] – 0 - 0 = [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

GENERAL PARAMETERS

<table>
<tr><td>Data / Parameter</td><td>$EG_{facility,y}$</td></tr>
<tr><td>Unit</td><td>MWh/yr</td></tr>
<tr><td>Description</td><td>Quantity of net electricity generation supplied by the project plant/unit to the grid in year y</td></tr>
<tr><td>Source of data</td><td>Electricity meter(s)</td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Measurement methods and procedures</td><td>The following parameters shall be measured:
(i) The quantity of electricity supplied by the project plant/unit to the grid; and
(ii) The quantity of electricity delivered to the project plant/unit from the grid

Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards and the Code of practice of electricity metering SANS 474:2009/NRS 057:2009.

The electricity supplied to the grid and delivered to the project plant/unit from the grid will be measured continuously (hourly measurement and at least monthly recording) by a main (facility metering installation) and a back-up meter (system metering installation). The facility meter is installed at the Delivery Point with the electricity grid as agreed with the national transmission company (NTC) or distributor, as applicable. The system meter will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.</td></tr>
<tr><td>Monitoring frequency</td><td>The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with PPA and SANS 474:2009/NRS 057:2009.</td></tr>
<tr><td>QA/QC procedures</td><td>Cross-check measurements results with records of sold electricity.

Calibration of meters will be done according to the appropriate standard and equipment specifications, whichever is more precise. According to standard SANS 474:2009/NRS 057:2009, the accuracy class of the meter and its maximum interval between calibrations are the following:
<table><tr><td>Size of project</td><td>Accuracy Class</td><td>Interval for period calibration (years)</td></tr><tr><td>10 MVA to < 100 MVA</td><td>0.5S</td><td>5</td></tr><tr><td>1 MVA to < 10 MVA</td><td>1</td><td>10</td></tr></table></td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

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

Overall authority and responsibility for monitoring will rest with the CME, which will also be responsible for managing the emission reduction monitoring and verification process.

In order to enable verification of emission reductions the CPA must maintain credible, transparent and adequate data measurement, collection, estimation and tracking systems. The following monitoring procedures and responsibilities will apply.

CPA implementing entity

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

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

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPAs monitoring responsibilities as described above.

The following parameters will be monitored:

Parameter	Description	Type of CPA
$EG_{facility,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All

CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid as a result of the implementation of the CDM CPA in year y ($EG_{facility,y}$). CPA implementing entity will be responsible for preparing invoices for the sales of electricity to the national transmission company (NTC) or the distribution company, as applicable. The quantity of electricity supplied to the grid will be reported to the CME on a quarterly basis for the previous three months and will be accompanied by supporting evidence for cross-checking purposes. CPA implementing entity will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

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

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

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

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

The Facility Metering Installation will be installed at the Delivery Point, which defines the commercial boundary between the licensee and the customer. The System Metering Installation will be also installed at the Delivery Point at the NTC or distributor side, as applicable.
The Facility Metering Installation readings will be crosschecked with the copies of invoices sent by the CPA implementing entity to the NTC or distributor, and the proof of payment of those invoices. If there is a difference between the values, the most conservative value will be used.

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

Table 14. Metering accuracy and calibration frequency

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

Emergency procedure: In case there is disagreement between the NTC and the CPA implementing entity with regard to the meter readings because the readings of the Facility Metering Installation and the System Metering Installation are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 14 above then the Facility Metering Installation and the System Metering Installation shall both be tested. Should the Facility Metering Installation be found to have a level of inaccuracy beyond the tolerance as described above, then the Facility Metering Installation shall be recalibrated and the electricity output will be based on the readings registered by the System Metering Installation from the date of the last previous test of the Facility Metering Installation.

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

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

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

Carbon Africa - Coordinating/managing entity

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

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

- Preparation of monitoring report

The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

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

The database contains the following information:

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

Training

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

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

PART II. Generic component project activity (CPA)

CPA TYPE: Hydro power plant (with accumulation reservoir)

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

The small-scale component project activity (SSC-CPA), which will be implemented under the Small Scale Renewable Energy Carbon Programme (SRECP) is a grid-connected hydro power plant (with accumulation reservoir).

The generic SSC-CPA comprises the implementation and operation of a hydro power plant (with accumulation reservoir) implemented at a site where no renewable power plant was operated prior to the implementation of the CPA.

CPAs will not include the combination of both renewable and non-renewable components (e.g. a hydro/diesel unit).

The CPA will generate electricity, which will be fed into to South Africa's national electricity grid or be supplied to an identified consumer facility via national grid through a contractual arrangement such as wheeling. By replacing fossil-fuel based electricity, the CPA will lead to emission reductions.

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

SSC-CPAs included in the PoA will apply approved baseline and monitoring methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17).

AMS-I.D. (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

CPAs included under this PoA will not apply the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02),* since no on-site fossil fuel consumption will take place.

B.2. Application of methodology(ies)

The CPA qualifies as small-scale Type I component project activity because the maximum output capacity achieved by individual SSC-CPAs will not exceed 15MW in each year of the crediting period. The CPA falls under category AMS-I.D. *Grid connected renewable electricity generation* (version 17) because the CPA meets the applicability criteria as follows:

Applicability criteria	**Generic CPA justification**
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	The generic SSC-CPA under the programme will use grid-connected hydro power plant (with accumulation reservoir) generation that will supply electricity to a national grid, or to an identified consumer facility via national grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) 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); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (greenfield plant).
Hydro power plants with reservoirs that satisfy at least one of the following conditions are	For SSC-CPAs that implement hydropower plants with a reservoir, at least one of the following

eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	conditions will be satisfied: • The SSC-CPA is implemented in an existing reservoir with no change in the volume of reservoir; • The SSC-CPA is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the SCC-CPA, as per definitions given in the project emissions section, is greater than 4 W/m2; • The SSC-CPA results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.
If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	Not applicable. The programme of activities will not use both, renewable and non-renewable components.
Combined heat and power (co-generation) systems are not eligible under this category.	Not applicable. The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable. The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable. The programme of activities does not include retrofits or replacements.

The following conditions apply for use of this methodology in a project activity under a programme of activities:

In the specific case of biomass project activities the applicability of the methodology is limited to either project activities that use biomass residues only or biomass from dedicated plantations complying with the applicability conditions of AM0042.	Not applicable. This programme of activities does not involve CPAs including biomass.
In the specific case of biomass project activities	Not applicable. This programme of activities does

the determination of leakage shall be done following the general guidance for leakage in small-scale biomass project activities (attachment C of Appendix B16 of simplified modalities and procedures for small-scale clean development mechanism project activities; decision 4/CMP.1) or following the procedures included in the leakage section of AM0042.	involve CPAs including biomass.
In case the project activity involves the replacement of equipment, and the leakage from the use of the replaced equipment in another activity is neglected because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.	Not applicable. This programme of activities does involve the replacement of equipment.

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).	This tool is applicable since the generic CPA involves the generation of electricity from hydro energy and its supply to the South African grid system.
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

According to the approved SSC-methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), “The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.”

The project power plant and all power plants physically connected to the South African national grid system constitute the project boundary for this project.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the tables below. The figures below provide flow charts of the equipment and systems, emissions sources and gases included in the project boundary as well as the monitoring variables in the project boundary of the different CPAs eligible under this PoA.

Hydro power CPAs involving reservoirs

Source		Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
		CH_4	No	Minor emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
		N_2O	No	Minor emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
Project Activity	CO_2 emissions from combustion of fossil fuels for electricity generation in the case of a combination of non-renewable and hydro power plant/unit involving reservoirs	CO_2	No	No on-site fossil fuel consumption will take place. Therefore no emissions as per AMS-I.D and the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*
		CH_4	No	
		N_2O	No	
	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Geothermal power plants are not included in this PoA and the CPA is hydro power plant/unit involving reservoirs
		CH_4	No	
		N_2O	No	
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Geothermal power plants are not included in this PoA and the CPA is a hydro power plant/unit involving reservoirs
		CH_4	No	
		N_2O	No	
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emissions since the CPA is a hydro power plant/unit involving reservoirs in accordance with AMS-I.D
		CH_4	Yes	Main emissions since the CPA is a hydro power

				plant/unit involving reservoirs in accordance with AMS-I.D
		N_2O	No	Minor emissions since the CPA is a hydro power plant/unit involving reservoirs in accordance with AMS-I.D

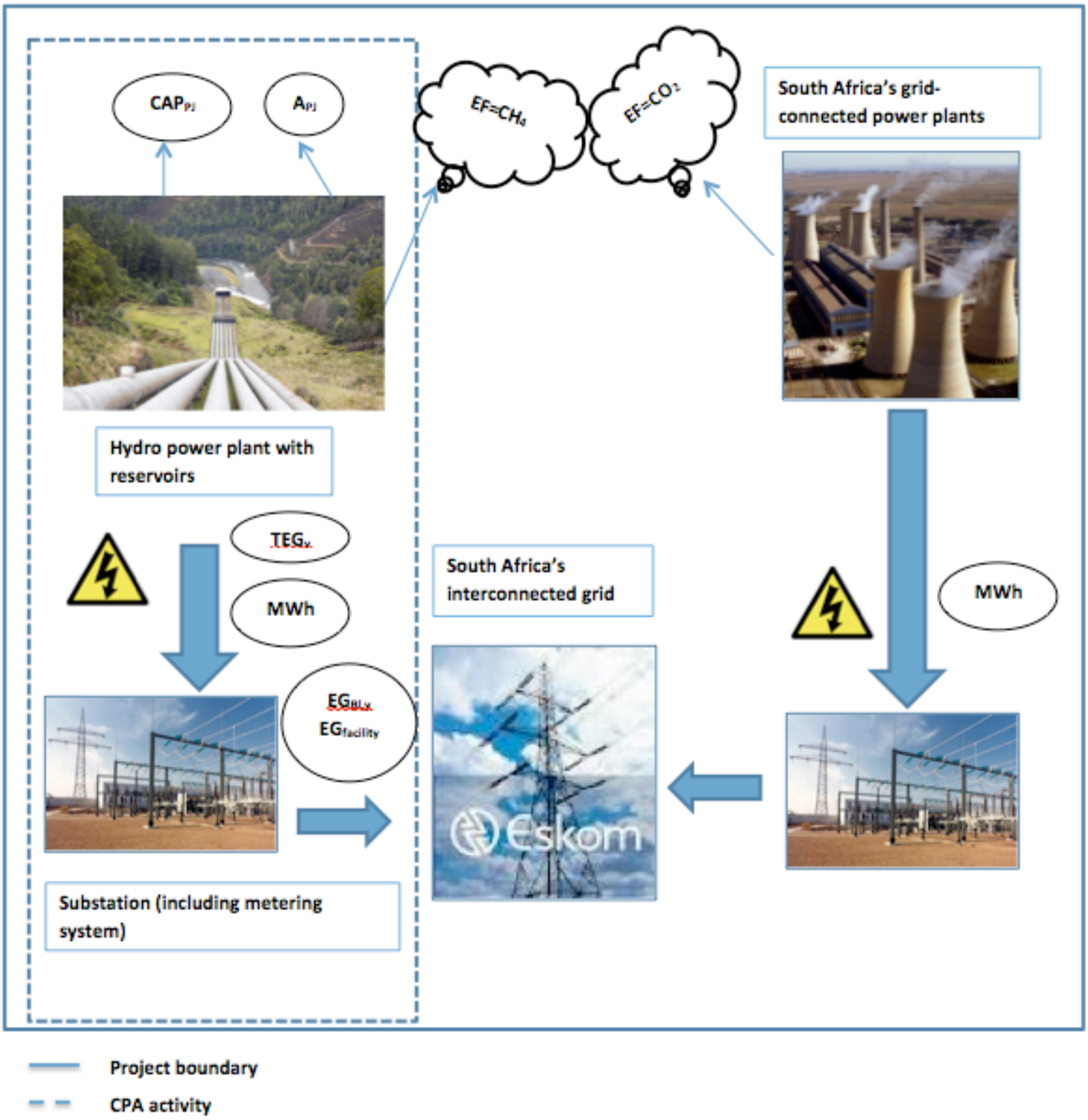

Figure 23: Hydro power CPA involving reservoirs

A detailed project description can be found for each CPA in the CPA-DD, section A.5.

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), the baseline scenario 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 into the grid".

The South African baseline scenario is described as follows:

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)*[40].

Specifically for the electricity sector of South Africa, the *Electricity Regulation Act of 2006 (No. 4 of 2006)*[41] determines the framework of the electricity sector. In May 2011, the Department of Energy, acting as the legislative entity, amended the *Electricity Regulations on New Generation Capacity*[42] under the *Electricity Regulation Act of 2006.* According to the new the current regulation, 70% of the new generation capacity must be implemented by the state-owned utility company Eskom, and 30% by Independent Power Producers (IPPs).[43] 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 *Electricity Regulation on New Generation Capacity* replaced the former *Renewable Energy Feed-in Tariff (REFIT)*[44]*,* which came into force on the 26 of March 2009.

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"*[45] 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.

