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

CONTENTS

Annexes

NOTE:

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

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

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

A.1 Title of the programme of activities:

South African Large Scale Grid Connected Solar Park Programme

Version number: 1.0

Date: 02/04/2012

A.2. Description of the programme of activities:

The energy system of the Republic of South Africa (RSA) is heavily dependent on fossil fuels, and the uptake on grid connected Renewable Energy (RE) power plants in the country is slow due to substantial coal reserves[1]. As of 31 March 2010 the total net capacity of coal-fired power plants servicing the national grid of the RSA is 34 658 MW (84.8% of the total net maximum capacity of all power plants servicing the grid)[2].

The main objective of the South African Large Scale Grid Connected Solar Park Programme is to contribute to the development and promotion of RE in the RSA by building a framework to secure carbon revenue for solar park[3] developers. The programme seeks to develop a series of grid connected solar power projects that supply clean electricity to either the national grid of the RSA or an identified consumer via RSA's grid. CDM programme activities (CPAs) included into this programme envisage the installation and operation of a solar park on a site where no solar park has been operated prior to the implementation of the CPA (Greenfield installation) as well as the capacity addition of an existing solar park.

Participation in this programme will enable the solar park developers to overcome the political and financial barriers and uncertainties associated with RE development in the RSA as well as to increase the economic viability of solar park construction projects due to the revenue from selling CERs.

The reduction of GHG emissions as a result of the implementation of CPAs will be achieved due to reduction of CO_2 emissions from combustion of fossil fuel at the existing grid-connected power plants and plants which would likely be built in the absence of the CPAs.

The Coordinating and Managing Entity of this programme is Blue World Carbon Asset Management (Pty) Ltd (BWC). BWC will act as a carbon consultant to develop all necessary CDM documentation, conduct procedures for PoA approval by the CDM Executive Board, direct CPA inclusion, monitor CPAs, and sell CERs in the international market for all CPAs under the PoA.

1. General operating and implementing framework of the PoA

The energy system of the RSA is managed by the state-owned company Eskom which is in charge of generation, transmission and distribution of power to end-users.

Independent Power Producers (IPPs) within the power generation sector of the RSA were called by South African Department of Minerals and Energy releasing "White Paper on Renewable Energy" as far back as 2003[4]. However the first Regulatory Guidelines on "Renewable Energy Feed-in Tariff (REFIT)" were only published by the National Energy Regulator of South Africa (NERSA) in March 2009. In March

[1] The RSA has the world's 6th largest recoverable coal reserve (nearly 50 billion tones).
[2] Eskom Annual Report 2010, page 298, http://financialresults.co.za/2010/eskom_ar2010/index.htm
[3] In this PoA 'solar' exclusively refers to production of electricity by the use of solar energy.
[4] http://www.energy.gov.za/files/policies/whitepaper_renewables_2003.pdf

2011 the NERSA published revised values for REFIT for public discussion where the tariffs for most types of RE were significantly reduced. On the 31st of July 2011 the Department of Energy released a competitive bidding scheme under which interested project developers may partake[5]. Currently the REFIT for solar generated electricity must be below 2.85 R/kWh. It should be noted that to date no solar park developers managed to sign a Power Purchase Agreement (PPA) with any state-owned entity and managed to obtain a REFIT for their PPA (hereafter 'Government PPA')[6]. The solar park developers also have an opportunity to sell power at a market price either to local municipalities or private consumers transporting power via the national grid or directly to the local municipalities (hereafter 'Private PPA'). Both Government PPAs and Private PPAs are eligible under this PoA.

The Coordinating and Managing Entity (CME) of this programme is Blue World Carbon Asset Management (Pty) Ltd. BWC will act as a carbon consultant to develop all necessary CDM documentation, conduct procedures for PoA approval by the CDM Executive Board, direct CPA inclusion, monitor CPAs, and sell CERs in the international market for all CPAs under the PoA. BWC receives a fee for their services. A schematic diagram of the flow of money and CERs between BWC, solar park developers and CER buyers can be seen in Figure A.3-1 below.

Participation in the PoA is voluntary. A solar park developer may choose whether or not to participate in the programme. If the developer decides to join the PoA, he has to sign a servicing agreement with BWC. Otherwise the developer may try to register its project under other schemes in order to get carbon credits.

2. **Policy/measure or stated goal of the PoA**

The main goal of the PoA is to establish a CDM framework to which solar power projects can be added as CPAs thus overcoming some political and financial barriers that solar park developers face in the RSA.

The other goals are the contribution to achievement of the goal to generate 10 000 GWh of electricity from renewable energy by 2013[7] and the objective to reduce RSA's GHG emissions by approximately 34% below the current emissions baseline by 2020.[8]

The programme satisfies all sustainable development criteria identified by the DNA of the RSA. The sustainable development is defined as "the integration of social, economic and environmental factors into planning, implementation and decision-making so as to ensure that development serves present and future generations"[9]. The main benefits of the implementation of the present PoA are:

1. Social and economic: Promotion and development of solar power technology in the RSA which in turn will lead to the creation of new job opportunities both during the construction and operation phases and to growth in tax revenues. Sales of carbon credits generated by each CPA will result in increased foreign direct investment;

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[5] http://www.ipp-renewables.co.za/

[6] Definition 'Government PPA' is referred to cases when the produced electricity is sold via specially determined Renewable Energy Feed-In Tariff for solar power generation projects, which usually has a higher value compared to the market values (such as tariffs of Private PPAs and existing electricity tariffs). Therefore, the REFIT value is established due to national and/or sectoral policies or regulations that give comparative advantages to less emissions-intensive technologies (RE technologies) over more emissions-intensive technologies.

[7] http://www.energy.gov.za/files/renewables_frame.html

[8] http://www.unep.org/climatepledges/Default.aspx?pid=68

[9] Sustainable development criteria for approval of CDM projects by the DNA of the CDM, Department of Minerals and Energy, RSA (page 1) http://www.energy.gov.za/files/esources/kyoto/Web%20info/Annex%203%20SA%20Sustainable%20Development%20Criteria.pdf

2. Environmental: Mitigation of the negative environmental impact. Combustion of fossil fuels (mostly coal) at Eskom's power plants and hereby emissions of the harmful substances into the atmosphere, such as flue ash, oxides of sulphur and nitrogen will be reduced due to the implementation of each CPA under this PoA;

Another advantage of solar power is the fact that it does not utilize water in order to produce energy[10]. The RSA is a semi-arid country with freshwater being the country's most limiting natural resource. The available freshwater resources are already almost fully-utilised and under stress.[11] Eskom consumes 1.34 L/kWh[12] which amounts to approximately 32 GL/a. The large-scale implementation of solar parks will reduce the water footprint of RSA's energy sector.

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

This PoA is not established as a result of a mandatory policy or regulation of the Government of the RSA. The proposed PoA is a voluntary action and initiative of BWC (the CME of this PoA). Participation under this PoA is voluntary.[13]

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

Name of Party involved ((host) indicates a Host Party)	Private and/or public entity(ies) project participants (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of South Africa (Host Party)	• Blue World Carbon Asset Management (Pty) Ltd (Private company)	No

The Coordinating and Managing Entity (CME) of this programme is Blue World Carbon Asset Management (Pty) Ltd (BWC). BWC will act as a carbon consultant to develop all necessary CDM documentation, conduct procedures for PoA approval by the CDM Executive Board, direct CPA inclusion, monitor CPAs, and sell CERs in the international market for all CPAs under the PoA. BWC receives a fee for their services and manage the PoA according to the PoA management system.

The basic operating framework of this PoA is illustrated in Figure A.3-1.