[40] Department of Energy (2008), National Energy Act of 2oo8 http://www.info.gov.za/view/DownloadFileAction?id=92826, accessed on 30.12.2011
[41] Department of Energy (2006), Electricity Regulation Act of 2006, http://www.info.gov.za/view/DownloadFileAction?id=67855, accessed on 30.12.2011
[42] Department of Energy (2011), Electricity Regulations on New Generation Capacity, http://www.sapvia.co.za/electricity-regulations-on-new-generation-capacity-4-may-2011/, accessed on 30.12.2011
[43] Department of Energy, http://www.energy.gov.za/files/electricity_frame.html, accessed on 30.12.2011
[44] NERSA (2009), South Africa Renewable Energy Feed-in Tariff (REFIT), http://www.info.gov.za/view/DownloadFileAction?id=99318 , accessed on 30.12.2011
[45] 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

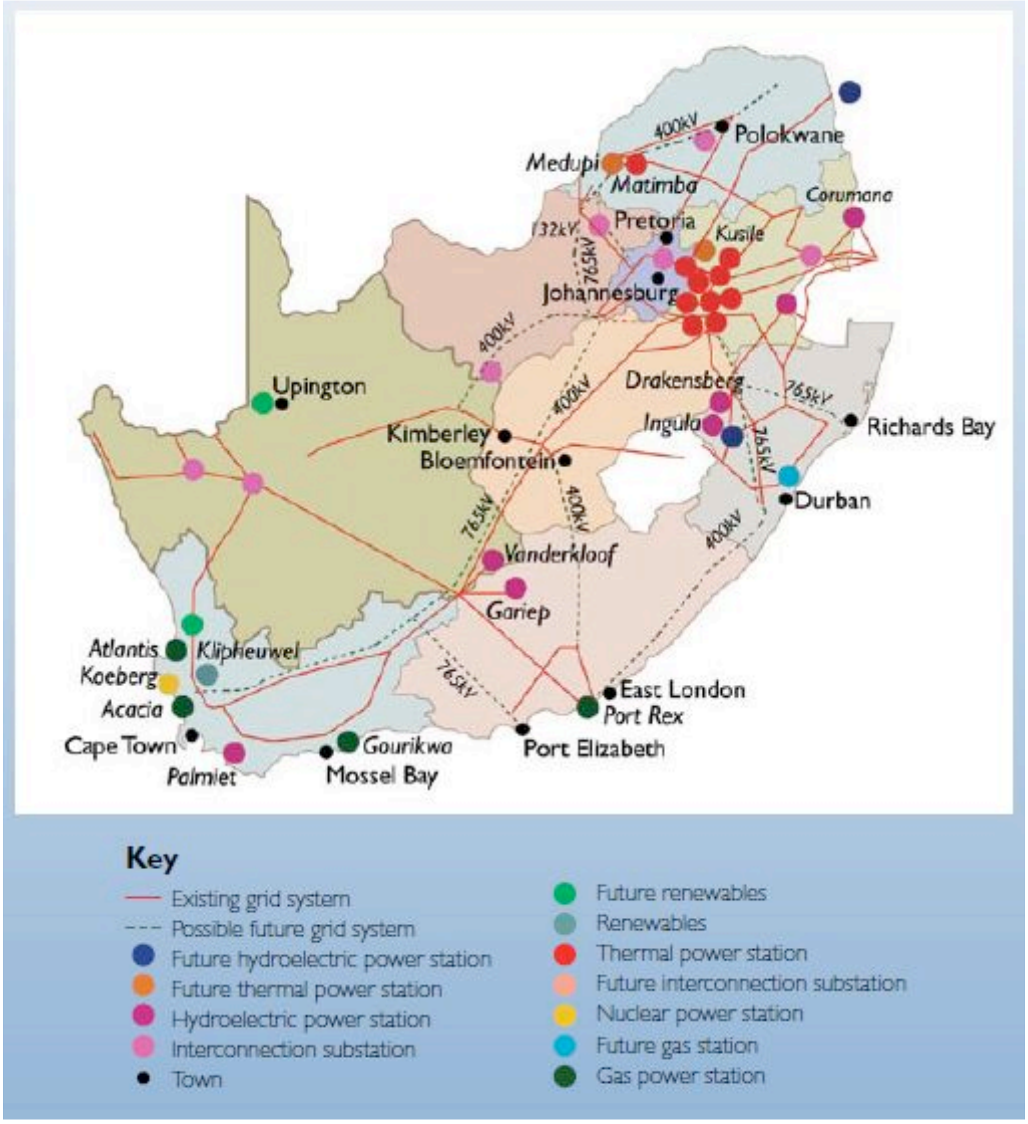

Figure 24. South African Power Sector

Generation

Electricity generation in South Africa is dominated by Eskom, which owns 93% of the installed capacity of 47,463 MW 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.[46]

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.[47] The latest published data for IPPs and municipal generation is from 2006[48].

[46] 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

[48] 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 15. 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
PSHSPP	1,400	1,400
Wind	3	3
Total	**44,145**	**41,294**

Table 16. Municipalities electricity generation capacity

Installed municipal capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,323	240
Gas	334	122
Hydro	4	-
PSHSPP	189	174
Total	**1,850**	**536**

Table 17. 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	7
Wind	5.2	5.2
Waste Water / Biogas	4.25	4.25
Landfill	5	5
Total	**1,468**	**1,020**

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 addtion, at the start of validation of this project, there were no solar PV power plants connected the South African grid.

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 that pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas etc. are negligible.

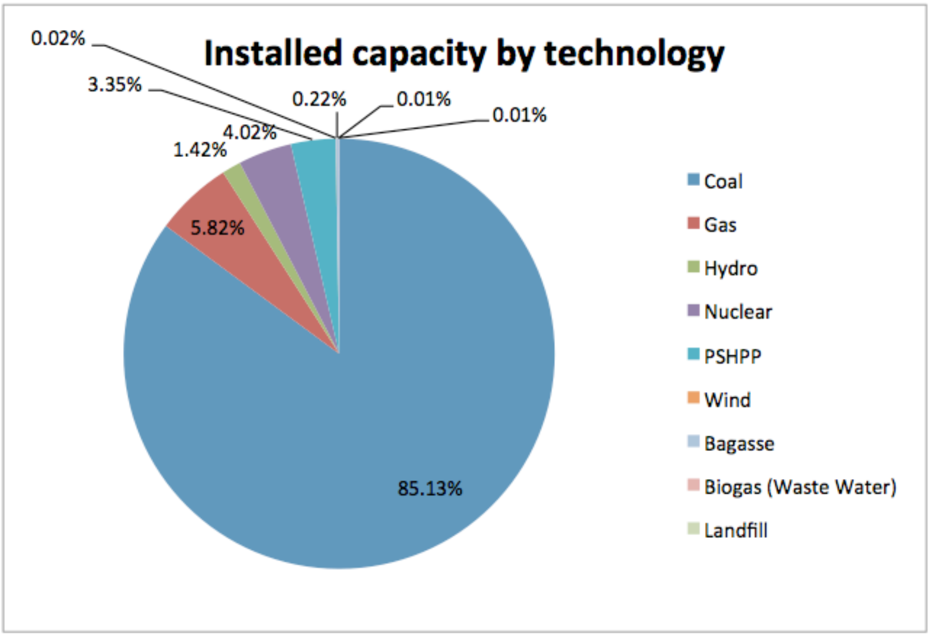

Figure 25: Installed capacity by technology

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: [49]

Table 18. 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 for Electricity 2010-2030* forecasts increasing imports of electricity generated from hydro power plants located in Zambia and Mozambique from 2022 on towards. However, *Integrated Resource Plan*

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

for Electricity 2010-2030 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.

The *Integrated Resource Plan for Electricity 2010-2030* also forecasts the continuation of the current power shortage until the year 2016 when newly installed power plants in line with *Integrated Resource Plan for Electricity 2010-2030* 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).[50] 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: [51]

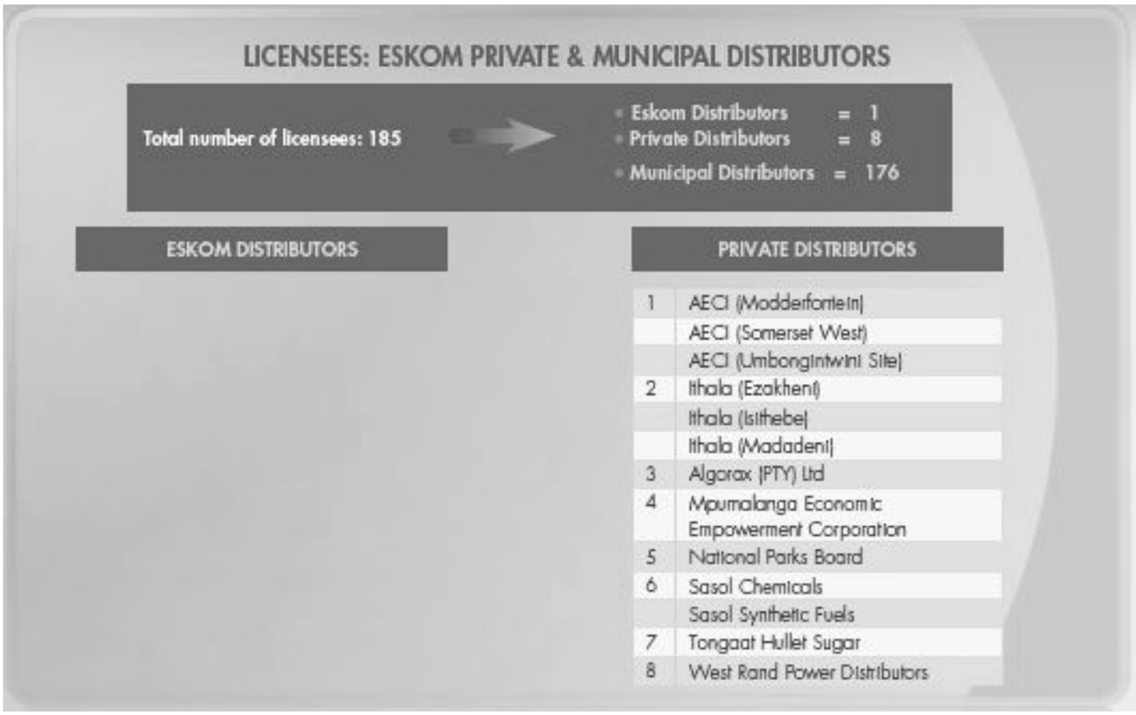

Figure 26. Distribution licenses

The government's policy on the Electricity Distribution Industry (EDI) requires the transmission of electricity to be separated from Eskom and merged with the electricity departments of municipalities to form a number of financially viable regional electricity distributors (REDs)[52]. An interim body, called

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

[51] 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

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

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 December 2010 by the government[53]. 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 for Electricity 2010-2030*, the *"Transmission Ten-Year Development Plan 2012-2021"*[54] published by the Transmission Division of Eskom determines the required additional transmission capacity as follows:

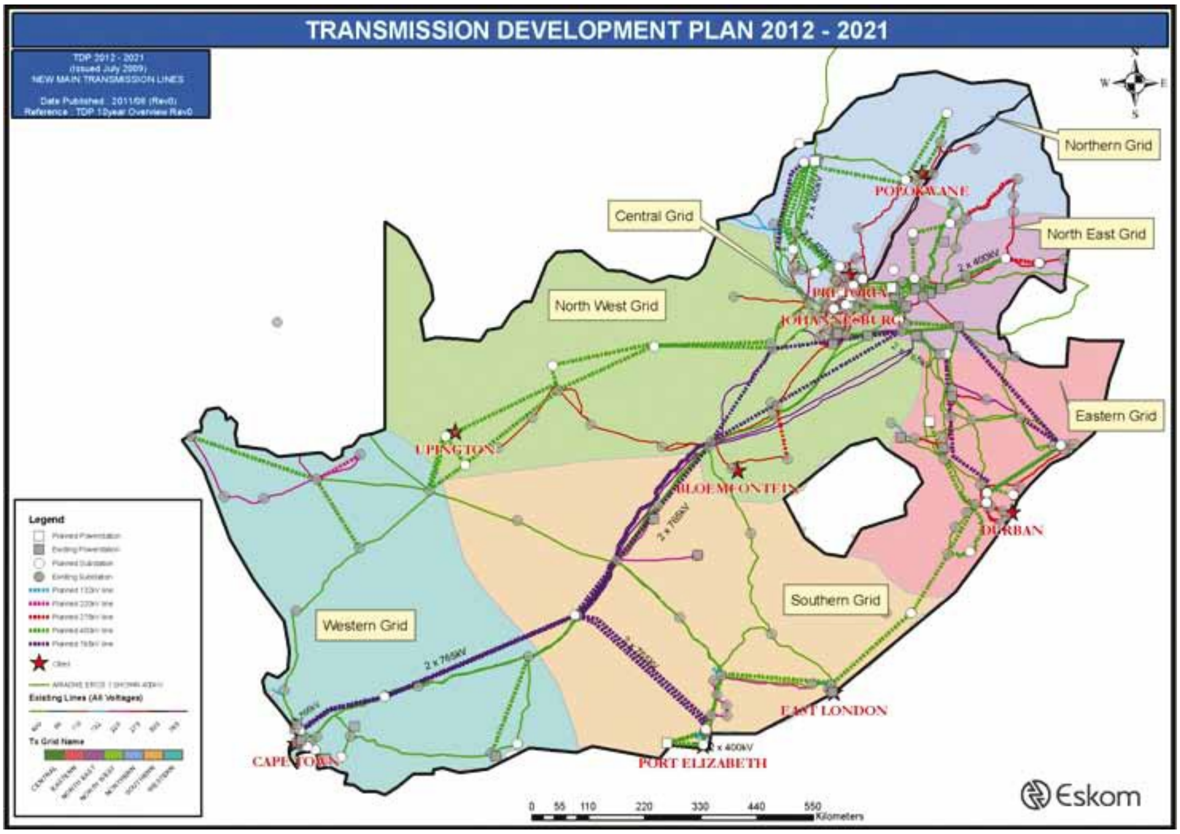

Figure 27. Transmission Development Plan 2012-2021

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

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

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

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 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 28. New grid assets 2022

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Documentary evidence
1)	Geographical boundary (a)	The geographical boundary of the SSC-CPA including any time-induced boundary is consistent with the geographical boundary set in section A.5 of the PoA-DD.	The geographical boundary of the CPA is consistent with the geographical boundary set in in section A.5 of the PoA DD since it is located in South Africa. EIA report, feasibility study or project description
2)	Double counting (b)	The SSC-CPA has not yet been included in another programme of activities or has not yet been registered as a single CDM project activity.	Agreement between CME and CPA where the CPA legally confirms its unique adhesion to this PoA as CDM component project activity; and evidence that the CME has cross-checked the information available on the UNFCCC website on the non existence of similar CDM project activities/component project activity, as described in the management system, section C. For the purpose of identification, each CPA will have a unique name, which will at least refer to the location of the CPA and the installed capacity of the

			project. The CME will also confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type as described in the management system, section C.
3)	Technology (c)	The SSC-CPA involves the implementation of a grid-connected renewable energy technology including solar PV, wind and hydro (run-of-river or with water accumulation reservoirs), which will only supply electricity to the national grid. SSC-CPAs involving the use of renewable biomass, geothermal, solar thermal and tidal/wave technologies for generating electricity are excluded from this programme of activities.	Feasibility study/technical description, PPA and/or EIA report by certified EIA specialist.
		In terms of compliance with testing/certification, the project will comply with the relevant standards as referred to in the Request for Qualification and Proposals for New Generation Capacity under the IPP Procurement Programme or other relevant policy guideline. In the current IPP Procurement Programme guidelines, no specific certification is required for hydro projects.	In the current IPP Procurement Programme guidelines, no specific certification is required for hydro projects.
		CPAs will also not include the combination of both renewable and non-renewable components (e.g. a wind/diesel unit).	Feasibility study/technical description, and/or EIA report by certified EIA specialist. In case the above mentioned documentation does not specify explicitly the non-deployment of non-renewable components, a confirmation letter that the CPA will not involve the use of non-renewable components and or on site fossil fuel consumption will be provided by the CPA implementing entity.
		Thereby the proposed SSC-CPA is the installation of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant).	Feasibility study/technical description, and/or EIA report by certified EIA specialist. In case the mentioned documentation does not clarify sufficiently that there was no renewable power plant operated at the project site

			before, a confirmation letter that no renewable power plant has been operated at the project site so far will be provided by the CPA implementing entity.
		CPAs will not involve energy generating equipment that is transferred from another activity	Feasibility study/technical description, and/or EIA report by certified EIA specialist . In case the above mentioned documentation does not specify explicitly the non-deployment of generating equipment transferred from another activity, a confirmation letter that the CPA will not involve the use of generating equipment transferred from another activity will be provided by the CPA implementing entity.
		If the proposed SSC-CPA is a hydropower plant: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; or • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2; or • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	In case the CPA is implemented in an existing reservoir with no change in the volume of reservoir, this will be evidenced by feasibility study/technical description, PPA and/or EIA report prepared by a certified EIA specialist.. In case the CPA is implemented in an existing reservoir with an increased reservoir volume or the CPA results in new reservoirs, the power density will be calculated in the specific CPA-DD based on information provided in the feasibility study/technical description, PPA and/or EIA report prepared by a certified EIA specialist.
4)	Start date (d)	The start of the SSC-CPA occurs is not, or will not be prior 12/06/2012 which is the commencement of the validation of the proposed CDM PoA, i.e. the date on which the PoA-DD is first published for global stakeholder consultation The start date will be defined as the earliest date on which a contract has been signed for equipment, construction or operation services required for the CPA. If the none of	Contract with party providing equipment/construction/operation services.