[10] http://www.waterfootprint.org/?page=files/Water-energy
[11] http://www.ngo.grida.no/soesa/nsoer/issues/water/ (Freshwater systems and resources, Dr R. D. Walmsley et al, from department of water affairs and forestry)
[12] Eskom Annual Report 2010, page 2, http://financialresults.co.za/2010/eskom_ar2010/index.htm
[13] Voluntary action declaration of BWC

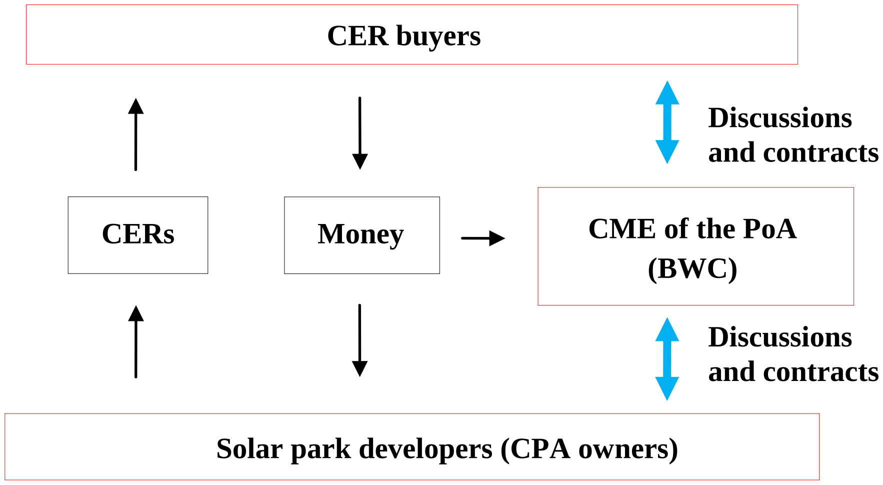

Figure A.3-1: A schematic diagram of the flow of money and CERs between BWC, solar park developers and CER buyers (the blue arrows indicate discussions and contacts)

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

A.4.1. Location of the programme of activities:

A.4.1.1. Host Party(ies):

The Republic of South Africa (RSA)[14]

[14] At later stage the CME may wish to expand the PoA to other regions.

A.4.1.2. Physical/ Geographical boundary:

The geographical boundary for this PoA is the Republic of South Africa (Figure A.4-1).

Figure A.4-1: Geographical boundaries of the RSA

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

A typical CPA under this PoA is one of the following:

a) The installation of a new grid connected solar park at a site where no solar park was operated prior to the implementation of the CPA; or

b) The capacity addition of an existing grid connected solar park[15].

Solar-generated electricity is supplied to either the national grid of the RSA or an identified consumer via the national grid.

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[15] A capacity addition is an increase in the installed power generation capacity of an existing solar park through: (i) the installation of a new solar park beside the existing solar park, or (ii) the installation of new solar park electricity generating equipment, additional to the existing solar park. The existing solar park continues to operate after the implementation of the activity. Therefore the capacity addition does not significantly affect the performance of the existing solar park and the electricity fed into the grid by the capacity addition is directly metered.

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

This PoA falls under sectorial scope: *Energy industries (renewable-/ non renewable sources)*; Type: *Renewable energy;* and category: *Electricity generation and supply*[16].

Each CPA under this PoA envisages the construction and operation of either a solar park or a capacity addition of an existing solar park. A solar park is a type of power plant where the sunlight is converted into electricity. Such power plants may use the following technologies, but are not limited to: Photovoltaics (PV) and Concentrated Solar Power (CSP).

PV Technologies

The term photovoltaic describes a solid-state electronic cell that produces direct current electrical energy from the radiant energy of the sun. "Photo" refers to light and "voltaic" to voltage. Solar cells are made of semi-conducting material, most commonly silicon, coated with special additives. When light strikes the cell, electrons are knocked loose from the silicon atoms and flows in a built-in circuit, producing electricity. If a load is connected under these conditions, an electrical current will result, which is capable of doing work. The current produced is proportional to the amount of light absorbed by the device. In a solar cell the photovoltaic effect is manifested as the generation of voltage at its terminals while being struck by the sun's rays. A solar panel is a packaged interconnected assembly of photovoltaic cells. Figure A.4-2 shows a typical PV solar panel. A PV solar park consists of several arrays of photovoltaic panels connected with each other to produce electricity.

Variations to this technology may include, but are not limited to:

1. Stationary PV: The PV solar panels remain stationery.
2. Concentrated PV: Optics such as lenses is used to concentrate a large amount of sunlight onto a small area of solar PV materials to generate electricity.
3. PV with solar trackers: PV panels are fitted with trackers. The solar tracker is a device which turns the panel towards the sun in order to maximise the amount of direct sunlight on the panel.

Figure A.4-2: Typical PV solar panel

CSP technologies

Concentrated solar power (also called concentrating solar power and CSP) systems use mirrors or lenses to concentrate a large area of sunlight, onto a small area. This type of technologies is also called 'solar thermal energy'. Electrical power is produced when the concentrated light is converted to heat, which

[16] CDM Methodology Booklet (page15), November 2011, http://cdm.unfccc.int/methodologies/documentation/meth_booklet.pdf

drives a heat engine (usually a steam turbine) connected to an electrical power generator. This technology also allows for the storage of thermal energy which can be used during the night.

Variations to this technology may include, but are not limited to:

1. Solar power tower: Solar power tower consists of an array of dual-axis tracking reflectors (heliostats) that concentrate light on a central receiver on top of a tower; the receiver contains a fluid that is heated and then used as a heat source for a power generation or energy storage system. Figure A.4-3 shows a typical CSP plant with tower.
2. Parabolic trough: Parabolic trough consists of a linear parabolic reflector that concentrates light onto a receiver positioned along the reflector's focal line. The receiver is a tube positioned directly above the middle of the parabolic mirror and filled with a working fluid. The reflector follows the sun during the daylight hours by tracking along a single axis. A working fluid is heated to 150–350 °C as it flows through the receiver and is then used as a heat source for a power generation system.
3. Fresnel reflectors: This technology is similar to parabolic trough but consists of many flat linear mirrors instead of a parabolic mirror.
4. Dish Stirling or Dish engine: This system consists of a stand-alone parabolic reflector that concentrates light onto a receiver positioned at the reflector's focal point. The reflector tracks the Sun along two axes. The working fluid in the receiver is heated to 250–700 °C and then used by a Stirling engine to generate power.

Figure A.4-3: Typical CSP plant (with tower)

The amount of electricity which is produced by the solar park is dependent on the irradiation intensity at the site and the type of technology. Solar-generated electricity will be supplied to either the national grid of the RSA or an identified consumer via the national grid.

Solar electricity is clean. Unlike fossil generated electricity, clean energy does not produce CO_2 emissions. Therefore the construction of solar parks for meeting the growing electricity demand of the RSA displaces CO_2 intensive electricity production form fossil fired electricity plants.

Solar power is regarded as an environmentally friendly technology[17], which will also be confirmed as part of the CPA inclusion (see Section A.4.2.2. Eligibility criteria number 10). Solar parks under this PoA must undertake an environmental assessment[18] to identify the negative environmental effects and propose migratory measures according to the RSA's legislation. The main negative environmental effects

[17] Department of Energy of the RSA (http://www.energy.gov.za/files/esources/renewables/r_solar.html)

[18] Related to the capacity, size or other characteristics of the plant

of a typical solar park include: aesthetic disturbance to nearby communities, and possibly disturbance of some ecosystems. Please refer to Section C.3 for the environmental assessments requirement in the RSA.

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

For a CPA to be eligible under the present PoA it has to be assessed against the list of criteria by the CME at the time when the CPA applies to enrol in the PoA.

According to the "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities" (EB 65, Annex 3)[19] the eligibility criteria shall cover as a minimum the conditions set out in Table A.4-2.

Table A.4-2: Eligibility criteria

	Requirements as per "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities" (EB 65, Annex 3)	**PoA eligibility criteria**
(a)	The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA	1. The CPA is in the geographical area of the Republic of South Africa (RSA).
(b)	Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo);	2. The location of the CPA is uniquely identified by the GPS coordinates. The GPS coordinates has been crosschecked with previous records of GPS coordinates of existing CPAs under this PoA to ensure that no overlap between activities can occur. 3. The CPA owner has contractually agreed and signed the following: a) The CPA has neither been and will not be registered as a CDM project activity, nor as a CPA under another PoA; and b) The owner is aware that the activity will be subscribed to the present PoA. 4. The CME has checked the UNFCCC CDM project database to verify that the proposed CPA has not been previously submitted to the UNFCCC.

[19] http://cdm.unfccc.int/Reference/Standards/index_poa.html

(c)	The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;	5. The CPA is one of the following: a) The installation of a new grid connected solar park at a site where no solar park was operated prior to the implementation of the CPA; or b) The capacity addition of an existing grid connected solar park. 6. The CPA is connected to the national grid of the RSA via either: a) The national transmission, distribution or reticulation lines;[20] or b) A municipal electricity network that is connected to the national transmission, distribution or reticulation lines. 7. The CPA is in line with the applicability conditions of ACM0002 (version 12.2.0).
(d)	Conditions to check the start date of the CPA through documentary evidence;	8. The start date of the CPA is clearly defined in the CPA-DD with supporting documentary evidence and is later than the date of start of global stakeholder process for the PoA (05/04/2012).
(e)	Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs;	The CPA is in line with applicability conditions of ACM0002 (This has already been established in criterion 7.)
(f)	The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality;	9. Additionally was demonstrated individually for the CPA according to the procedures described in the Section E.5.1of the CDM-CPA-DD.
(g)	The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;	10. The environmental impact assessment required by RSA's legislation and local stakeholder consultations has been completed.
(h)	Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;	11. No official Development Aid will be involved or diverted as a result of the CPA. The official declaration of 'no development aid' has been provided by the solar park developer.
(i)	Where applicable, target group (e.g. domestic/commercial/industrial, rural /urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation);	Not applicable. There is no target group or distribution mechanism for this PoA.

[20] 'Eskom grid' at the time of drafting of the PoA-DD

(j)	Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys;	Not applicable since no sampling is required under this PoA.
(k)	Where applicable, the conditions that ensure that CPA in aggregate meets the small-scale or micro-scale threshold criteria and remain within those thresholds throughout the crediting period of the CPA;	Not applicable since all CPAs will apply the large scale methodology ACM0002.
(l)	Where applicable, the requirements for the debundling check, in case CPAs belong to small-scale (SSC) or microscale project categories.	Not applicable since all CPAs will apply the large scale methodology ACM0002.
		12. A CME has checked that the CPA satisfies the eligibility criteria of the latest version of the PoA-DD.[21]

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

(i) The proposed PoA is a voluntary coordinated action

This PoA is not implementing any mandatory policy or regulation of the Government of the RSA. In South Africa project developers that seek to privately produce electricity are free to take up any projects and to choose the type of technology as long as the appropriate environmental, construction and operational permits have been obtained. The proposed PoA is a voluntary action and initiative of BWC (the CME of this PoA). Participation under this PoA is voluntary[22].

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

As per paragraph 73 of the 47th EB meeting report "*additionality is to be demonstrated either at the PoA level or at CPA level*".[23]

The additionality for CPAs under this PoA will be demonstrated at CPA level in accordance with the latest version (at the time of drafting the PoA-DD) of the "Tool for the demonstration and assessment of additionality" (Version 6.0.0)[24]. To demonstrate the additionality for a CPA the project developer will have to choose whether to apply an investment analysis, or investment and barrier analysis, together with the common practise analysis. These aspects are addressed in Sections E.5.1 and E.5.2.

[21] Additional criterion identified by the CME
[22] Declaration of voluntary action by BWC
[23] http://cdm.unfccc.int/EB/047/eb47rep.pdf
[24] http://cdm.unfccc.int/methodologies/PAmethodologies/tools (this version of the tool will be applied throughout the document.)

The decision to demonstrate additionality on CPA level was governed by the variability of factors that affect the possible investment or barrier analysis. Over time factors like investment cost, electricity price and exchange rates may vary to such an extent that it surpasses the scope of a generic investment analysis in a PoA. Similarly, for a barrier analysis the state of political, market, technological and investment barriers may alter significantly over the course of the PoA.

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

Not applicable since there is no mandatory policy or regulation in connection with this PoA.

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

Not applicable since there is no mandatory policy or regulation in connection with this PoA.

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

A.4.4.1. Operational and management plan:

According to the "Standard for the development of eligibility criteria for the inclusion of a project activity as a CPA under the PoA" (Version 1.0, EB 63 annex 3, paragraph 9)[25] the CME is required to develop a management system. The 'Management System for South African Large Scale Grid Connected Solar Park Programme (Version 1)' was developed to meet all the requirements of the above standard, and to facilitate efficient management of this PoA.

CPA inclusion will be conducted in 3 subsequent phases.

Phase 1: Request all CPA information and documentary evidence. The CME will maintain an electronic database with information for each CPA that seeks to be subscribed to the PoA.
Phase 2: The CME shall check each of the 12 eligibility criteria according to Table A.4-2.
Phase 3: Drafting of the CDM-CPA-DD.

A.4.4.2. Monitoring plan:

(i) Description of the proposed statistically sound sampling method/procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of greenhouse gases achieved by CPAs under the PoA

Not Applicable since each CPA will be individually monitored, no sampling methods are required.

(ii) In case the coordinating/managing entity opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods) a transparent system is to be defined and described that ensures that no double accounting occurs and that the status of verification can be determined anytime for each CPA;

Refer to the eligibility criteria 2, 3 and 4 (Section A.4.2.2., requirement b) for provisions to avoid double accounting. Each CPA is monitored individually by its own measurement equipment. The monitoring plan will be devised on the CPA level as per the latest version which was published before EB66 of the approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 12.2.0). The

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25 http://cdm.unfccc.int/filestorage/D/C/9/DC92PAJI0NROHF8ME1T35VGSWZYXL4/eb63_repan03.pdf?t=bk18bHlyZHE1fDABbXjTyBh7FTOLn87DYeE_

CME will oversee that monitoring reports are up to standard and will submit the monitoring reports to verification team for each CPA individually.

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

The PoA will not receive public funding[26].

[26] Declaration of No Public funding of BWC

SECTION B. Duration of the programme of activities

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

05/04/2012 (the expected date of publishing of the PoA for global stakeholders comment)

B.2. Length of the programme of activities:

28 years (0 months)

SECTION C. Environmental Analysis

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

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

The environmental analysis will be done at a CPA level. The localized impact of each CPA will need to be assessed individually which justifies separate environmental analyses.

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

The environmental analysis will be done at a CPA level. The different type of environmental analyses is discussed in section C.3. Since all CPAs are grid connect solar parks they will contribute to the reduction of greenhouse gas (GHG) emissions by replacing electricity from fossil fuel based power plants. The positive environmental benefits may include:

- Decreased air pollution linked to the use of the fossil fuels;
- Displacement of fossil fuels and GHG emission reductions;
- Decreased dependency on fossil fuels;
- Job creation.

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

Solar power is a recognised form of clean renewable energy. Using solar power will contribute to South Africa's sustainable development and effectively reduce GHG emissions and the dependence on fossil fuels in the country. In order to apply for environmental authorisation of a solar power project governmental laws and regulations should be followed.

The National Environmental Management Act 107 of 1998, amended in June 2010[27], governs Environmental Impact Assessment (EIA) and requires a scoping assessment and EIA or Basic Assessment (BA) depending on the nature of the activity. The Act is to provide for co-operative, environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for coordinating environmental functions exercised by organs of state; and to provide for matters connected therewith.

[27] http://www.capegateway.gov.za/eng/pubs/public_info/N/200703

The Listing Notices specify measures which cannot be started without environmental authorization from the competent authority. The localized impact of each CPA will need to be assessed individually, which justifies separate environmental analyses. The legislation regarding the electricity production is given below.[28]

Notice	Description of activity involving electricity production	Effect
NEMA listing notice 1:	The construction of facilities or infrastructure for the generation of electricity where: (a) the electricity output is more than 10 megawatts but less than 20 megawatts; or (b) the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare.	Basic assessment is required
NEMA listing notice 2:	The construction of facilities or infrastructure for the generation of electricity where the electricity output is 20 megawatts or more.	Scoping assessment and EIA is required

[28] Other legislations may also be applicable to certain activities under the CPA. The details of such activities (e.g. impact on nearby residents, or physical size of the development) will be discussed in the EIA or BA and may alter the scope of the environmental assessment that is required.

SECTION D. Stakeholders' comments

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

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

Stakeholder consultation will be conducted at CPA level in order to include essential project specific information and to ensure that the all the affected parties have the best opportunity to attend.

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

N/A (Conducted at CPA level)

D.3. Summary of the comments received:

N/A (Conducted at CPA level)

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

N/A (Conducted at CPA level)

SECTION E. Application of a baseline and monitoring methodology

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

The latest version which was published before EB66 of the consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 12.2.0)[29] is applicable to all CPAs registered under this PoA.