		contracts for the equipment, construction or operation services required for the CPA are available at the time of inclusion of the CPA, the CPA start date will automatically be after 12/06/2012 since the start date of the CPA could not have taken place before.	
5)	Applicability of methodology (e)	The SSC-CPA meets all the applicability criteria of version 17 of AMS I.D Grid connected renewable electricity generation as per section B.2, part II of the PoA-DD.	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D Grid connected renewable electricity generation is explained in section D.2 of the specific CPA-DD.
6)	Additionality (f)	The SSC-CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below (Additionality related eligibility criteria).	Additionality check carried out in D.5 of each CPA-DD in line with additionality-related eligibility criteria.
7)	Stakeholder consultation and EIA (g)	(a) The SSC-CPA has carried out a local stakeholder consultation. (b) The SSC-CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations	a) Evidence that a local stakeholder consultation was carried out. These evidences may include a summary of concerns raised and clarification provided and other information such as attendance sheet, invitations and photographs. (b) Environmental Impact Assessment (EIA) report and/or EIA license.
8)	ODA (h)	The SSC-CPA has not received funding from Annex I parties that results in a diversion of official development assistance	In case no ODA is involved, confirmation letter from CPA implementing entity that the CPA has not received funding from Annex I parties. In case ODA is involved, confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
9)	Target group (g)	The SSC-CPA supplies electricity to the South African national grid or supplies electricity to an identified consumer facility via the national grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation proving that the CPA supplies electricity to a national grid; or supplies electricity to an identified consumer facility via national grid through a contractual arrangement such as wheeling.
10)	Installed capacity limits (k)	The installed capacity of the SSC-CPA is smaller than or equal to 15 MW. However, if a CPA is applying the additionality Option A for microscale project activities, the installed capacity of the SSC-CPA	Feasibility study/technical description

		will be smaller than or equal to 5 MW.	
11)	Debundling (l)	The SSC-CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the Guidelines on assessment of debundling for SSC project activities (version 03).	Debundling check carried out in line with the latest approved version of the Guidelines on assessment of debundling for SSC project activities (version 03).

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

In case the CPA is microscale, the following criteria apply:

Option A: Microscale additionality	
Criteria	*Means of verification*
Installed capacity of the SSC-CPA is smaller than or equal to 5 MW	Feasibility study or other relevant project documentation.
The geographic location of the CPA is in a special underdeveloped zone (SUZ) of the host country, South Africa. or The CPA employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	Geographical coordinates of the CPA South African government official notification delineating special underdeveloped zones (SUZs) for development assistance including planning, management, and investment satisfying the following condition: - The portion of the population with income less than USD 2 per day (PPP) in the region is greater than 50% Or, those areas have been approved by the Executive Board of the CDM based on recommendations or Documentation from the CDM Executive Board recognizing the specific renewable energy technology used by the SSC-CPA.
Rationale	
In case the SSC-CPA is a microscale CPA, i.e. CPAs up to five megawatts that employ renewable energy technology, additionality will be demonstrated using the *Guidelines for demonstrating additionality of microscale project activities* (version 04.0). SSC-CPAs under the PoA follow the methodology AMS-I.D, therefore eligible SSC-CPAs will have to follow paragraph 2 (a) or paragraph 2 (d) of the guidelines as they are grid-connected renewable energy technologies, in order to demonstrate microscale additionality.	

In case the SSC-CPA is not a microscale CPA, additionality will be demonstrated using *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) and the *Non binding best practice examples to demonstrate additionality for SSC project activities* (version 01).

Option B.1 Investment Barrier (Paragraph 1 (a) of EB 68, Annex 27)	
Criteria	*Means of verification*
Without the CDM revenue of the SSC-CPA, a financially more viable alternative to the CPA would have led to higher emissions. In order to	Investment analysis spread sheet and appropriate evidences for benchmark calculation and all relevant input parameters in accordance with

evidences that SSC-CPA is less financially attractive than the baseline scenario, a benchmark analysis will show that the CPA financial indicator is less favourable than the benchmark applied. Therefore, the following steps will be taken in line with paragraph 12 of the *Guidelines on the assessment of investment analysis* (version 05): Step 1: CPAs will apply one of the following two benchmark indicators based on parameters which are standard in the market at the time of investment decision of the SSC-CPA: • Pre-tax nominal Weighted Average Cost of Capital (WACC) • Post-tax nominal Return on Equity The pre-tax, nominal Weighted Average Cost of Capital is an appropriate benchmark because it circumvents the impact of loan interest on income tax calculations (see also paragraph 11 in the *Guidelines on the assessment of investment analysis* (version 05). The post-tax nominal Return on Equity is considered an appropriate benchmark because equity investors and shareholders are mostly interested in after tax cash flows.	*Guidelines on the assessment of investment analysis* (version 05). 1. The Return on Equity will be based on the default value as provided in the latest version of the *Guidelines on the assessment of investment analysis* for Group 1 projects in South Africa (i.e. 10.9%). 2. Standard market commercial lending rates for hydro power power plants will be used in order to determine the cost of debt. This will be evidenced by applicable lending term sheets, confirmation from experienced third party or publicly available rates issued by credible entities e.g. South African Reserve Bank. 3. The inflation will be based on one of the following options: • The inflation forecast of the South African Reserve Bank for the duration of the CPA crediting period • The target inflation of the South African Reserve Bank • The average forecasted inflation rate for South Africa published by the IMF or the World Bank for the next five years after start of the project activity 4. The tax rate used in line with the South African corporate tax legislation, currently being 28%. 5. The relevant debt/equity ratio observed for the hydro power plants in South Africa will be applied. This will be based on publicly available data issued by credible entities e.g. NERSA or by written confirmation of a experienced third party,
Step 2: CPAs will apply one of the following two financial indicators based on parameters which are standard in the market at the time of investment decision of the SSC-CPA: • Pre-tax Project IRR, based on nominal cash-flows • Post-tax equity IRR, based on nominal cash-flows The WACC will be the benchmark for the Project IRR and the Return on Equity will be the benchmark for the Equity IRR in accordance with paragraph 12 of *Guidelines on the assessment of investment analysis* (version 05). The calculation of the financial indicator will be	Investment analysis spread sheet and appropriate credible evidences for IRR calculation and all input parameter in accordance with *Guidelines on the assessment of investment analysis* (version 05). Credible evidences for the input parameter are: • Documentation that has been prepared by an experienced third party • Documentation that has been approved or issued by South African governmental authorities • Documentation that has been submitted to or received from financing institutions like banks and equity providers • Documentation submitted for official purposes such as documents submitted to South African

carried out in accordance with all provisions outlined in the *Guidelines on the assessment of investment analysis* (version 05).	authorities. • Documentation that carries an official signature from the CPA implementing entity, CME or project participant. This is only applicable if the CPA implementing entity can provide evidence that the values used are considered standard in the market.
Step 3: A sensitivity analysis carried out in line with the *Guidelines on the assessment of investment analysis* (version 05) will demonstrate in which scenarios the CPA would pass the benchmark. The sensitivity analysis will show that a deviation of +10% and -10% of the parameters as shown below will not lead to a scenario that the CPA crosses the benchmark: • Electricity generation • Tariff • Investment cost • Operating and maintenance cost Step 4: The sensitivity analysis will also demonstrate in which scenarios the CPA would pass the benchmark and demonstrate the non-likelihood of occurrence of those scenarios.	Investment analysis spread sheet and CPA-DD.
Rationale	
Investment barrier: a financially more viable alternative to the CPA would have led to higher emissions. The investment barrier shall be demonstrated using benchmark analysis in accordance with the provisions of the *Non-binding best practice examples to demonstrate additionality for SSC project activities* (EB35, Annex34) and the *Guidelines on the assessment of investment analysis* (version 05).	

Option B.2 Access-to-capital Barrier (Par 1 (d) "other barriers" of EB 68, Annex 27)	
Criteria	*Means of verification*
The CPA implementing entity has signed a loan agreement/term sheet with a company that also buys the CERs. The loan agreement/term sheet explicitly mentions that it requires the transfer of CERs to the facilitating entity since this shows that the loan was assured due to the benefit of the CDM. or, The CPA implementing entity has received a significant part of the project investment as a pre-payment for expected CERs. **and,**	Loan agreement or Emission Reduction Purchase Agreement (ERPA)
The CPA implementing entity has provided information about the ownership of the project	Incorporation documents of the entity implementing the SSC-CPA.

<table>
<tr><td>which shows that, at the time the of equity investment/loan agreement based on the CERs is made, there is no significant shareholding by multinational companies, state-owned companies or companies listed on the Johannesburg Stock Exchange

and,

The project has provided its financial statements for the most recent year prior to the of equity investment/loan agreement based on the CERs, which shows that raising finance off is difficult, as per its balance sheet.</td><td>and,

Financial statements for the most recent year prior to the investment based on the CERs.</td></tr>
<tr><td colspan="2">Rationale</td></tr>
<tr><td colspan="2">Access-to-capital barrier: the CPA could not access appropriate capital without consideration of the CDM revenues. The access-to-capital shall be demonstrated by referring to guidelines 1 and 6 of the Guidelines for objective demonstration and assessment of barriers (version 01.0), as follows:
7. While demonstrating barriers related to the lack of access to capital, information should include nature of company, organization and its ownership and, financial information. A company that is a subsidiary of a multinational group may have different access to capital, technologies or skilled labour than a local SME company.
8. The project proponent should demonstrate in the PDD that the financing of the project was assured only due to the benefit of the CDM. Therefore, it should be demonstrated that the loan approval (or other significant financing decision(s)) by the lender takes explicitly the CDM registration into account. For the cases where the investment is done by a company which also purchases the CERs and the loan agreement mentions that, there is an objective demonstration that the CDM facilitated the lending.
The rationale behind this demonstration is that CPA implementing entities had raised finance thanks to the expected CERs. This evidence will be supported by demonstrating that without CDM, the project would have had difficulties to raise that finance as there is no multinational company, state-owned company, or company listed in the Johannesburg Stock Exchange with a significant share of the project which would have had facilitated the raising of financing. The financial statements will back it up by, for instance, showing that there is a lack of sufficient assets to work as collateral.</td></tr>
</table>

Option B.3 *Barrier due to prevailing practice*, and Option C *Automatic additionality,* as explained in Part I of this PoA-DD, are not possible for hydro power projects with accumulated reservoir in South Africa. Therefore, they have not being included.

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

B.6.1. Explanation of methodological choices

The generic CPA will focus on grid-connected renewable electricity generation from hydro power plant (with accumulation reservoir).

The generic CPA 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 CPA (greenfield plant).

CPAs will not include the combination of both renewable and non-renewable components (e.g. a hydro/diesel unit).

The emission factor of the grid is 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 described in the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).

Baseline emissions

The baseline emissions for CPAs hydro power (with reservoirs) are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year y (t CO_2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2grid,y}$	=	CO_2 emission factor of the grid in year y (t CO_2/MWh)

As per AMS-I.D (version 17):

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

<u>Calculation of $EF_{CO2,grid,y}$</u>

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

The grid emission factor will be calculated for the South African electricity system 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 are not spot markets in the South African grid system
- Although the South African grid is connected to a number of its neighboring countries' grids including Lesotho, Namibia, Swaziland, Botswana and Mozambique, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary.

- Finally, South Africa does not have a layered dispatch system and 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):

i) Simple OM
j) Simple adjusted OM
k) Dispatch data analysis OM
l) Average OM

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

- Coal used in South African power plants is a cheap resource compared to other technologies e.g. natural gas/kerosene because South Africa is the 6th largest producer of coal in the world with one of the lowest coal prices in the world.[55]
- 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 base load plants.

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

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

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

The average OM emission factor is calculated using equation 1

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

Where:

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

$EF_{grid,OM-ave,y}$ = Average operating margin CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/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

<u>*Determination of $EG_{m,y}$*</u>

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

$EG_{m,y}$ for CDM projects have been estimated based on the existing monitoring reports on the CDM website. Although the monitoring reports are not available for three years, it is considered to be more conservative to include an estimate for the electricity generation for the CDM projects for the calculation of the emission factor (both the operating margin and the build margin) than to assume that there was no electricity generation by the CDM projects for the years during which no data was available. Based on the number of months and the electricity generation reported in the monitoring report, the electricity generated per month was first calculated. This was then multiplied by twelve to get the generation per year.

		Generation Data (*MWh*)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Arnot	Coal	11,987,281	13,227,864	12,194,878
Camden	Coal	6,509,079	7,472,070	7,490,836
Duvha	Coal	21,769,489	22,581,228	20,267,508
Grootvlei	Coal	1,249,556	2,656,230	3,546,952
Hendrina	Coal	12,296,687	12,143,292	11,938,206
Kendal	Coal	23,841,401	23,307,031	25,648,258
Komati	Coal	-	1,016,023	2,060,141
Kriel	Coal	18,156,686	15,906,816	18,204,910
Lethabo	Coal	23,580,232	25,522,698	25,500,366
Majuba	Coal	22,676,924	22,340,081	24,632,585
Matimba	Coal	26,256,068	27,964,141	28,163,040
Matla	Coal	21,863,400	21,954,536	21,504,422
Tutuka	Coal	21,504,122	19,847,894	19,067,501
Acacia	Gas (Jet kerosene)	-	971.00	992.00
Port Rex	Gas (Jet kerosene)	-	322.00	5,507.00
Ankerlig	Gas/Diesel Oil	-	6,303.00	-
Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-

Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,756,730**	**228,828,053**	**232,394,838**

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:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/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:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

$EF_{CO2,m,i,y}$ = Average CO_2 emission factor of fossil fuel type *i* in power unit *m* in year *y* (tCO_2/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	30%	0.84
Port Rex	0.0697	30%	0.84
Ankerlig	0.0726	39.5%	0.66
Gourikwa	0.0726	39.5%	0.66

The default value for open cycle gas turbines that began generation after the year 2000 in Annex 1 in the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) has been used for Ankerlig and Gourikwa whereas the default value for the years before 2000 have been used for Acacia and Port Rex.