The methodology ACM0002 is applicable to grid-connected renewable power generation project activities that propose to install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity, or involves the capacity addition of an existing facility.

The latest version (at the time of drafting of the PoA-DD) of the "Tool to calculate the emission factor for an electricity system" (Version 02.2.1)[30] is used to calculate the combined margin CO_2 emission factor of RSA's grid.

The latest version (at the time of drafting of the PoA-DD) of the "Tool for the demonstration and assessment of additionality" (Version 6.0.0)[31] is used to demonstrate and assess the additionality of each CPA.

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

The ACM0002 methodology is applicable to grid-connected renewable power generation project activities[32] that:

(a) Install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity(greenfield plant);

(b) Involve a capacity addition;

(c) Involve a retrofit of (an) existing plant(s); or

(d) Involve a replacement of (an) existing plant(s).

The proposed CPAs will need to fall under item (a) or (b) to be eligible under this PoA according to the eligibility criteria listed in Section A.4.2.2. Moreover the CPA meets all necessary applicability conditions of the ACM0002 methodology as listed in Table E.2-1.

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[29] http://cdm.unfccc.int/methodologies/PAmethodologies/approved (this version of the methodology will be applied throughout the document.)

[30] http://cdm.unfccc.int/methodologies/PAmethodologies/tools (this version of the tool will be applied throughout the document.)

[31] http://cdm.unfccc.int/methodologies/PAmethodologies/tools (this version of the tool will be applied throughout the document.)

[32] The methodology ACM0002 refers to a "project activity". In the case of a PoA the "project activity" is referred to as a CDM Programme Activity (CPA).

Table E.2-1: Applicability conditions for ACM0002

Applicability condition	Applicability	Reasoning
The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit.	Applicable	The CPA involves either the installation or capacity addition of a solar power plant.
In the case of capacity additions, retrofits or replacements (except for wind, solar, wave or tidal power capacity addition projects which use option 2 on page 11 (of ACM0002) calculate the parameter $EG_{PJ,y}$): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity expansion or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity.	Not Applicable	This condition does not apply to solar power plants.

Applicability condition	Applicability	Reasoning
In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m^2 all the following conditions must apply: • The power density calculated for the entire project activity using equation 5 is greater than 4 W/m^2; • Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project that collectively constitute the generation capacity of the combined power plant; • Water flow between multiple reservoirs is not used by any other hydropower unit which is not a part of the project activity; • Total installed capacity of the power units, which are driven using water from the reservoirs with power density lower than 4 W/m^2, is lower than 15MW; • Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m^2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.	Not applicable	The CPA involves solar power and therefore it does not need to satisfy this applicability condition.
Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site.	Not applicable	Switching from fossil fuels to Renewable Energy is not allowed under this PoA. (According to the ACM0002, the CPA must not satisfy this applicability condition.)

Applicability condition	Applicability	Reasoning
Biomass fired power plants.	Not applicable	Biomass fired power plants are not eligible for a CPA under this PoA. (According to the ACM0002, the CPA must not satisfy this applicability condition.)
Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2.	Not applicable	Hydro power plants are not eligible for a CPA under this PoA. (According to the ACM0002, the CPA must not satisfy this applicability condition.)

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

The spatial extent of the CPA boundary includes the proposed renewable energy power plants and all power plants physically connected to the grid of the Republic of South Africa (Figure E.3-1).

The greenhouse gases and emission sources that are included in or excluded from the CPA boundary are shown in Table E.3-1.

Table E.3-1: Emissions sources included in or excluded from the CPA boundary

Source		Gas	Included ?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the CPA	CO_2	Yes	Main emission source
		CH_4	No	Minor emission sources, which are not included in the baseline
		N_2O	No	
CPA	GHG emissions from the proposed CPA	CO_2	No	GHG emissions for the solar parks are equal to zero and no fossil fuel combustion will occur as part of the operation of the solar park.
		CH_4	No	
		N_2O	No	

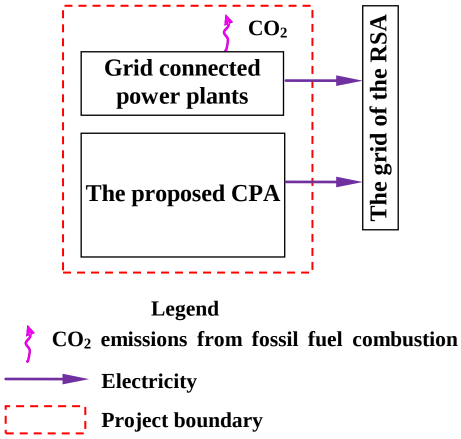

Figure E.3-1: CPA boundary

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

According to the ACM0002:

1. *If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:*

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

2. *If the project activity is a capacity addition to existing grid-connected renewable power plant/unit, the baseline scenario is the following:*

In the absence of the CDM project activity, the existing facility would continue to supply electricity to the grid at historical levels, until the time at which the generation facility would likely be replaced or retrofitted ($DATE_{BaselineRetrofit}$). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and no emission reductions are assumed to occur.

The CPA is one of the following:

a) The installation of a new grid connected solar park at a site where no solar park was operated prior to the implementation of the activity; or

b) The capacity addition of an existing grid connected solar park.

The baseline scenario of the proposed CPAs is:

Type of a CPA	Baseline scenario
a	Electricity delivered to the grid by the solar park would have otherwise been generated by the operation of Eskom's grid-connected power plants and by the addition of new generation sources that is reflected in the CM calculations presented in Section E.6.
b	In the absence of the CPA, the existing facility would continue to supply electricity to the grid at historical levels, until the time at which the generation facility would likely be replaced or retrofitted *($DATE_{BaselineRetrofit}$)*. Electricity delivered to the grid by the capacity addition(s) of the solar park would have otherwise been generated by the operation of Eskom's grid-connected power plants and by the addition of new generation sources that is reflected in the CM calculations presented in Section E.6.

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

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

As discussed in Section A.4.3 the additionally will be demonstrated at the CPA level.

The additionality of the CPA is demonstrated and assessed using the "Tool for the demonstration and assessment of additionality" (hereinafter in Section E.5.1 referred to as 'the tool'). This tool provides for the following step-wise approach:

Step 1: Identification of alternatives to the project activity[33] consistent with current laws and regulations

Step 2: Investment analysis (optional)

Step 3: Barrier analysis (optional)

Step 4: Common practice analysis

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

Realistic and credible alternatives to the proposed CPA shall be provided through the following Sub-steps:

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

[33] The 'Tool for the demonstration and assessment of additionality' refers to a "project activity". In the case of a PoA the "project activity" is referred to as a CDM Programme Activity (CPA).

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

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

The alternatives available to the solar park developer or similar project developers that provide outputs or services comparable with the proposed project activity are to include:

(a) The proposed project activity undertaken without being registered as a CDM project activity;

(b) Other realistic and credible alternative scenario(s) to the proposed CDM project activity scenario that deliver outputs services (e.g., cement) or services (e.g. electricity, heat) with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology;

(c) If applicable, continuation of the current situation (no project activity or other alternatives undertaken).

According to the ACM0002 the baselines for eligible projects are:

1. *If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:*

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

2. *If the project activity is a capacity addition to existing grid-connected renewable power plant/unit, the baseline scenario is the following:*

In the absence of the CDM project activity, the existing facility would continue to supply electricity to the grid at historical levels, until the time at which the generation facility would likely be replaced or retrofitted ($DATE_{BaselineRetrofit}$). From that point of time onwards, the baseline scenario is assumed to correspond to the project activity, and no emission reductions are assumed to occur.

Also according to the tool: *Project activities that apply this tool in context of approved consolidated methodology ACM0002 only need to identify that there is at least one credible and feasible alternative that would be more attractive than the proposed project activity.*

<u>For each CPA the following alternatives shall be considered:</u>

Alternative 1	The proposed CPA is undertaken without CDM revenue
Alternative 2	The CPA participant does not undertake an investment but an investment to provide comparable outputs or services is undertaken by a third party (or parties).

Outcome of Sub-step 1a: Both alternatives are to be discussed individually in each CPA-DD. These alternatives are carried to Sub-step 1b.

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

Both alternatives shall be in compliance with all applicable mandatory legal and regulatory requirements.