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 CO_2 emission factor in year y (tCO_2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2/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 (mm/dd/yy)
1	Bethlehem hydroelectric project	Hydro	11/11/09
2	Durban landfill gas Bisasar Road project	Land Fill Project	03/01/08
3	PetroSA biogas to energy	Waste water	09/01/07
4	Gourikwa	Gas fuel	03/30/07
5	Ankerlig	Gas fuel	03/29/07
6	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006
7	Klipheuwel	Wind	08/01/02
8	Majuba	Coal	04/01/96
9	Kendal	Coal	10/01/88
10	Palmiet	Pumped storage	04/18/88
11	Matimba	Coal	12/04/87
12	Lethabo	Coal	12/22/85
13	Tutuka	Coal	06/01/85
14	Colleywobbles	Hydropower	01/01/85
15	Koeberg	Nuclear	07/21/84
16	Ncora	Hydropower	03/01/83
17	Drakensberg	Pumped storage	06/17/81
18	Duvha	Coal	01/18/80
19	Matla	Coal	09/29/79
20	Second Falls	Hydropower	04/01/79
21	First Falls	Hydropower	02/01/79
22	Vanderkloof	Hydropower	01/01/77
23	Port Rex	Gas fuel	09/30/76
24	Acacia	Gas fuel	05/13/76
25	Kriel	Coal	05/06/76

26	Arnot	Coal	09/21/71
27	Gariep	Hydropower	09/08/71
28	Hendrina	Coal	05/12/70
29	Grootvlei	Coal	06/30/69
30	Camden	Coal	12/21/66
31	Komati	Coal	11/06/61

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 %**	***EGm,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 $SET_{sample\text{-}CDM}$ was calculated.

	Name	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,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	09/01/07	0.028%	23,286
CDM	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006	0.030%	3,744
	Total	***AEG*** $SET_{sample\text{-}CDM}$			***69,736***

AEG $SET_{sample\text{-}CDM}$ 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 ($SET_{sample\text{-}CDM>10years}$) was as follows:

Number	Name	Technology	Year of Commissioning	Cumulative %	*EGm,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	09/01/07	0.0%	23,285.54
	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006	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** $_{SETsample-CDM>10years}$*			***50,350,579***

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

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

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,,y}$	=	Average CO_2 emission factor of fuel type *i* used in power plant *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	The power *units* included in the build margin
y	=	The relevant year as per the data vintage chosen in Step 5

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

Name	*Technology*	***EFCO$_2$,m,i,y (tCO$_2$/GJ)***	***ηm,y***	***EFEL,m,y***
Gourikwa	Gas fuel	0.0726	39.5%	0.66
Ankerlig	Gas fuel	0.0726	39.5%	0.66

Klipheuwel	Wind	0.0000	-	-
Bethlehem hydroelectric project	Hydro	0.0000	-	-
Durban landfill gas Bisasar Road project	Land fill	0.0000	-	-
PetroSA biogas to energy	Waste water	0.0000	-	-
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	0.0000	-	-
Majuba	Coal	0.0895	35.5%	0.91
Kendal	Coal	0.0895	35.5%	0.91
	AEG SETsample-CDM>10years			

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

Name	***Technology***	***EFel,m,y (tCO_2/MWh)***	***EGm,y (MWh/y)***
Gourikwa	Gas fuel	0.66	-
Ankerlig	Gas fuel	0.66	-
Klipheuwel	Wind	-	2,000.00
Bethlehem hydroelectric project	Hydro	-	8983
Durban landfill gas Bisasar Road project	Land fill	-	31723
PetroSA biogas to energy	Waste water	-	23286
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	-	3744
Majuba	Coal	0.91	24,632,585
Kendal	Coal	0.91	25,648,258
Total	***AEG SETsample-CDM>10years***		***50,350,579***

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

Step 6: Calculate the Combined Margin
Option A i.e. the weighted average combined margin is used.

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 CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,CM,y}$	=	Operating margin CO_2 emission factor in year y (tCO2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

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

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

$$EF_{grid,CM,y} = EF_{CO2,grid,y}$$

Project emissions

For most renewable energy projects, PE_y = 0. As per the provisions in AMS-I.D (version 17), project emissions will be considered following the procedures described in ACM0002 (version 13.0.0) using **equation (1):**

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year y (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year y (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year y (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year y (tCO_2e/yr)

<u>Project emissions from fossil fuel consumption ($PE_{FF,y}$)</u>

This CPA involves hydro power plants, which does not comprise fossil fuel consumption of geothermal power plants. Therefore there are no emissions from consumption of fossil fuels.

<u>Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$)</u>

This CPA involves hydro power plants, not geothermal power plants. Therefore there are no emissions of non-condensable gases from the operation of geothermal power plants.

<u>Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)</u>

For hydro power project activities that result in new single or multiple reservoirs and hydro power project activities that result in the increase of single or multiple existing reservoirs, project proponents shall account for CH_4 emissions from the reservoirs, estimated as follows:

(a) If the power density of the single or multiple reservoirs (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2, **equation 3** in ACM0002 (version 13.0.0) will be used to calculate $PE_{HP,y}$:

$$PE_{HP,y} = (EF_{Res} * TEG_y) / 1000$$

Where:

$PE_{HP,y}$	=	Project emissions from reservoirs of hydro power plants in year *y* (tCO2e/yr)
EF_{Res}	=	Default emission factor for emissions from reservoirs of hydro power plants in year *y* (kgCO2e/MWh)
TEG_y	=	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

According to the methodology, the default value for EF_{Res} is used, 90 $kgCO_2e/MWh$.

b) If the power density of the project activity (*PD*) is greater than 10 W/m^2 **equation 4** will be used:

$$PE_{HP,y} = 0$$

The power density of the project activity (*PD*) will be calculated using **(equation 5)** in ACM0002 version 13.0.0, as follows:

$$PD = (Cap_{PJ} – Cap_{BL}) / (A_{PJ} – A_{BL})$$

Where:

PD	=	Power density of the project activity (W/m^2)
Cap_{PJ}	=	Installed capacity of the hydro power plant after the implementation of the project activity (W).
Cap_{BL}	=	Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero
A_{PJ}	=	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)
A_{BL}	=	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2/y)
BE_y	=	Baseline Emissions in year *y* (t CO_2/y)
PE_y	=	Project emissions in year *y* (t CO_2/y)
LE_y	=	Leakage emission in year *y* (t CO_2/y)

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

SPECIFIC PARAMETERS FOR GRID EMISSION FACTOR CALCULATIONS

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

Nested table (Value(s) applied):

Fuel Type	NCV (GJ/kg)
Coal (other bituminous coal)	0.0199
Gas/Jet kerosene	0.042
Gas/Diesel Oil	0.0414

Data / Parameter	$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$
Unit	tCO_2/GJ
Description	CO_2 emission factor 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 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	<table><tr><th>Fuel Type</th><th>EFCO₂ (tCO₂/GJ)</th></tr><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></table>
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also 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 (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

Data / Parameter	$\eta_{m,y}$
Unit	-
Description	Average net conversion efficiency of power unit *m* in year *y*
Source of data	Default value for open cycle gas turbines built before and after 2000 and Fluidised Bed System (FBS) coal generation technology for units built before and in 2000 is used as per Annex 1 of the *Tool to calculate the emission factor for an electricity system.*
Value(s) applied	<table><tr><th>Type of turbine</th><th>Efficiency</th></tr><tr><td>Open cycle gas turbines built before and in 2000</td><td>30%</td></tr><tr><td>Open cycle gas turbines built after 2000</td><td>39.5%</td></tr><tr><td>(FBS) coal generation technology for units built before and in 2000</td><td>35.5%</td></tr></table>
Choice of data or Measurement methods and procedures	There is no data published on the efficiency of Eskom's gas power plants, therefore default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

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

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

SPECIFIC PARAMETERS FOR HYDRO PROJECT ACTIVITIES

Data / Parameter	$\mathbf{Cap_{BL}}$
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data	Project site
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	Determine the installed capacity based on recognized standards
Purpose of data	Calculation of project emissions
Additional comment	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m^2

Data / Parameter	$\mathbf{A_{BL}}$
Unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero
Source of data	Project activity site
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc.
Purpose of data	Calculation of project emissions
Additional comment	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m^2

B.6.3. Ex-ante calculations of emission reductions

Baseline emissions

The baseline emissions for CPAs involving hydro power (with reservoirs) are to be calculated as follows:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

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

Calculation of $EG_{facility,y}$

Parameter	**Value**	**Unit**	**Source**
$EG_{facility,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for hydro power (with reservoirs) SSC-CPAs:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	0.9063	tCO_2/MWh	GEF calculations
w_{BM}	0.5		Defalut value
$EF_{grid,OM-DD,y}$	0.9585	tCO_2/MWh	GEF calculations
w_{OM}	0.5		Default value
$EF_{grid,CM,y}$	0.9324	tCO_2/MWh	GEF calculations

Therefore:

For CPAs involving hydro power (with reservoirs) $EF_{CO2,grid,y}$ = 0.9324 tCO_2/MWh

For CPAs involving hydro power (with reservoirs) BE_y = [Insert] * 0.9324 = [Insert] tCO_2/year

Project emissions

In CPAs that include hydro power (with reservoir) project emissions (CH_4) from reservoirs shall be accounted for using the following method from ACM0002 version 13.0.0:

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

For hydro power project activities that result in new single or multiple reservoirs and hydro power project activities that result in the increase of single or multiple existing reservoirs, project proponents shall account for CH_4 emissions from the reservoirs. The project emissions will depend on the power density of the single or multiple reservoirs.

The power density of the single or multiple reservoirs (*PD*) will be calculated using **equation (5)** in ACM0002 version 13.0.0, as follows:

$$PD = (Cap_{PJ} – Cap_{BL}) / (A_{PJ} – A_{BL})$$

The table(s) provide(s) an overview of the parameter values used to calculate the power density of the single or multiple reservoirs:

Parameter	Value	Unit	Source
Cap_{PJ}	[insert value]	[insert unit]	[insert source]
Cap_{BL}	[insert value]	[insert unit]	[insert source]
A_{PJ}	[insert value]	[insert unit]	[insert source]
A_{BL}	[insert value]	[insert unit]	[insert source]

The power density of the single or multiple reservoirs equals [insert value] W/m^2. Therefore, the following formula is used to calculate the project emissions:

[include one of the following two options]

(a) If the power density of the single or multiple reservoirs (*PD*) is greater than 4 W/m^2 and less than or equal to 10 W/m^2, **equation 3** in ACM0002 (version 13.0.0) will be used to calculate $PE_{HP,y}$:

$$PE_{HP,y} = (EF_{Res} * TEG_y) / 1000$$

The table(s) provide(s) an overview of the parameter values used to calculate the emissions from water reservoires of the single or multiple reservoirs:

Parameter	**Value**	**Unit**	**Source**
EF_{Res}	90	$kgCO_2e/MWh$	ACM0002 version 13.0.0
TEG_y	[insert value]	[insert unit]	[insert source]
$PE_{HP,y}$	[insert value]	[insert unit]	[insert source]

b) If the power density (PD) of the CPA is greater than 10 W/m^2:

$$PE_{HP,y} = 0$$

For CPAs involving wind power, solar PV or hydro power (run-of-river), project emissions (PE_y) are considered 0.

PE_y = [insert value]

Leakage emissions

The CPA does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Therefore, emission reductions equal:

For CPAs including hydro power (with reservoirs): [insert value of BE_y] – [insert value of PE_y] - 0 = [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

GENERAL PARAMETERS

<table>
<tr><td>Data / Parameter</td><td>$EG_{facility,y}$</td></tr>
<tr><td>Unit</td><td>MWh/yr</td></tr>
<tr><td>Description</td><td>Quantity of net electricity generation supplied by the project plant/unit to the grid in year y</td></tr>
<tr><td>Source of data</td><td>Electricity meter(s)</td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Measurement methods and procedures</td><td>The following parameters shall be measured:
(i) The quantity of electricity supplied by the project plant/unit to the grid; and
(ii) The quantity of electricity delivered to the project plant/unit from the grid

Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards and the Code of practice of electricity metering SANS 474:2009/NRS 057:2009.

The electricity supplied to the grid and delivered to the project plant/unit from the grid will be measured continuously (hourly measurement and at least monthly recording) by a main (facility metering installation) and a back-up meter (system metering installation). The facility meter is installed at the Delivery Point with the electricity grid as agreed with the national transmission company (NTC) or distributor, as applicable. The system meter will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.</td></tr>
<tr><td>Monitoring frequency</td><td>The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with PPA and SANS 474:2009/NRS 057:2009.</td></tr>
<tr><td>QA/QC procedures</td><td>Cross-check measurements results with records of sold electricity.

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

<table><tr><td>Size of project</td><td>Accuracy Class</td><td>Interval for period calibration (years)</td></tr><tr><td>10 MVA to < 100 MVA</td><td>0.5S</td><td>5</td></tr><tr><td>1 MVA to < 10 MVA</td><td>1</td><td>10</td></tr></table></td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

SPECIFIC PARAMETERS FOR HYDRO PROJECTS

Data / Parameter	TEG_y
Unit	MWh/yr
Description	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*
Source of data	Project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	Electricity meter will be installed prior to internal loads and losses, whereby exact location will be specified during CPA level. Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards and the *Code of practice of electricity metering* SANS 474:2009/NRS 057:2009.
Monitoring frequency	Continuous measurement and at least monthly recording
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comment	Applicable to hydro power projects activities with a power density of the project activity (PD) greater than 4 W/m2 and less than or equal to 10 W/m2

Data / Parameter	CAP_{PJ}
Unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data	Project site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	Determine the installed capacity based on recognized standards
Monitoring frequency	Monitoring must be done on an annual basis
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

Data / Parameter	A_{PJ}
Unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data	Project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	Measured from topographical surveys, maps, satellite pictures, etc
Monitoring frequency	Monitoring must be done on an annual basis
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

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

Overall authority and responsibility for monitoring will rest with the CME, which will also be responsible for managing the emission reduction monitoring and verification process.

In order to enable verification of emission reductions the CPA must maintain credible, transparent and adequate data measurement, collection, estimation and tracking systems. The following monitoring procedures and responsibilities will apply.

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

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

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPAs monitoring responsibilities as described above.

The following parameters will be monitored:

Parameter	Description	Type of CPA
$EG_{facility,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All

TEG_Y	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*	Hydro CPAs
CAP_{PJ}	Installed capacity of the hydro power plant after the implementation of the project activity.	Hydro CPAs
A_{PJ}	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.	Hydro CPAs

CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid as a result of the implementation of the CDM CPA in year y ($EG_{facility,y}$). CPA implementing entity will be responsible for preparing invoices for the sales of electricity to the national transmission company (NTC) or the distribution company, as applicable. The quantity of electricity supplied to the grid will be reported to the CME on a quarterly basis for the previous three months and will be accompanied by supporting evidence for cross-checking purposes. CPA implementing entity will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

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

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

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

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

The Facility Metering Installation will be installed at the Delivery Point, which defines the commercial boundary between the licensee and the customer. The System Metering Installation will be also installed at the Delivery Point at the NTC or distributor side, as applicable.
The Facility Metering Installation readings will be crosschecked with the copies of invoices sent by the CPA implementing entity to the NTC or distributor, and the proof of payment of those invoices. If there is a difference between the values, the most conservative value will be used.

In order to determine $TEG_{y,}$ main and back-up meters for gross generation will be installed prior to internal loads and losses, whereby exact location will be specified during CPA level.