The mandatory laws that govern the proposed construction of new facilities are discussed in section C. Any project that seeks to be added to the PoA will be in compliance with these laws.

Outcome of Sub-step 1b shall be: Both alternatives are in compliance with mandatory legislation and regulations.

Then the project developer has to proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). The project developer shall proceed to Step 2 (Investment analysis).

Step 2: Investment analysis

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

(a) The most economically or financially attractive; or

(b) Economically or financially feasible without the revenue from the sale of Certified Emission Reductions (CERs).

The BWC shall demonstrate that the proposed CPA is not economically or financially feasible without the revenue from the sale of CERs using the following Sub-steps:

Sub-step 2a: Determine appropriate analysis method

Sub-step 2b: Apply simple cost analysis (Option I), investment comparison analysis (Option II) or benchmark analysis (Option III)

Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III)

Sub-step 2d: Sensitivity analysis (only applicable to Option II and III)

Sub-step 2a: Determine appropriate analysis method

It has to be determined whether to apply simple cost analysis (Option I), investment comparison analysis (Option II) or benchmark analysis (Option III).

The CPAs will generate financial and economic benefits other than CER revenues, so the simple cost analysis (Option I) is not applicable. Following the paragraph 16 of the latest version (at the time of drafting of the PoA) of the “Guidelines on the assessment of investment analysis” (Version 05)[34] “*if the alternative to the project activity is the supply of electricity from the grid, this is not considered an investment and a benchmark approach is considered appropriate*” the benchmark analysis (Option III) shall be used.

Sub-step 2b: Apply benchmark analysis (Option III)

For the benchmark analysis, the project Internal Rate of Return (project IRR) before tax shall be used to determine the project financial viability. An appropriate benchmark shall be determined at the time when a CPA is being added to the PoA and according to the requirements of the “Tool for the demonstration and assessment of additionality” and “Guidelines on the assessment of investment analysis”

According to the paragraph 13 of the “Guidelines on the assessment of investment analysis” “*in the cases of projects which could be developed by an entity other than the project participant the benchmark should be based on parameters that are standard in the market*”.

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

According to the Tool the project developer should while calculating a suitable financial indicator “*include all relevant costs (including, for example, the investment cost, the operations and maintenance*

[34] http://cdm.unfccc.int/Reference/Guidclarif/reg/index.html

costs), and revenues (excluding CER revenues, but possibly including inter alia subsidies/fiscal incentives[35]*, ODA, etc*".

In South Africa electricity prices for renewable energy projects are contractually determined by means of a Power Purchase Agreement (PPA). Two options are considered under this PoA.

1. Government PPA: in this case the produced electricity will be sold via specially determined Renewable Energy Feed-In Tariff (REFIT) for solar power generation projects, which has a higher value[36] compared to the market values[37]. The REFIT value is established due to national and/or sectoral policies or regulations that give comparative advantages to less emissions-intensive technologies (RE technologies) over more emissions-intensive technologies.
2. Private PPA: in this case the produced electricity will be sold to a grid connected entity (typically a municipality or other identified consumer) at a predetermined market price[38].

At the twenty-second meeting the Executive Board (EB) accepted "Clarifications on the consideration of national and/or sectoral policies and circumstances in baseline scenarios" (Version 02)[39] where EB separates out following two types of national and/or sectoral policies that are to be taken into account when establishing baseline scenarios (paragraph 6):

(a) National and/or sectoral policies or regulations that give comparative advantages to more emissions-intensive technologies or fuels over less emissions-intensive technologies or fuels (so called type E+);

(b) National and/or sectoral policies or regulations that give comparative advantages to less emissions-intensive technologies over more emissions-intensive technologies (e.g. public subsidies to promote the diffusion of renewable energy or to finance energy efficiency programs) (so called type E-).

According to the paragraph 7 of this clarifications "*national and/or sectoral policies or regulations under paragraph 6 (b) that have been implemented since the adoption by the COP of the CDM M&P (decision 17/CP.7, 11 November 2001) need not be taken into account in developing a baseline scenario (i.e. the baseline scenario could refer to a hypothetical situation without the national and/or sectoral policies or regulations being in place)*".

In November 2003 South African Department of Minerals and Energy released White Paper on Renewable Energy (White Paper)[40] where it sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in the RSA.

White Paper, page i,*"It is in this context that the Ministry is committed to this policy document which is intended to give much needed thrust to renewable energy; a policy that envisages a range of measures to bring about integration of renewable energies into the mainstream energy economy. To achieve this aim Government is setting as its target 10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro".*

[35] "*See EB guidance on the consideration of national/local/sectoral policies and measures for the baseline setting*"
[36] At the time of the PoA-DD drafting this value is determined through the bidding process. There procedures may be changed in the future.
[37] At the time of the PoA-DD drafting this value is determined based on average electricity price for the national grid of the RSA.
[38] This may include additional fees for the use of the national grid to transfer power.
[39] http://cdm.unfccc.int/EB/022/eb22_repan3.pdf
[40] http://unfccc.int/files/meetings/seminar/application/pdf/sem_sup1_south_africa.pdf (White paper on renewable energy)

In March 2009 the National Energy Regulator of South Africa (NERSA)[41] approved a Renewable Energy Feed - In Tariff[42] to meet the government target of 10 000 GWh by 2013. REFIT for PV solar parks was 3.94 ZAR/kWh. In March 2011 an updated REFIT tariff of 2.311 ZAR/kWh was published. On the 31st of July 2011 the Department of Energy released a competitive bidding scheme under which interested project developers may partake[43]. Currently the REFIT for PV solar generated electricity must be below 2.85 R/kWh. The REFIT will only be allowed to increase according to the Cost Price Index (CPI).

According to the latest version (at the time of writing the PoA-DD) of "Clarifications on the consideration of national and/or sectoral policies and circumstances in baseline scenarios" (Version 02) the policy pursued by NERSA falls under E- policy and need not be taken into account (see paragraph 7 (b) for more details).

Thus, an additional income that will be received due to REFIT (compared with an income which would have been received in the absence of REFIT) should be excluded from the calculation of revenues. Instead, a hypothetical feed-in tariff (FIT) which would have existed in the absence of such REFIT should be used to calculate the project IRR before tax.

Table E.5-1 shows the typical input data that is required to calculate the project IRR for a CPA.

[41] http://www.nersa.org.za/
[42] 'REFIT' refers to a general REFIT determined by the government, which may adopt different strategies and change over time.
[43] http://www.ipp-renewables.co.za/

Table E.5-1: Input data to calculate project IRR before tax CPA

Parameter	Unit	Data source/comment
Capacity of the solar park	MW	Project developer or Feasibility Study, EIA or Basic assessment, PPA or other official documents.
Load factor of the solar park	ratio	
The period of assessment	years	The period of assessment shall be determined based on commercial lifetime of the solar park, but the period of assessment is limited to 20 years.
Electricity tariff[44]	ZAR/kWh	<u>For Government PPA:</u> the E- policy is applied and hypothetical feed-in tariff shall be used. <u>For projects that involve a private PPA:</u> Use electricity price agreed upon in PPA.
Total investment cost	ZAR/kW (or ZAR)	Documents from the project developer such as Feasibility Study, EIA or Basic assessment, PPA or others as well as from any official document, public announcement, or information that was made officially available in any other way by ESKOM, NERSA, a governmental related department within the RSA, the UNFCCC or the project participants of the CPA.
Operations and Maintenance (O&M) costs	ZAR/kW (or ZAR)	
ZAR exchange rate[45]	ZAR/Currency	Publically available data source

These values are used to calculate and compare the project IRR before tax for the CPA with the benchmark (as calculated according to *Sub-step 2b* of this section).

Outcome of Sub-step 2c, if:

Project IRR of the CPA ≥ Benchmark	The CPA is economically feasible without the revenue from the sale of CERs. Proceed to Step 3 (Barrier analysis)
Project IRR of the CPA < Benchmark	The CPA is not economically feasible without the revenue from the sale of CERs. This serves as a strong argument in favour of additionality. Proceed to Sub-step 2d (Sensitivity analysis)

Sub-step 2d: Sensitivity analysis

A sensitivity analysis is included to show that the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid

[44] The electricity tariff may be adjusted to account for transportation of electricity and the use of the grid.