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

Table 19. Metering accuracy and calibration frequency

Size of project	Accuracy Class	Interval for period

		calibration (years)
10 MVA to < 100 MVA	0.5S	5
1 MVA to < 10 MVA	1	10

Emergency procedure: In case there is disagreement between the NTC and the CPA implementing entity with regard to the meter readings because the readings of the Facility Metering Installation and the System Metering Installation are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 19 above then the Facility Metering Installation and the System Metering Installation shall both be tested. Should the Facility Metering Installation be found to have a level of inaccuracy beyond the tolerance as described above, then the Facility Metering Installation shall be recalibrated and the electricity output will be based on the readings registered by the System Metering Installation from the date of the last previous test of the Facility Metering Installation.

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

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

In order to monitor the parameter TEG_y procedures as per SANS 474:2009/NRS 057:2009 will be applied. In case readings of the main and the back up meter as are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 19 above then the main and back up meter shall both be tested. Should the main meter be found to have a level of inaccuracy beyond the tolerance as described above, then the main meter shall be recalibrated and the gross energy generation will be based on the readings registered by the back up meter from the date of the last previous test of the main meter.

Should both the main meter and the back up meter be found to have a level of inaccuracy falling outside the maximum tolerance level then each of the main and back up meter shall be recalibrated and the gross energy generation shall be recalculated applying the error identified in the calibration test of the main meter for all values from the date of the last previous test of the main meter.

In cases where one meter breaks down, the readings of the other meter will be applied in the emission reduction calculations. If both meters break down or are unavailable, then the gross energy generation value for that period will be assumed to be similar to the value of the year before for the specific period. If no data is available from the year before, the most conservative (highest) value based on the Feasibility study will be applied for the specific period.

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

Carbon Africa - Coordinating/managing entity

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

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

- Preparation of monitoring report

The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

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

The database contains the following information:

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

Training

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

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

PART II. Generic component project activity (CPA)

CPA TYPE: Hydro (run-of-river) power plants

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

The small-scale component project activity (SSC-CPA), which will be implemented under the Small Scale Renewable Energy Carbon Programme (SRECP) is a grid-connected hydro power plant (run-of-river)

The generic SSC-CPA comprises the implementation and operation of a hydro power plant (run-of-river) implemented at a site where no renewable power plant was operated prior to the implementation of the CPA.

CPAs will not include the combination of both renewable and non-renewable components (e.g. a hydro/diesel unit).

The CPA will generate electricity, which will be fed into to South Africa's national electricity grid or be supplied to an identified consumer facility via national grid through a contractual arrangement such as wheeling. By replacing fossil-fuel based electricity, the CPA will lead to emission reductions.

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

SSC-CPAs included in the PoA will apply approved baseline and monitoring methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17).

AMS-I.D. (version 17) also refers to the latest versions of the following methodological tools:

- *Tool to calculate the emission factor for an electricity system (version 02.2.1)*
- *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02)*

CPAs included under this PoA will not apply the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (version 02),* since no on-site fossil fuel consumption will take place.

B.2. Application of methodology(ies)

The CPA qualifies as small-scale Type I component project activity because the maximum output capacity achieved by individual SSC-CPAs will not exceed 15MW in each year of the crediting period. The CPA falls under category AMS-I.D. *Grid connected renewable electricity generation* (version 17) because the CPA meets the applicability criteria as follows:

Applicability criteria	**Generic CPA justification**
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	The generic SSC-CPA under the programme will use grid-connected hydro power plant (run-of-river) that will supply electricity to a national grid, or to an identified consumer facility via national grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) 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); (b) Involve a capacity addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	The generic SSC-CPA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (greenfield plant).
Hydro power plants with reservoirs that satisfy at least one of the following conditions are	Not applicable. This CPA includes run-of-river hydro power plan, not hydro power plants with with

eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	reservoirs..
If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	Not applicable. The programme of activities will not use both, renewable and non-renewable components.
Combined heat and power (co-generation) systems are not eligible under this category.	Not applicable. The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	Not applicable. The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Not applicable. The programme of activities does not include retrofits or replacements.

The following conditions apply for use of this methodology in a project activity under a programme of activities:

In the specific case of biomass project activities the applicability of the methodology is limited to either project activities that use biomass residues only or biomass from dedicated plantations complying with the applicability conditions of AM0042.	Not applicable. This programme of activities does not involve CPAs including biomass.
In the specific case of biomass project activities	Not applicable. This programme of activities does

the determination of leakage shall be done following the general guidance for leakage in small-scale biomass project activities (attachment C of Appendix B16 of simplified modalities and procedures for small-scale clean development mechanism project activities; decision 4/CMP.1) or following the procedures included in the leakage section of AM0042.	involve CPAs including biomass.
In case the project activity involves the replacement of equipment, and the leakage from the use of the replaced equipment in another activity is neglected because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.	Not applicable. This programme of activities does involve the replacement of equipment.

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).	This tool is applicable since the generic CPA involves the generation of electricity from hydro energy and its supply to the South African grid system.
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

According to the approved SSC-methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), “The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.”

The project power plant and all power plants physically connected to the South African national grid system constitute the project boundary for this project.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the tables below. The figures below provide flow charts of the equipment and systems, emissions sources and gases included in the project boundary as well as the monitoring variables in the project boundary of the different CPAs eligible under this PoA.

Run-of-river hydro power CPA

Source		Gas	Included?	Justification/Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to project activity	CO_2	Yes	Main emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
		CH_4	No	Minor emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
		N_2O	No	Minor emission source as per AMS-I.D and the *Tool to calculate the emission factor for an electricity system*
Project Activity	CO_2 emissions from combustion of fossil fuels for electricity generation in the case of a combination of non-renewable and hydro power plant/unit (<u>Run-of-river</u>)	CO_2	No	No on-site fossil fuel consumption will take place. Therefore no emissions as per AMS-I.D and the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*
		CH_4	No	
		N_2O	No	
	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Geothermal power plants are not included in this PoA and the CPA is hydro power plant/unit (<u>Run-of-river</u>)
		CH_4	No	
		N_2O	No	
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	No	Geothermal power plants are not included in this PoA and the CPA is a hydro power plant/unit (<u>Run-of-river</u>)
		CH_4	No	
		N_2O	No	
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	No emissions since the CPA is a hydro power plant (<u>run-of-river</u>) without reservoir
		CH_4	No	No emissions since the

				CPA is a hydro power plant (run-of-river) without reservoir
		N_2O	No	No emissions since the CPA is a hydro power plant (run-of-river) without reservoir

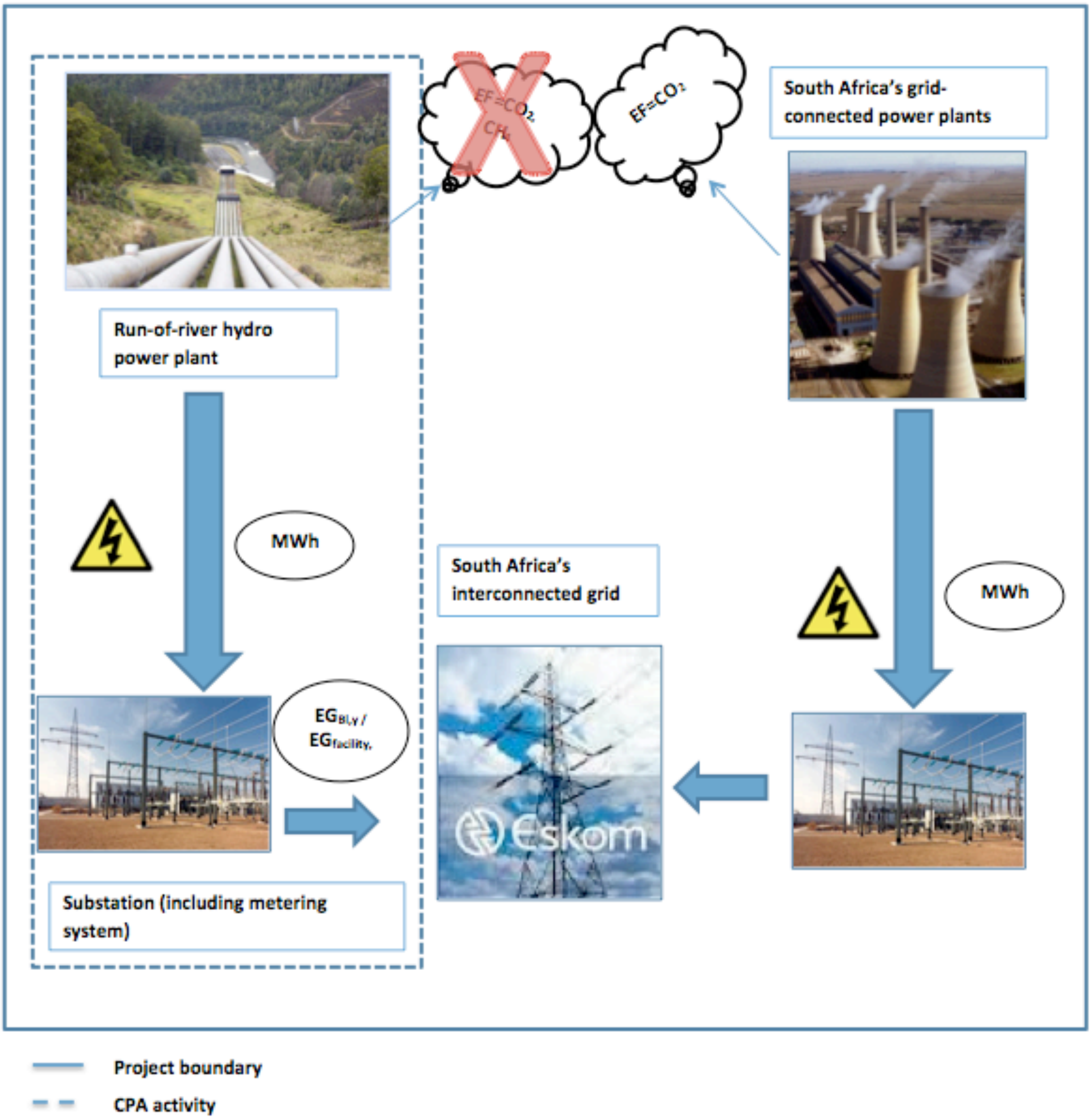

Figure 29: Run-of-river hydro power CPA

A detailed project description can be found for each CPA in the CPA-DD, section A.5.

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D. *Grid connected renewable electricity generation* (version 17), the baseline scenario 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 into the grid”.

The South African baseline scenario is described as follows:

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)*[56].

Specifically for the electricity sector of South Africa, the *Electricity Regulation Act of 2006 (No. 4 of 2006)*[57] determines the framework of the electricity sector. In May 2011, the Department of Energy, acting as the legislative entity, amended the *Electricity Regulations on New Generation Capacity*[58] under the *Electricity Regulation Act of 2006.* According to the new the current regulation, 70% of the new generation capacity must be implemented by the state-owned utility company Eskom, and 30% by Independent Power Producers (IPPs).[59] 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 *Electricity Regulation on New Generation Capacity* replaced the former *Renewable Energy Feed-in Tariff (REFIT)*[60]*,* which came into force on the 26 of March 2009.

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”*[61] 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.

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[56] Department of Energy (2008), National Energy Act of 2oo8 http://www.info.gov.za/view/DownloadFileAction?id=92826, accessed on 30.12.2011
[57] Department of Energy (2006), Electricity Regulation Act of 2006, http://www.info.gov.za/view/DownloadFileAction?id=67855, accessed on 30.12.2011
[58] Department of Energy (2011), Electricity Regulations on New Generation Capacity, http://www.sapvia.co.za/electricity-regulations-on-new-generation-capacity-4-may-2011/, accessed on 30.12.2011
[59] Department of Energy, http://www.energy.gov.za/files/electricity_frame.html, accessed on 30.12.2011
[60] NERSA (2009), South Africa Renewable Energy Feed-in Tariff (REFIT), http://www.info.gov.za/view/DownloadFileAction?id=99318 , accessed on 30.12.2011
[61] Department of Energy (2011), Electricity Regulations on the Integrated Resource Plan 2010-2030, http://www.info.gov.za/view/DownloadFileAction?id=146082, accessed on 30.12.2011

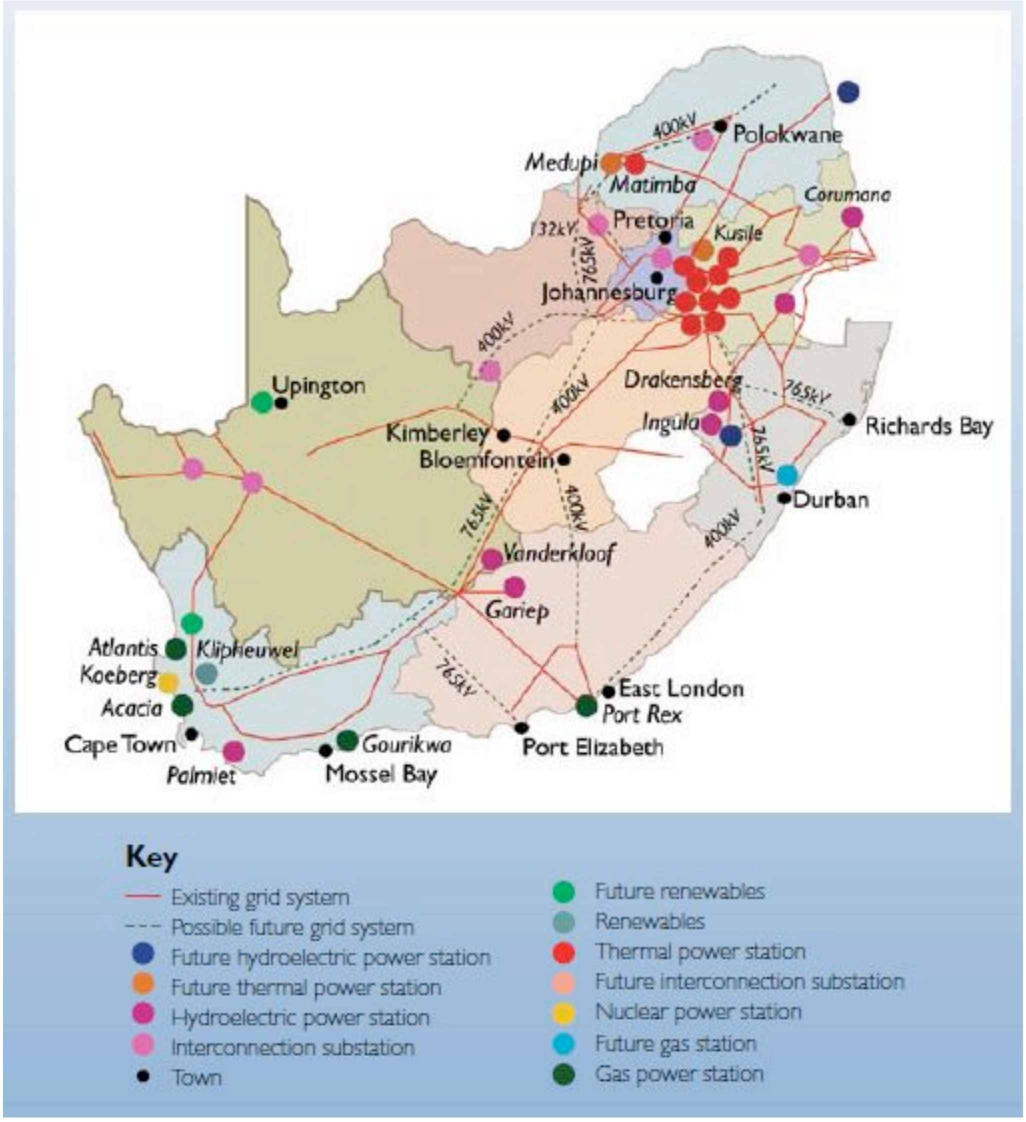

Figure 30. South African Power Sector

Generation

Electricity generation in South Africa is dominated by Eskom, which owns 93% of the installed capacity of 47,463 MW and supplies about 95% of South Africa's electricity. Municipal owned power plants and IPPs supply the remaining 5% of electricity. Approximately 90% of the total generated electricity is based on coal.[62]

Detailed description of the installed capacity for each technology is presented in the following tables. Data from Eskom's power plants is dated from 2011.[63] The latest published data for IPPs and municipal generation is from 2006[64].

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

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

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

Table 20. 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
PSHSPP	1,400	1,400
Wind	3	3
Total	**44,145**	**41,294**

Table 21. Municipalities electricity generation capacity

Installed municipal capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,323	240
Gas	334	122
Hydro	4	-
PSHSPP	189	174
Total	**1,850**	**536**

Table 22. 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	7
Wind	5.2	5.2
Waste Water / Biogas	4.25	4.25
Landfill	5	5
Total	**1,468**	**1,020**

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 addtion, at the start of validation of this project, there were no solar PV power plants connected the South African grid.

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 that pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas etc. are negligible.

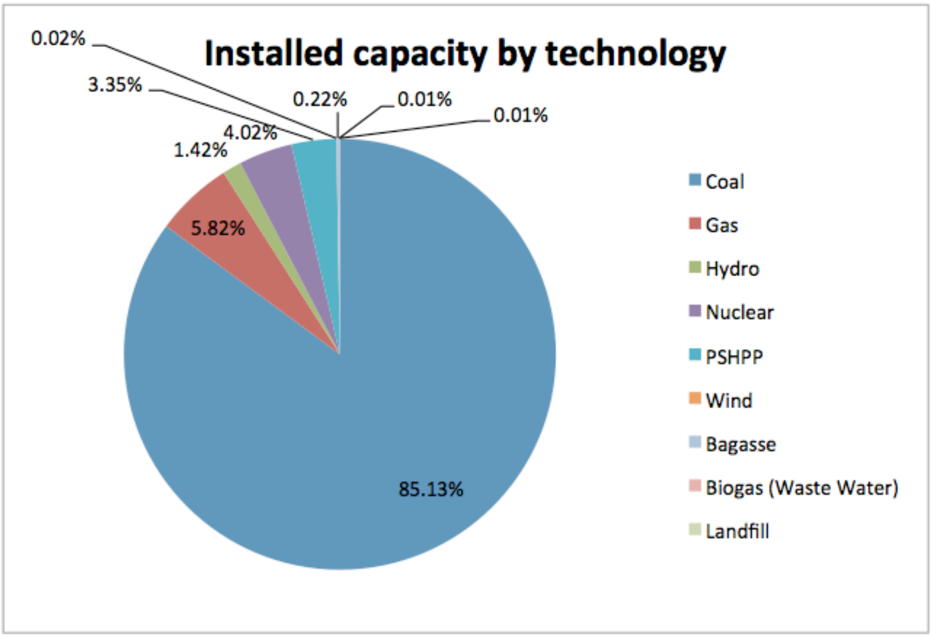

Figure 31: Installed capacity by technology

The *Integrated Resource Plan 2010-2030 for Electricity,* which determines the needed capacity and share of technologies in the future proposes the following capacity additions until 2030: [65]

Table 23. 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 for Electricity 2010-2030* forecasts increasing imports of electricity generated from hydro power plants located in Zambia and Mozambique from 2022 on towards. However, *Integrated Resource Plan*

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

for Electricity 2010-2030 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.

The *Integrated Resource Plan for Electricity 2010-2030* also forecasts the continuation of the current power shortage until the year 2016 when newly installed power plants in line with *Integrated Resource Plan for Electricity 2010-2030* 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).[66] 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: [67]

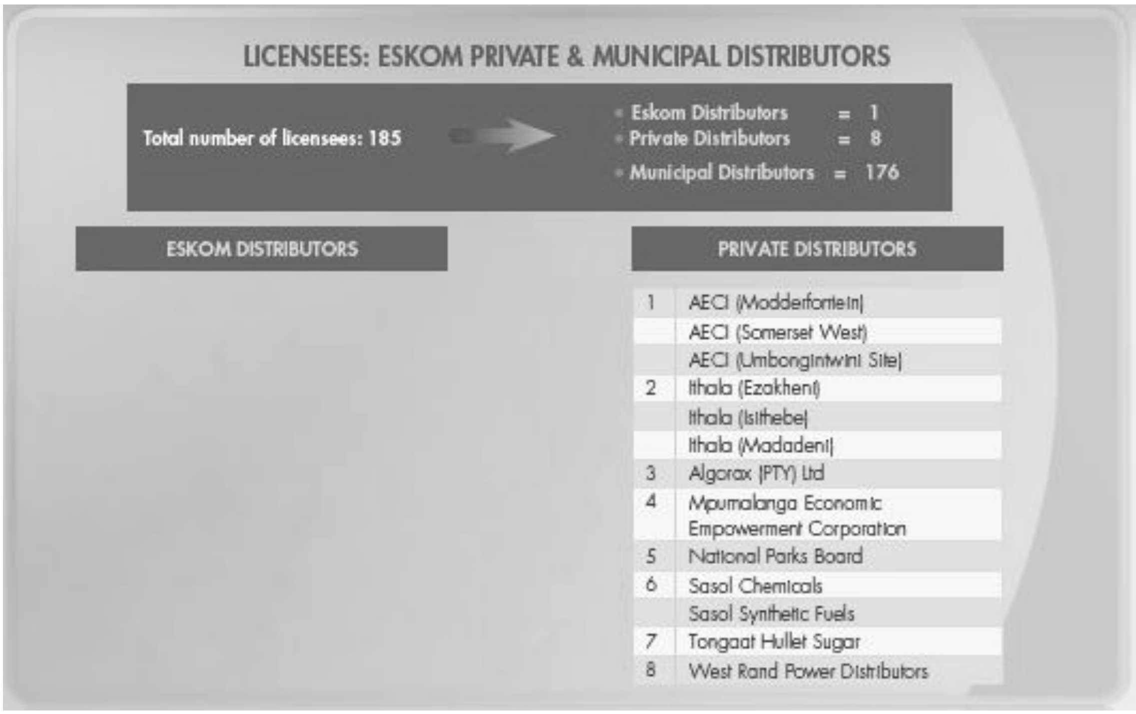

Figure 32. Distribution licenses

The government's policy on the Electricity Distribution Industry (EDI) requires the transmission of electricity to be separated from Eskom and merged with the electricity departments of municipalities to form a number of financially viable regional electricity distributors (REDs)[68]. An interim body, called

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

[67] 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

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

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 December 2010 by the government[69]. 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 for Electricity 2010-2030*, the *"Transmission Ten-Year Development Plan 2012-2021"*[70] published by the Transmission Division of Eskom determines the required additional transmission capacity as follows:

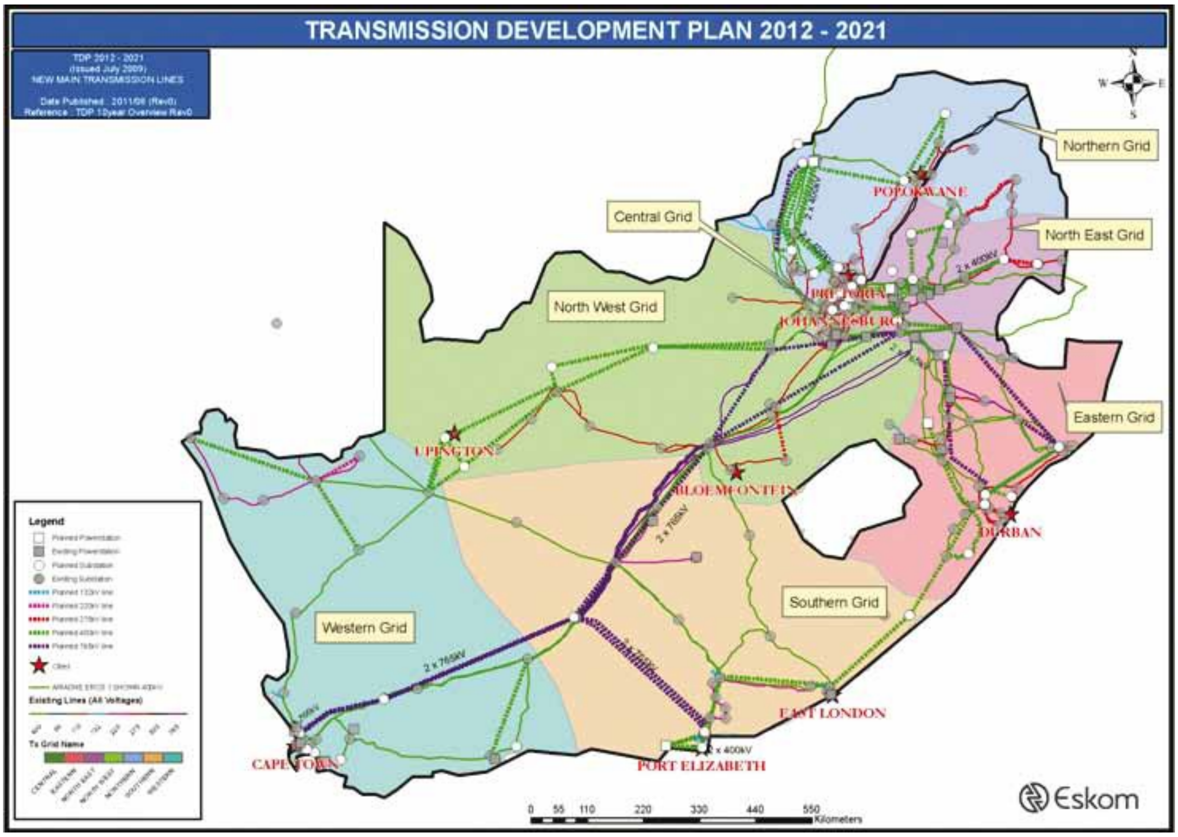

Figure 33. Transmission Development Plan 2012-2021

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

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

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

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 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 34. New grid assets 2022

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Documentary evidence
1)	Geographical boundary (a)	The geographical boundary of the SSC-CPA including any time-induced boundary is consistent with the geographical boundary set in section A.5 of the PoA-DD.	The geographical boundary of the CPA is consistent with the geographical boundary set in in section A.5 of the PoA DD since it is located in South Africa. EIA report, feasibility study or project description
2)	Double counting (b)	The SSC-CPA has not yet been included in another programme of activities or has not yet been registered as a single CDM project activity.	Agreement between CME and CPA where the CPA legally confirms its unique adhesion to this PoA as CDM component project activity; and evidence that the CME has cross-checked the information available on the UNFCCC website on the non existence of similar CDM project activities/component project activity, as described in the management system, section C. For the purpose of identification, each CPA will have a unique name, which will at least refer to the location of the

			CPA and the installed capacity of the project. The CME will also confirm that there is no geographical overlap between the CPA and another single CDM project or CPA of the same type as described in the management system, section C.
3)	Technology (c)	The SSC-CPA involves the implementation of a grid-connected renewable energy technology including solar PV, wind and hydro (run-of-river or with water accumulation reservoirs), which will only supply electricity to the national grid. SSC-CPAs involving the use of renewable biomass, geothermal, solar thermal and tidal/wave technologies for generating electricity are excluded from this programme of activities. In terms of compliance with testing/certification, the project will comply with the relevant standards as referred to in the Request for Qualification and Proposals for New Generation Capacity under the IPP Procurement Programme or other relevant policy guideline. In the current IPP Procurement Programme guidelines, no specific certification is required for hydro projects. CPAs will also not include the combination of both renewable and non-renewable components (e.g. a wind/diesel unit). Thereby the proposed SSC-CPA is the installation of a new power plant at a site where no renewable power plant was operated prior to the implementation of the project	Feasibility study/technical description, PPA and/or EIA report by certified EIA specialist. In the current IPP Procurement Programme guidelines, no specific certification is required for hydro projects. Feasibility study/technical description, and/or EIA report by certified EIA specialist. In case the above mentioned documentation does not specify explicitly the non-deployment of non-renewable components, a confirmation letter that the CPA will not involve the use of non-renewable components and or on site fossil fuel consumption will be provided by the CPA implementing entity. Feasibility study/technical description, and/or EIA report by certified EIA specialist. In case the mentioned documentation does not clarify sufficiently that there was no renewable power plant operated at the project site

		activity (greenfield plant). CPAs will not involve energy generating equipment that is transferred from another activity If the proposed SSC-CPA is a hydropower plant: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; or • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2; or • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2.	before, a confirmation letter that no renewable power plant has been operated at the project site so far will be provided by the CPA implementing entity. Feasibility study/technical description, and/or EIA report by certified EIA specialist . In case the above mentioned documentation does not specify explicitly the non-deployment of generating equipment transferred from another activity, a confirmation letter that the CPA will not involve the use of generating equipment transferred from another activity will be provided by the CPA implementing entity. Not applicable, since the CPA is a run-of-river hydro power plant, which does not involve reservoirs.
4)	Start date (d)	The start of the SSC-CPA occurs is not, or will not be prior 12/06/2012 which is the commencement of the validation of the proposed CDM PoA, i.e. the date on which the PoA-DD is first published for global stakeholder consultation The start date will be defined as the earliest date on which a contract	Contract with party providing equipment/construction/operation services.

		has been signed for equipment, construction or operation services required for the CPA. If the none of contracts for the equipment, construction or operation services required for the CPA are available at the time of inclusion of the CPA, the CPA start date will automatically be after 12/06/2012 since the start date of the CPA could not have taken place before.	
5)	Applicability of methodology (e)	The SSC-CPA meets all the applicability criteria of version 17 of AMS I.D Grid connected renewable electricity generation as per section B.2, part II of the PoA-DD.	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D Grid connected renewable electricity generation is explained in section D.2 of the specific CPA-DD.
6)	Additionality (f)	The SSC-CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown below (Additionality related eligibility criteria).	Additionality check carried out in D.5 of each CPA-DD in line with additionality-related eligibility criteria.
7)	Stakeholder consultation and EIA (g)	(a) The SSC-CPA has carried out a local stakeholder consultation. (b) The SSC-CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations	a) Evidence that a local stakeholder consultation was carried out. These evidences may include a summary of concerns raised and clarification provided and other information such as attendance sheet, invitations and photographs. (b) Environmental Impact Assessment (EIA) report and/or EIA license.
8)	ODA (h)	The SSC-CPA has not received funding from Annex I parties that results in a diversion of official development assistance	In case no ODA is involved, confirmation letter from CPA implementing entity that the CPA has not received funding from Annex I parties. In case ODA is involved, confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
9)	Target group (g)	The SSC-CPA supplies electricity to the South African national grid or supplies electricity to an identified consumer facility via the national grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation proving that the CPA supplies electricity to a national grid; or supplies electricity to an identified consumer facility via national grid through a contractual arrangement such as wheeling.