[45] The exchange rate will typically be required if the solar park equipment is imported. The average exchange rate over a 6 month period will be used. Any applicable currency may be applied, which will depend on information provided by the project participants.

argument in favour of additionality as this sensitivity analysis consistently supports (for a realistic range of assumptions) the conclusion that the CPA is likely or unlikely to be economically attractive.

According to the paragraph 17 of the "Guidelines on the assessment of investment analysis" only variables that constitute more than 20% of either total project costs or total project revenues should be included in the sensitivity analysis. The sensitivity analysis should at least cover the range of +10% and -10%.

According to these guidelines the following variables are normally included in the sensitivity analysis:

- Income from electricity sale
- Investment cost; and
- Operations and Maintenance (O&M) costs.

The results of the sensitivity analysis shall be displayed in table format as illustrated in Table E.5-2.

Table E.5-2: Sensitivity analysis of the project IRR before tax of the CPA

Variable	Variation				
	-10%	-5%	0%	+5%	+10%
Electricity Price					
Investment Cost					
O&M Cost					

In the sensitivity analysis all variables are varied individually. If any one of the IRR values calculated in Table E.5-2 are higher than or equal to the benchmark the CPA is deemed to be economically feasible without the sale of CERs.

Outcome of Sub-step 2d, if:

Any one of the IRR values presented in Table E.5-2 for the CPA ≥ Benchmark	The investment analysis does not provide a valid argument in favour of additionality. Proceed to Step 3 **(**Barrier analysis)
All IRR values presented in Table E.5-2 for the CPA < Benchmark	The investment analysis provides a valid argument in favour of additionality. Proceed to Step 4 (Common practice analysis). (Step 3 is optional)

Step 3: Barrier analysis

The barrier analysis is optional, and will therefore be applied only in cases where the project participants believe that the *Investment analysis (Step 2)* does not, by itself, give a strong argument in favour of additionally for the CPA. Two options are possible:

Skip Step 3	The barrier analysis is not applied, proceed to Step 4 (Common practice analysis)
Apply Step 3	Apply barrier analysis

If Step 3 is applied, determine whether the proposed project activity faces barriers that:

(a) Prevent the implementation of this type of proposed project activity; and

(b) Do not prevent the implementation of at least one of the alternatives if the project is not "first of its kind" according to the definition provided in paragraph 40(c)(i).

For barriers other than barriers due to project being first of its kind as defined in paragraph 40(c)(i), the identified barriers are only sufficient grounds for demonstration of additionality if they would prevent potential project proponents from carrying out the proposed activity undertaken without being registered under this PoA.

Typical barriers include: investment barriers, technological barriers, political barriers, and barriers due to prevailing practice.

The latest version (at the time of drafting the CPA-DD) of "Guidelines for objective demonstration and assessment of barriers"[46] shall be used to demonstrate applicable barriers to the CPA.

Outcome of Sub-step 3a - 3b, if:

Both sub-steps 3a and 3b are satisfied	Proceed to Step 4 (Common practice analysis)
Sub-steps 3a and/or 3b is not satisfied	Additionally has not been demonstrated

<u>Step 4: Common practice analysis</u>

Unless the proposed project type has demonstrated to be first-of-its kind (according to Sub-step 3a), identify and discuss the existing common practice and the extent to which the proposed project type has already diffused in the relevant sector and region using the following Sub-steps:

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

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

The CPA has demonstrated to be 'first of its kind' according to step 3	No common practice analysis is required
CPA is not 'first of its kind'	Apply common practice analysis

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

According to the paragraph 44 of the Tool: *projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing, etc*.

and also,

Other CDM project activities (registered project activities and project activities which have been published on the UNFCCC website for global stakeholder consultation as part of the validation process) are not to be included in this analysis.

[46] Version 01.0 at the time of drafting the PoA-DD, http://cdm.unfccc.int/Reference/Guidclarif/meth/index_guid.html

Similar projects that are occurring at the time the CPA is undertaken shall be identified and discussed in the CPA-DD.

Outcome of Sub-step 4a: If:

There are no activities similar to the CPA in the RSA	The proposed CPA is additional
There are activities similar to the CPA in the RSA	Proceed to sub-step 4b

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

The guidelines in the Tool shall be followed:

"If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity is financially unattractive (as contended in Step 2) or faces barriers (as contended in Step 3). Therefore, if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is financially/economically unattractive or subject to barriers. This can be done by comparing the proposed project activity to the other similar activities, and pointing out and explaining essential distinctions between them that explain why the similar activities enjoyed certain benefits that rendered it financially/economically attractive (e.g., subsidies or other financial flows) and which the proposed project activity cannot use or did not face the barriers to which the proposed project activity is subject. If necessary data/information of some similar projects are not accessible for PPs to conduct this analysis, such projects can be excluded from this analysis. In case similar projects are not accessible, the PDD should include justification about non-accessibility of data/information."

Essential distinctions may include a serious change in circumstances under which the proposed CDM project activity will be implemented when compared to circumstances under which similar projects were carried out. For example, new barriers may have arisen, or promotional policies may have ended, leading to a situation in which the proposed CDM project activity would not be implemented without the incentive provided by the CDM. The change must be fundamental and verifiable.

Outcome of Step 4: If:

There are no activities similar to the CPA in the RSA as per *Sub-step 4a*	***The proposed CPA undertaken without being registered under this PoA is not a baseline scenario; the proposed CPA is additional.***
There are similar activities to the CPA in the RSA, and these projects enjoyed certain benefits that rendered them financial/economically attractive as per *Sub-step 4a and 4b*	***The proposed CPA undertaken without being registered under this PoA is not a baseline scenario; the proposed CPA is additional.***
There are similar project activities to the CPA in the RSA, and these projects did not enjoy benefits that rendered them more financial/economically attractive as per *Sub-step 4b*	***The proposed CPA is not additional.***

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

The requirements for demonstration of additionally are defined in Section E.5.1 (and A.4.3). The key steps are *investment analysis (benchmark analysis and sensitivity analysis), barrier analysis* and *common practice analysis*.

Investment analysis

The flowing information is required for the investment analysis to prove that the CPA is not financially attractive without the CDM contribution:

1. An appropriate benchmark (Sub-step 2b);
2. A Power Purchase Agreement and other CPA specific information as per Table E.5-1 (Sub-step 2c);
3. Calculation of the before tax project IRR for the CPA (Sub-step 2c);
4. Result of sensitivity analysis on the variation of income from electricity sale, investment costs and O&M costs (sub-step 2d).

Barrier analysis

The barrier analysis may be conducted to prove that realistic and credible barriers prevent the implementation of the proposed CPA from being carried out.

Common practice analysis

Conducted to assess how well the technology for each respective CPA is established within the National Energy Sector of the RSA at the time of CPA drafting. If the technology proposed by the CPA is similar to technology that is established it should be proven that this technology enjoyed financial benefits, or favourable political conditions which enabled the construction of these projects.

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

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

ACM0002 will be used to establish the baseline and calculate GHG emission reductions. This methodology also refers to the "*Tool to calculate the emission factor for an electricity system*" for calculations of CM emission factor. The applicability of ACM0002 has already been demonstrated in Section E.2.

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

Project emissions

Since the CPA uses solar energy to generate electricity the project emissions are equal to zero (equation 1 in ACM0002):

$$PE_y = 0 \qquad \text{(E.6-1)}$$

Where:

PE_y = CPA emissions in year *y* (tCO_2e/yr)

Baseline emissions

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the CPA. The ACM0002 methodology stipulates that electricity delivered to the grid[47] by the solar park would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. The baseline emissions are calculated as follows (equation 6 in ACM0002):

$$BE_y = EG_{PJ,y} \cdot EF_{grid,CM,y} \quad \text{(E.6-2)}$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CPA in year *y* (MWh/yr)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* (tCO_2/MWh)

Calculation of $EG_{PJ,y}$

The method for calculation of $EG_{PJ,y}$ may be one of the following possibilities:

1. New grid-connected solar park; or
2. Capacity addition of an existing solar park

New grid-connected solar park

Since the CPA is the installation of a new grid-connected renewable power plant at a site where no renewable power plant was operated prior to the implementation of the CPA, $EG_{PJ,y}$ is calculated as follows (equation 7 in ACM0002):

$$EG_{PJ,y} = EG_{\text{facility,y}} \quad \text{(E.6-3)}$$

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CPA in year *y* (MWh/yr)
$EG_{\text{facility,y}}$	=	Quantity of net electricity generation supplied by the solar park to the grid in year *y* (MWh/yr)

Capacity addition of an existing solar park

According to ACM0002: "*In the case of wind, solar, wave or tidal power plants, it is assumed that the addition of new capacity does not significantly affect the electricity generated by the existing plant(s) or unit(s). In this case, the electricity fed into the grid by the added power plant(s) or unit(s) could be directly metered and used to determine $EG_{PJ,y}$*".