10)	Installed capacity limits (k)	The installed capacity of the SSC-CPA is smaller than or equal to 15 MW. However, if a CPA is applying the additionality Option A for microscale project activities, the installed capacity of the SSC-CPA will be smaller than or equal to 5 MW.	Feasibility study/technical description
11)	Debundling (l)	The SSC-CPA is not a debundled component of a large-scale project activity in accordance with the latest approved version of the Guidelines on assessment of debundling for SSC project activities (version 03).	Debundling check carried out in line with the latest approved version of the Guidelines on assessment of debundling for SSC project activities (version 03).

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

In case the CPA is microscale, the following criteria apply:

Option A: Microscale additionality	
Criteria	*Means of verification*
Installed capacity of the SSC-CPA is smaller than or equal to 5 MW	Feasibility study or other relevant project documentation.
The geographic location of the CPA is in a special underdeveloped zone (SUZ) of the host country, South Africa. or The CPA employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	Geographical coordinates of the CPA South African government official notification delineating special underdeveloped zones (SUZs) for development assistance including planning, management, and investment satisfying the following condition: - The portion of the population with income less than USD 2 per day (PPP) in the region is greater than 50% Or, those areas have been approved by the Executive Board of the CDM based on recommendations or Documentation from the CDM Executive Board recognizing the specific renewable energy technology used by the SSC-CPA.
Rationale	
In case the SSC-CPA is a microscale CPA, i.e. CPAs up to five megawatts that employ renewable energy technology, additionality will be demonstrated using the *Guidelines for demonstrating additionality of microscale project activities* (version 04.0). SSC-CPAs under the PoA follow the methodology AMS-I.D, therefore eligible SSC-CPAs will have to follow paragraph 2 (a) or paragraph 2 (d) of the guidelines as they are grid-connected renewable energy technologies, in order to demonstrate microscale additionality.	

In case the SSC-CPA is not a microscale CPA, additionality will be demonstrated using *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) and the *Non binding best practice examples to demonstrate additionality for SSC project activities* (version 01).

<table>
<tr><th colspan="2">Option B.1 Investment Barrier (Paragraph 1 (a) of EB 68, Annex 27)</th></tr>
<tr><td>Criteria</td><td>Means of verification</td></tr>
<tr><td>Without the CDM revenue of the SSC-CPA, a financially more viable alternative to the CPA would have led to higher emissions. In order to evidences that SSC-CPA is less financially attractive than the baseline scenario, a benchmark analysis will show that the CPA financial indicator is less favourable than the benchmark applied.

Therefore, the following steps will be taken in line with paragraph 12 of the Guidelines on the assessment of investment analysis (version 05):

Step 1: CPAs will apply one of the following two benchmark indicators based on parameters which are standard in the market at the time of investment decision of the SSC-CPA:

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

The pre-tax, nominal Weighted Average Cost of Capital is an appropriate benchmark because it circumvents the impact of loan interest on income tax calculations (see also paragraph 11 in the Guidelines on the assessment of investment analysis (version 05). The post-tax nominal Return on Equity is considered an appropriate benchmark because equity investors and shareholders are mostly interested in after tax cash flows.</td><td>Investment analysis spread sheet and appropriate evidences for benchmark calculation and all relevant input parameters in accordance with Guidelines on the assessment of investment analysis (version 05).

1. The Return on Equity will be based on the default value as provided in the latest version of the Guidelines on the assessment of investment analysis for Group 1 projects in South Africa (i.e. 10.9%).

2. Standard market commercial lending rates for hydro power plants will be used in order to determine the cost of debt. This will be evidenced by applicable lending term sheets, confirmation from experienced third party or publicly available rates issued by credible entities e.g. South African Reserve Bank.

3. The inflation will be based on one of the following options:
• The inflation forecast of the South African Reserve Bank for the duration of the CPA crediting period
• The target inflation of the South African Reserve Bank
• The average forecasted inflation rate for South Africa published by the IMF or the World Bank for the next five years after start of the project activity

4. The tax rate used in line with the South African corporate tax legislation, currently being 28%.

5. The relevant debt/equity ratio observed for the hydro power plants in South Africa will be applied. This will be based on publicly available data issued by credible entities e.g. NERSA or by written confirmation of a experienced third party,</td></tr>
<tr><td>Step 2: CPAs will apply one of the following two financial indicators based on parameters which are standard in the market at the time of investment decision of the SSC-CPA:
• Pre-tax Project IRR, based on nominal cash-flows</td><td>Investment analysis spread sheet and appropriate credible evidences for IRR calculation and all input parameter in accordance with Guidelines on the assessment of investment analysis (version 05).
Credible evidences for the input parameter are:</td></tr>
</table>

• Post-tax equity IRR, based on nominal cash-flows The WACC will be the benchmark for the Project IRR and the Return on Equity will be the benchmark for the Equity IRR in accordance with paragraph 12 of *Guidelines on the assessment of investment analysis* (version 05). The calculation of the financial indicator will be carried out in accordance with all provisions outlined in the *Guidelines on the assessment of investment analysis* (version 05).	• Documentation that has been prepared by an experienced third party • Documentation that has been approved or issued by South African governmental authorities • Documentation that has been submitted to or received from financing institutions like banks and equity providers • Documentation submitted for official purposes such as documents submitted to South African authorities. • Documentation that carries an official signature from the CPA implementing entity, CME or project participant. This is only applicable if the CPA implementing entity can provide evidence that the values used are considered standard in the market.
Step 3: A sensitivity analysis carried out in line with the *Guidelines on the assessment of investment analysis* (version 05) will demonstrate in which scenarios the CPA would pass the benchmark. The sensitivity analysis will show that a deviation of +10% and -10% of the parameters as shown below will not lead to a scenario that the CPA crosses the benchmark: • Electricity generation • Tariff • Investment cost • Operating and maintenance cost Step 4: The sensitivity analysis will also demonstrate in which scenarios the CPA would pass the benchmark and demonstrate the non-likelihood of occurrence of those scenarios.	Investment analysis spread sheet and CPA-DD.
Rationale	
Investment barrier: a financially more viable alternative to the CPA would have led to higher emissions. The investment barrier shall be demonstrated using benchmark analysis in accordance with the provisions of the *Non-binding best practice examples to demonstrate additionality for SSC project activities* (EB35, Annex34) and the *Guidelines on the assessment of investment analysis* (version 05).	

Option B.2 Access-to-capital Barrier (Par 1 (d) “other barriers” of EB 68, Annex 27)	
Criteria	*Means of verification*
The CPA implementing entity has signed a loan agreement/term sheet with a company that also buys the CERs. The loan agreement/term sheet explicitly mentions that it requires the transfer of CERs to the facilitating entity since this shows that the loan was assured due to the benefit of the CDM.	Loan agreement or Emission Reduction Purchase Agreement (ERPA)

<table>
<tr><td>or,

The CPA implementing entity has received a significant part of the project investment as a pre-payment for expected CERs.

and,</td><td></td></tr>
<tr><td>The CPA implementing entity has provided information about the ownership of the project which shows that, at the time the of equity investment/loan agreement based on the CERs is made, there is no significant shareholding by multinational companies, state-owned companies or companies listed on the Johannesburg Stock Exchange

and,

The project has provided its financial statements for the most recent year prior to the of equity investment/loan agreement based on the CERs, which shows that raising finance off is difficult, as per its balance sheet.</td><td>Incorporation documents of the entity implementing the SSC-CPA.

and,

Financial statements for the most recent year prior to the investment based on the CERs.</td></tr>
<tr><td colspan="2">Rationale</td></tr>
<tr><td colspan="2">Access-to-capital barrier: the CPA could not access appropriate capital without consideration of the CDM revenues. The access-to-capital shall be demonstrated by referring to guidelines 1 and 6 of the Guidelines for objective demonstration and assessment of barriers (version 01.0), as follows:
9. While demonstrating barriers related to the lack of access to capital, information should include nature of company, organization and its ownership and, financial information. A company that is a subsidiary of a multinational group may have different access to capital, technologies or skilled labour than a local SME company.
10. The project proponent should demonstrate in the PDD that the financing of the project was assured only due to the benefit of the CDM. Therefore, it should be demonstrated that the loan approval (or other significant financing decision(s)) by the lender takes explicitly the CDM registration into account. For the cases where the investment is done by a company which also purchases the CERs and the loan agreement mentions that, there is an objective demonstration that the CDM facilitated the lending.
The rationale behind this demonstration is that CPA implementing entities had raised finance thanks to the expected CERs. This evidence will be supported by demonstrating that without CDM, the project would have had difficulties to raise that finance as there is no multinational company, state-owned company, or company listed in the Johannesburg Stock Exchange with a significant share of the project which would have had facilitated the raising of financing. The financial statements will back it up by, for instance, showing that there is a lack of sufficient assets to work as collateral.</td></tr>
</table>

Option B.3 *Barrier due to prevailing practice* is not applicable to hydro projects as there are already small-scale and micro-scale hydro projects in South Africa. Option C *Automatic additionality,* as explained in Part I of this PoA-DD, is also not possible for hydro power (run-of-river) projects in South Africa. Therefore, they have not being included.

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

The generic CPA will focus on grid-connected renewable electricity generation from hydro power plants (run-of-river). The generic CPA 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 CPA (greenfield plant).

CPAs will not include the combination of both renewable and non-renewable components (e.g. a hydro/diesel unit).

The emission factor of the grid is 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 described in the *Tool to calculate the emission factor for an electricity system* (version 02.2.1).

Baseline emissions

The baseline emissions for CPAs involving hydro power (run-of-river) are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

The baseline emissions (BE_y) are calculated using **equation (1)** of AMS-I.D version 17:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

Where:

BE_y	=	Baseline Emissions in year y (t CO_2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2grid,y}$	=	CO_2 emission factor of the grid in year y (t CO_2/MWh)

As per AMS-I.D (version 17):

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

Calculation of $EF_{CO2,grid,y}$

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

The grid emission factor will be calculated for the South African electricity system 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 are not spot markets in the South African grid system
- Although the South African grid is connected to a number of its neighboring countries' grids including Lesotho, Namibia, Swaziland, Botswana and Mozambique, there is no data available to provide proof of the existence of significant transmission constraints by means of the application criteria, therefore the application criteria does not result in a clear grid boundary.
- Finally, South Africa does not have a layered dispatch system and 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):

m) Simple OM
n) Simple adjusted OM
o) Dispatch data analysis OM
p) Average OM

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

- Coal used in South African power plants is a cheap resource compared to other technologies e.g. natural gas/kerosene because South Africa is the 6th largest producer of coal in the world with one of the lowest coal prices in the world.[71]
- 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 base load plants.

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

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

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

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

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:

$EF_{grid,OM\text{-}ave,y}$	=	Average operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year *y* (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year *y* (tCO_2/MWh)
m	=	All grid power units serving the grid in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

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

$EG_{m,y}$ for CDM projects have been estimated based on the existing monitoring reports on the CDM website. Although the monitoring reports are not available for three years, it is considered to be more conservative to include an estimate for the electricity generation for the CDM projects for the calculation of the emission factor (both the operating margin and the build margin) than to assume that there was no electricity generation by the CDM projects for the years during which no data was available. Based on the number of months and the electricity generation reported in the monitoring report, the electricity generated per month was first calculated. This was then multiplied by twelve to get the generation per year.

		Generation Data (*MWh*)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Arnot	Coal	11,987,281	13,227,864	12,194,878
Camden	Coal	6,509,079	7,472,070	7,490,836
Duvha	Coal	21,769,489	22,581,228	20,267,508
Grootvlei	Coal	1,249,556	2,656,230	3,546,952
Hendrina	Coal	12,296,687	12,143,292	11,938,206
Kendal	Coal	23,841,401	23,307,031	25,648,258
Komati	Coal	-	1,016,023	2,060,141
Kriel	Coal	18,156,686	15,906,816	18,204,910
Lethabo	Coal	23,580,232	25,522,698	25,500,366
Majuba	Coal	22,676,924	22,340,081	24,632,585
Matimba	Coal	26,256,068	27,964,141	28,163,040
Matla	Coal	21,863,400	21,954,536	21,504,422

Tutuka	Coal	21,504,122	19,847,894	19,067,501
Acacia	Gas (Jet kerosene)	-	971.00	992.00
Port Rex	Gas (Jet kerosene)	-	322.00	5,507.00
Ankerlig	Gas/Diesel Oil	-	6,303.00	-
Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-
Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,756,730**	**228,828,053**	**232,394,838**

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:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

$FC_{i,m,y}$ = Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (Mass or volume unit)

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)

$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/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:

$EF_{EL,m,y}$ = CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)

$EF_{CO2,m,i,y}$ = Average CO_2 emission factor of fossil fuel type *i* in power unit *m* in year *y* (tCO_2/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	0	0	219,913.98

	(Jet kerosene)			
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	30%	0.84
Port Rex	0.0697	30%	0.84
Ankerlig	0.0726	39.5%	0.66
Gourikwa	0.0726	39.5%	0.66

The default value for open cycle gas turbines that began generation after the year 2000 in Annex 1 in the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) has been used for Ankerlig and Gourikwa whereas the default value for the years before 2000 have been used for Acacia and Port Rex.

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 CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/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 (mm/dd/yy)
1	Bethlehem hydroelectric project	Hydro	11/11/09
2	Durban landfill gas Bisasar Road project	Land Fill Project	03/01/08
3	PetroSA biogas to energy	Waste water	09/01/07
4	Gourikwa	Gas fuel	03/30/07
5	Ankerlig	Gas fuel	03/29/07
6	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006
7	Klipheuwel	Wind	08/01/02
8	Majuba	Coal	04/01/96
9	Kendal	Coal	10/01/88
10	Palmiet	Pumped storage	04/18/88
11	Matimba	Coal	12/04/87
12	Lethabo	Coal	12/22/85
13	Tutuka	Coal	06/01/85
14	Colleywobbles	Hydropower	01/01/85
15	Koeberg	Nuclear	07/21/84
16	Ncora	Hydropower	03/01/83
17	Drakensberg	Pumped storage	06/17/81
18	Duvha	Coal	01/18/80

19	Matla	Coal	09/29/79
20	Second Falls	Hydropower	04/01/79
21	First Falls	Hydropower	02/01/79
22	Vanderkloof	Hydropower	01/01/77
23	Port Rex	Gas fuel	09/30/76
24	Acacia	Gas fuel	05/13/76
25	Kriel	Coal	05/06/76
26	Arnot	Coal	09/21/71
27	Gariep	Hydropower	09/08/71
28	Hendrina	Coal	05/12/70
29	Grootvlei	Coal	06/30/69
30	Camden	Coal	12/21/66
31	Komati	Coal	11/06/61

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 %**	***EGm,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 $SET_{sample\text{-}CDM}$ was calculated.

	Name	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,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	09/01/07	0.028%	23,286
CDM	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006	0.030%	3,744

	Total	***AEG SET**$_{sample-CDM}$*		***69,736***

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

Number	Name	Technology	Year of Commissioning	Cumulative %	*EGm,y (MWh/y)*
1	Gourikwa	Gas fuel	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	09/01/07	0.0%	23,285.54
	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	November 2006	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** $_{SETsample-CDM>10years}$*			***50,350,579***

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

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

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,,y}$	=	Average CO_2 emission factor of fuel type *i* used in power plant *m* in year *y* (tCO_2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	The power *units* included in the build margin
y	=	The relevant year as per the data vintage chosen in Step 5

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

Name	***Technology***	***EFCO₂,m,i,y (tCO₂/GJ)***	***ηm,y***	***EFEL,m,y***
Gourikwa	Gas fuel	0.0726	39.5%	0.66
Ankerlig	Gas fuel	0.0726	39.5%	0.66
Klipheuwel	Wind	0.0000	-	-
Bethlehem hydroelectric project	Hydro	0.0000	-	-
Durban landfill gas Bisasar Road project	Land fill	0.0000	-	-
PetroSA biogas to energy	Waste water	0.0000	-	-
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	0.0000	-	-
Majuba	Coal	0.0895	35.5%	0.91
Kendal	Coal	0.0895	35.5%	0.91
	AEG SETsample-CDM>10years			

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

Name	***Technology***	***EFel,m,y (tCO_2/MWh)***	***EGm,y (MWh/y)***
Gourikwa	Gas fuel	0.66	-
Ankerlig	Gas fuel	0.66	-
Klipheuwel	Wind	-	2,000.00
Bethlehem hydroelectric project	Hydro	-	8983
Durban landfill gas Bisasar Road project	Land fill	-	31723
PetroSA biogas to energy	Waste water	-	23286
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	-	3744
Majuba	Coal	0.91	24,632,585
Kendal	Coal	0.91	25,648,258
Total	***AEG SETsample-CDM>10years***		***50,350,579***

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

Step 6: Calculate the Combined Margin
Option A i.e. the weighted average combined margin is used.

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 CO_2 emission factor in year *y* (tCO_2/MWh)
$EF_{grid,CM,y}$	=	Operating margin CO_2 emission factor in year *y* (tCO2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

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

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

$$EF_{grid,CM,y} = EF_{CO2,grid,y}$$

Project emissions

For most renewable energy projects, $PE_y = 0$. As per the provisions in AMS-I.D (version 17), project emissions will be considered following the procedures described in ACM0002 (version 13.0.0) using **equation (1):**

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$$

Where:

PE_y	=	Project emissions in year *y* (tCO_2e/yr)
$PE_{FF,y}$	=	Project emissions from fossil fuel consumption in year *y* (tCO_2/yr)
$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$PE_{HP,y}$	=	Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr)

Project emissions from fossil fuel consumption ($PE_{FF,y}$)

This CPA involves hydro power plants, which does not comprise fossil fuel consumption of geothermal power plants. Therefore there are no emissions from consumption of fossil fuels.

Emissions of non-condensable gases from the operation of geothermal power plants ($PE_{GP,y}$)

This CPA involves hydro power plants, not geothermal power plants. Therefore there are no emissions of non-condensable gases from the operation of geothermal power plants.

Emissions from water reservoirs of hydro power plants ($PE_{HP,y}$)

This CPA does not hydro power plants with reservoirs SSC-CPAs, therefore there are no emissions of water reservoirs of hydro power plants.

For CPAs involving hydro power (run-of-river), project emissions (PE_y) are considered 0.

Leakage emissions

CPAs included in the PoA will not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

In line with the used methodology AMS-I.D. (version 17) the emission reduction are calculated using **equation 10** in AMS-I.D (version 17), as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2/y)
BE_y	=	Baseline Emissions in year *y* (t CO_2/y)
PE_y	=	Project emissions in year *y* (t CO_2/y)
LE_y	=	Leakage emission in year *y* (t CO_2/y)

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

SPECIFIC PARAMETERS FOR GRID EMISSION FACTOR CALCULATIONS

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

Fuel Type	NCV (GJ/kg)
Coal (other bituminous coal)	0.0199
Gas/Jet kerosene	0.042
Gas/Diesel Oil	0.0414

Data / Parameter	**$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$**
Unit	tCO_2/GJ
Description	CO_2 emission factor 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 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	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	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 (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

Fuel Type	$EFCO_2$ (tCO_2/GJ)
Coal (other bituminous coal)	0.0895
Gas/Jet kerosene	0.0697
Gas/Diesel Oil	0.0726

Data / Parameter	**$\eta_{m,y}$**
Unit	-
Description	Average net conversion efficiency of power unit *m* in year *y*
Source of data	Default value for open cycle gas turbines built before and after 2000 and Fluidised Bed System (FBS) coal generation technology for units built before and in 2000 is used as per Annex 1 of the *Tool to calculate the emission factor for an electricity system.*
Value(s) applied	<table><tr><th>Type of turbine</th><th>Efficiency</th></tr><tr><td>Open cycle gas turbines built before and in 2000</td><td>30%</td></tr><tr><td>Open cycle gas turbines built after 2000</td><td>39.5%</td></tr><tr><td>(FBS) coal generation technology for units built before and in 2000</td><td>35.5%</td></tr></table>
Choice of data or Measurement methods and procedures	There is no data published on the efficiency of Eskom's gas power plants, therefore default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

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

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

B.6.3. Ex-ante calculations of emission reductions

Baseline emissions

The baseline emissions for CPAs involving hydro power (run-of-river) are to be calculated as follows:

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

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

Calculation of $EG_{facility,y}$

Parameter	**Value**	**Unit**	**Source**
$EG_{facility,y}$	[insert value]	[insert unit]	[insert source]

Calculation of $EF_{CO2,grid,y}$

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

$$EF_{CO2,grid,y} = EF_{grid,CM,y}$$

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

Values to determine $EF_{grid,CM,y}$ for hydro power (run-of-river) SSC-CPAs:

Parameter	**Value**	**Unit**	**Source**
$EF_{grid,BM,y}$	0.9063	tCO_2/MWh	GEF calculations
w_{BM}	0.5		Defalut value
$EF_{grid,OM-DD,y}$	0.9585	tCO_2/MWh	GEF calculations
w_{OM}	0.5		Default value
$EF_{grid,CM,y}$	0.9324	tCO_2/MWh	GEF calculations

Therefore:

For CPAs involving hydro power (run-of-river) $EF_{CO2,grid,y}$ = 0.9324 tCO_2/MWh

For CPAs involving hydro power (run-of-river) BE_y = [Insert] * 0.9324 = [Insert] tCO_2/year

Project emissions

For CPAs involving hydro power (run-of-river), project emissions (PE_y) are considered 0.

$PE_y = 0$

Leakage emissions

The CPA does not use energy generating equipment that is transferred from another activity. Therefore, leakage emissions are not considered.

Emission reductions

$$ER_y = BE_y - PE_y - LE_y$$

Therefore, emission reductions equal:

For CPAs including hydro power (run-of-river): [insert value of BE_y] – 0 - 0 = [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

GENERAL PARAMETERS

<table>
<tr><td>Data / Parameter</td><td>$\mathbf{EG_{facility,y}}$</td></tr>
<tr><td>Unit</td><td>MWh/yr</td></tr>
<tr><td>Description</td><td>Quantity of net electricity generation supplied by the project plant/unit to the grid in year y</td></tr>
<tr><td>Source of data</td><td>Electricity meter(s)</td></tr>
<tr><td>Value(s) applied</td><td>To be reported in the specific CPA-DD</td></tr>
<tr><td>Measurement methods and procedures</td><td>The following parameters shall be measured:
(i) The quantity of electricity supplied by the project plant/unit to the grid; and
(ii) The quantity of electricity delivered to the project plant/unit from the grid

Metering for electricity generation will be conducted with calibrated measurement equipment according to relevant industry standards and the Code of practice of electricity metering SANS 474:2009/NRS 057:2009.

The electricity supplied to the grid and delivered to the project plant/unit from the grid will be measured continuously (hourly measurement and at least monthly recording) by a main (facility metering installation) and a back-up meter (system metering installation). The facility meter is installed at the Delivery Point with the electricity grid as agreed with the national transmission company (NTC) or distributor, as applicable. The system meter will be installed adjacent to the facility metering installation in accordance with the transmission agreement or distribution agreement, as applicable.</td></tr>
<tr><td>Monitoring frequency</td><td>The quantity of electricity supplied to the grid will be measured continuously and recorded at least monthly. The basic measurement period shall be carried out in line with PPA and SANS 474:2009/NRS 057:2009.</td></tr>
<tr><td>QA/QC procedures</td><td>Cross-check measurements results with records of sold electricity.

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

<table>
<tr><td>Size of project</td><td>Accuracy Class</td><td>Interval for period calibration (years)</td></tr>
<tr><td>10 MVA to < 100 MVA</td><td>0.5S</td><td>5</td></tr>
<tr><td>1 MVA to < 10 MVA</td><td>1</td><td>10</td></tr>
</table></td></tr>
<tr><td>Purpose of data</td><td>Calculation of baseline emissions</td></tr>
<tr><td>Additional comment</td><td>-</td></tr>
</table>

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

Overall authority and responsibility for monitoring will rest with the CME, which will also be responsible for managing the emission reduction monitoring and verification process.

In order to enable verification of emission reductions the CPA must maintain credible, transparent and adequate data measurement, collection, estimation and tracking systems. The following monitoring procedures and responsibilities will apply.

CPA implementing entity

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

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

The CPA implementing entity will appoint a monitoring officer who will be in charge of the CPAs monitoring responsibilities as described above.

The following parameters will be monitored:

Parameter	Description	Type of CPA
$EG_{facility,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All

CPA implementing entity will monitor and keep records of the quantity of net electricity supplied to the grid as a result of the implementation of the CDM CPA in year y ($EG_{facility,y}$). CPA implementing entity will be responsible for preparing invoices for the sales of electricity to the national transmission company (NTC) or the distribution company, as applicable. The quantity of electricity supplied to the grid will be reported to the CME on a quarterly basis for the previous three months and will be accompanied by supporting evidence for cross-checking purposes. CPA implementing entity will keep electronic copies of all CDM related data at its headquarters, at least until two years after the end of the last crediting period.

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

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

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

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

The Facility Metering Installation will be installed at the Delivery Point, which defines the commercial boundary between the licensee and the customer. The System Metering Installation will be also installed at the Delivery Point at the NTC or distributor side, as applicable.
The Facility Metering Installation readings will be crosschecked with the copies of invoices sent by the CPA implementing entity to the NTC or distributor, and the proof of payment of those invoices. If there is a difference between the values, the most conservative value will be used.

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

Table 24. Metering accuracy and calibration frequency

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

Emergency procedure: In case there is disagreement between the NTC and the CPA implementing entity with regard to the meter readings because the readings of the Facility Metering Installation and the System Metering Installation are significantly different from one another and/or demonstrate a level of inaccuracy beyond a tolerance level of as per table 24 above then the Facility Metering Installation and the System Metering Installation shall both be tested. Should the Facility Metering Installation be found to have a level of inaccuracy beyond the tolerance as described above, then the Facility Metering Installation shall be recalibrated and the electricity output will be based on the readings registered by the System Metering Installation from the date of the last previous test of the Facility Metering Installation.

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

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

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

Carbon Africa - Coordinating/managing entity

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

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

- Preparation of monitoring report

The CME will carry out a quality control on the data received as described below and store them in the electronic database. The CME will prepare monitoring reports for submission to the DOE for verification on a regular basis.

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

The database contains the following information:

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

Training

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

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

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

Organization	Carbon Africa Limited
Street/P.O. Box	P.O. Box 14938
Building	-
City	Nairobi
State/Region	-
Postcode	00800
Country	Kenya
Telephone	+254 731 851 754
Fax	-
E-mail	info@carbonafrica.co.ke
Website	www.carbonafrica.co.ke
Contact person	Adriaan Tas
Title	Director
Salutation	Mr
Last name	Tas
Middle name	-
First name	Adriaan
Department	-
Mobile	-
Direct fax	-
Direct tel.	-
Personal e-mail	adriaan@carbonafrica.co.ke

Organization	Climate Corporation Emissions Trading GmbH
Street/P.O. Box	Guntramsdorfer Street 103
Building	-
City	Moedling
State/Region	-
Postcode	2340
Country	Austria
Telephone	+43 2236 8002 7000
Fax	+43 2236 8002 7099
E-mail	mn@climatecorp.com
Website	Climatecorp.eu
Contact person	Michael Novoszad
Title	Director Carbon Assets
Salutation	Ms
Last name	Stockmayer
Middle name	-
First name	Josefin
Department	-
Mobile	-
Direct fax	-
Direct tel.	+43 2236 8002 7006
Personal e-mail	mn@climatecorp.com

Appendix 2: Affirmation regarding public funding

No public funding involved in the PoA

Appendix 3: Application of methodology(ies)

No additional information

Appendix 4: Further background information on ex ante calculation of emission reductions

Net electricity generated by power plant/unit *m* in year *y* ($EG_{m,y}$)

		Generation Data (MWh)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Arnot	Coal	11,987,281	13,227,864	12,194,878
Camden	Coal	6,509,079	7,472,070	7,490,836
Duvha	Coal	21,769,489	22,581,228	20,267,508
Grootvlei	Coal	1,249,556	2,656,230	3,546,952
Hendrina	Coal	12,296,687	12,143,292	11,938,206
Kendal	Coal	23,841,401	23,307,031	25,648,258
Komati	Coal	-	1,016,023	2,060,141
Kriel	Coal	18,156,686	15,906,816	18,204,910
Lethabo	Coal	23,580,232	25,522,698	25,500,366

Majuba	Coal	22,676,924	22,340,081	24,632,585
Matimba	Coal	26,256,068	27,964,141	28,163,040
Matla	Coal	21,863,400	21,954,536	21,504,422
Tutuka	Coal	21,504,122	19,847,894	19,067,501
Acacia	Gas (Jet kerosene)	-	971.00	992.00
Port Rex	Gas (Jet kerosene)	-	322.00	5,507.00
Ankerlig	Gas/Diesel Oil	-	6,303.00	-
Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-
Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,756,730**	**228,828,053**	**232,394,838**

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

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

Appendix 5: Further background information on the monitoring plan

No additional information

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History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the programme design document form for small-scale CDM programmes of activities" (EB 66, Annex 13).
01	EB33, Annex43 27 July 2007	Initial adoption.
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