If the CPA is a capacity addition, project participants may use one of the following two options to determine $EG_{PJ,y}$:

Option 1: Use the approach applied to retrofits and replacements in ACM0002. $EG_{facility,y}$

[47] The 'grid' refers to the national grid of the RSA and includes the transmission, distribution, reticulation lines ('Eskom grid' at the time of drafting of the PoA-DD) and municipal networks.

corresponds to the total electricity generation of the existing plant(s) or unit(s) and the added plant(s) or unit(s). A separate metering of electricity fed into the grid by the added plant(s) or unit(s) is not necessary under this option. This option may be applied to all renewable power projects.

Option 2: For wind, solar, wave or tidal power plant(s) or unit(s), the following approach can be used provided that the electricity fed into the grid by the added power plant(s) or unit(s) addition is separately metered:

$$EG_{PJ,y} = EG_{PJ\_add\_y} \quad \text{(E.6-4)}$$

Where:

$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CPA in year *y* (MWh/yr)
$EG_{PJ\_add\_y}$	=	Quantity of net electricity generation supplied to the grid in year *y* by the capacity addition(s) under the CPA (MWh/yr)

Option 2 will be applied for all CPAs, and therefore the additional electricity will be metered separately.

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

Combined margin CO_2 emission factor for grid connected power generation in year *y* ($EF_{grid,CM,y}$) is calculated using the "Tool to calculate the emission factor for an electricity system". According to this tool the following six steps shall be applied:

Step 1: Identify the relevant electricity systems;

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

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

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

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

Step 6: Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electricity systems

Electricity generated by the proposed CPA will be supplied to the national grid of the RSA which is defined as a project electricity system by default. The national grid of the RSA is managed by the state-owned company Eskom which is the only company in the South Africa in charge of generation, transmission and distribution of power to end-users.

The basic scheme of the Eskom electricity network is presented in Annex 3-1.

Data on Eskom's grid-connected power plants as of 31 March 2010 is presented in Annex 3-2.

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

The project participant may choose between the following two options to calculate the operating margin and build margin emission factors:

Option I: Only grid power plants are included in the calculation; or

Option II: Both grid power plants and off-grid power plants are included in the calculation.

Option I was chosen to calculate the operating margin and build margin emission factors.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:

(a) Simple OM; or

(b) Simple adjusted OM; or

(c) Dispatch data analysis OM; or

(d) Average OM.

Option (a) (Simple OM method) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

Low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

The most recent data on the electricity supplied to the national grid of the RSA is presented in Table E.6-1. Share of electricity supplied from the low-cost/must-run sources in total grid generation on average of the five most recent years constitute 7.03%. Thus, Option (a) (Simple OM method) has been chosen to calculate the operating margin emission factor.

Table E.6-1: Electricity supplied to the national grid of the RSA, GWh[48]

Type of power plant	Years*					Average	Share
	04.2005 - 03.2006	04.2006 - 03.2007	04.2007 - 03.2008	04.2008 - 03.2009	04.2009 - 03.2010		
Coal-fired	206 606	215 211	222 908	211 941	215 940	214 521	92,84%
Hydro-electric	1 141	2 443	751	1 082	1 274	1 338	**0,58%**
Pumped storage	2 867	2 947	2 979	2 772	2 742	2 861	**1,24%**
Gas turbine	78	62	1 153	143	49	297	0,13%
Nuclear	11 293	11 780	11 317	13 004	12 806	12 040	**5,21%**
Wind energy	3	2	1	2	1	2	**0,00%**
Total net generation	221 988	232 445	239 109	228 944	232 812	231 060	100,00%

*A reporting year for Eskom starts on the 1st of April and finishes on the 31st of March.

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

- *Ex ante option*: The emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average;
- *Ex post option*: The emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

[48]Eskom Annual Report 2010, page 1, http://financialresults.co.za/2010/eskom_ar2010/index.htm

Ex ante option was chosen to calculate the OM emission factor for all CPAs under this PoA.

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

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

The simple OM may be calculated by one of the following two options:

> *Option A*: Based on the net electricity generation and a CO_2 emission factor of each power unit; or
>
> *Option B*: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

Option A is used as data on the net electricity generation and a CO_2 emission factor of each Eskom's power plant is available. The OM emission factor is calculated as follows:

$$EF_{grid,OM} = EF_{grid,OMsimple} \quad \text{(E.6-5)}$$

Where:

$EF_{grid,OM}$	=	Operating margin CO_2 emission factor calculated ex ante (tCO_2/MWh)
$EF_{grid,OMsimple}$	=	Simple operating margin CO_2 emission factor calculated ex ante (tCO_2/MWh)

The simple operating margin CO_2 emission factor is calculated as follows:

$$EF_{grid,OMsimple} = \frac{\sum_{m,y} EG_{m,y} \cdot EF_{EL,m,y}}{\sum_{m,y} EG_{m,y}} \quad \text{(E.6-6)}$$

Where:

$EF_{grid,OMsimple}$	=	Simple operating margin CO_2 emission factor calculated ex ante (tCO_2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh). Data is presented in Annex 3-3
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
m	=	All power units serving the grid in year *y* except low-cost/must-run power units. The list of power plants included into the operating margin is presented in Annex 3-3
y	=	The relevant year as per the data vintage chosen in Step 3

Data for the three most recent reporting years on operation of Eskom's power plants included into the operating margin is presented in Annex 3-3.

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

As data on fuel consumption and electricity generation for each coal-fired power unit *m* is available, the emission factor ($EF_{EL,m,y}$) for these units is determined as follows (*Option A1*):

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}} \quad \text{(E.6-7)}$$

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). Data is presented in Annex 3-3
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit). Constant value was adopted.
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ). Constant value was adopted.
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh). Data is presented in Annex 3-3
m	=	All power units serving the grid in year *y* except low-cost/must-run power units. The list of power plants included into the operating margin is presented in Annex 3-3
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

As only data on electricity generation for gas turbine power plants is available, *Option A2* is used to determine $EF_{EL,m,y}$ for these plants:

$$EF_{EL,m,y} = \frac{EF_{CO2,m,i,y} \cdot 3.6}{\eta_{m,y}} \quad \text{(E.6-8)}$$

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 unit *m* in year *y* (tCO_2/GJ). Constant value was adopted
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio). Constant value was adopted
m	=	All power units serving the grid in year *y* except low-cost/must-run power units. Option A2 is only used for gas turbine power plants (see Annex 3-3)
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 calculation of the operating margin emission factor is presented in Annex 3-5.

<u>Step 5: Calculate the build margin (BM) emission factor</u>

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

Option 1: For the first crediting period, calculate the build margin emission factor ex ante based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. This option does not require monitoring the emission factor during the crediting period; or

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available.

Option 1 was chosen.

The build margin calculation algorithm is presented in the Figure E.6-1. For simplification three levels were identified for the calculation of the BM.

> *Level A*: Inclusion of power units which started to supply electricity to the grid less than 10 years ago, excluding power units registered as CDM project activities;
>
> *Level B*: Inclusion of power units which started to supply electricity to the grid less than 10 years ago and power units registered as CDM project activities; and
>
> *Level C:* Inclusion of power units which started to supply electricity to the grid more than 10 years ago and power units registered as CDM project activities.

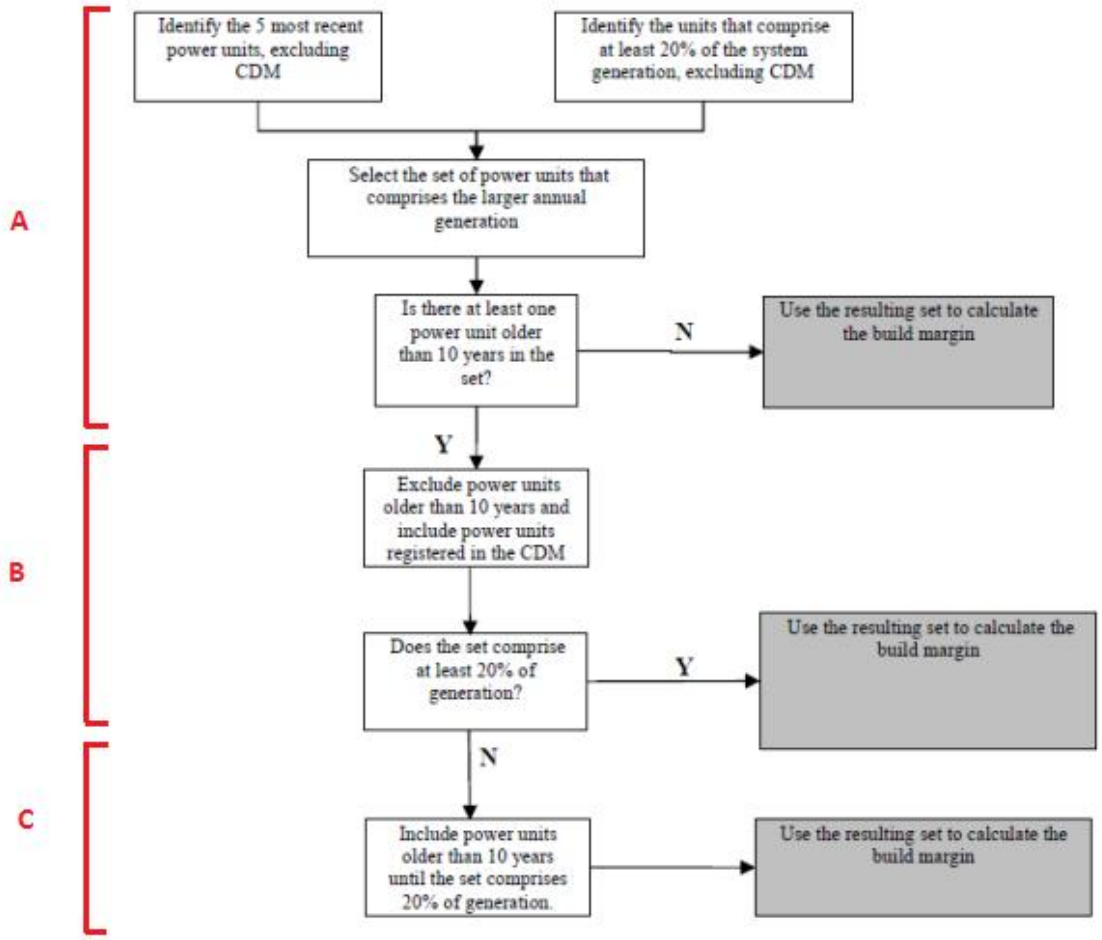

Figure E.6-1: Build margin calculation algorithm

The following procedures were applied to determine the sample group of power units *n* used to calculate the build margin:

a. Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

b. Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

c. From $SET_{5\text{-}units}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

   Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. In this case ignore steps (d), (e) and (f);

The sets of power units $SET_{5\text{-}units}$ and $SET_{\geq 20\%}$ were identified (see Annex 3-4). The set of power units $SET_{\geq 20\%}$ that comprises the larger annual electricity generation was chosen as SET_{sample}. As SET_{sample} includes power units which started to supply electricity to the grid more than 10 years ago, the conditions for *Level A* have therefore not been satisfied and the project developer move to step (d).

d. Exclude from SET_{sample} the power units which started to supply electricity to the grid more than 10 years ago. Include in that set the power units registered as CDM project activities, starting with power units that started to supply electricity to the grid most recently, until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) to the extent is possible. Determine for the resulting set ($SET_{sample\text{-}CDM}$) the annual electricity generation ($AEG_{SET\text{-}sample\text{-}CDM}$, in MWh);

   If the annual electricity generation of that set comprises at least 20% of the annual electricity generation of the project electricity system (i.e. $AEG_{SET\text{-}sample\text{-}CDM} \geq 0.2 \times AEG_{total}$), then use the sample group $SET_{sample\text{-}CDM}$ to calculate the build margin. Ignore steps (e) and (f);

The annual electricity generation of $SET_{sample\text{-}CDM}$ comprises less than 20% of the annual electricity generation of the national grid of the RSA (see Annex 3-4). The conditions for *Level B* have not been satisfied. Therefore continue to step (e) and (f).

e. Include in the sample group $SET_{sample\text{-}CDM}$ the power units that started to supply electricity to the grid more than 10 years ago until the electricity generation of the new set comprises 20% of the annual electricity generation of the project electricity system (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation);

f. The sample group of power units *n* used to calculate the build margin is the resulting set ($SET_{sample\text{-}CDM\text{-}>10yrs}$).

The power units in $SET_{sample\text{-}CDM\ \text{-}>10yrs}$ was used to calculate the build margin. The list of power plants included into the build margin is presented in Annex 3-4.

The build margin emission factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *n* included into the build margin during the most recent year *y* (2010 reporting year) for which electricity generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_n EG_{n,y} \cdot EF_{EL,n,y}}{\sum_n EG_{n,y}} \quad \text{(E.6-9)}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (2010 reporting year) (tCO_2/MWh)
$EG_{n,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit *n* in year *y* (MWh). Data is presented in Annex 3-4
$EF_{EL,n,y}$	=	CO_2 emission factor of power unit *n* in year *y* (tCO_2/MWh)
n	=	Power units included in the build margin. The list of power plants included into the build margin is presented in Annex 3-4
y	=	Most recent historical year for which electricity generation data is available. The 2010 reporting year was selected

The CO_2 emission factor of power unit *n* in year *y* ($EF_{EL,n,y}$) is calculated using Formulas (E.6-7) and (E.6-8).

According to the "Tool to calculate the emission factor for an electricity system" if the power units included in the build margin *n* correspond to the sample group $SET_{sample-CDM->10yrs,}$ then, as a conservative approach, only *Option A2* from *Step 4* can be used to calculate $EF_{EL,n,y}$ and the default values provided in Annex 1 of the Tool shall be used to determine the parameter $\eta_{m,y}$. Therefore Formula (E.6-8) was used to calculate $EF_{EL,n,y}$ for Majuba and Kendal power plants.

The calculation of the build margin CO_2 emission factor is presented in Annex 3-5.

<u>Step 6: Calculate the combined margin emissions factor</u>

The combined margin emission factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,CM} = EF_{grid,OM} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM} \quad \text{(E.6-10)}$$

Where:

$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* (tCO_2/MWh)
$EF_{grid,CM}$	=	Combined margin CO_2 emission factor for grid connected power generation calculated ex ante (tCO_2/MWh)
$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in the most recent year *y* (2010 reporting year) (tCO_2/MWh)
$EF_{grid,OM}$	=	Operating margin CO_2 emission factor (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emission factor
w_{BM}	=	Weighting of build margin emission factor

According to the “Tool to calculate the emission factor for an electricity system” the following default values should be used for solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25.

The calculation of the combined margin CO_2 emission factor is presented in Annex 3-5.

Leakage

According to ACM0002:

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

CPA leakage is therefore zero:

$$LE_y = 0 \quad \text{(E.6-11)}$$

Where:

LE_y = CPA leakage (tCO_2e/yr)

Emission reductions

Emission reductions are calculated as follows (ACM0002, equation 11):

$$ER_y = BE_y - PE_y \quad \text{(E.6-12)}$$

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)

BE_y = Baseline emissions in year *y* (tCO_2/yr)

PE_y = CPA emissions in year *y* (tCO_2e/yr)

Since PE_y (equation E.6-1) is equal to zero, equations E.6-2, E.6-3, E.6-10 and E.6-12 can be combined:

$$ER_y = EG_{CPA,y} \times EF_{grid,CM} \quad \text{(E.6-13)}$$

Where:

ER_y = Emission reductions in year *y* (tCO_2e/yr)

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

$EF_{grid,CM}$ = Combined margin CO_2 emission factor for grid connected power generation calculated ex ante (tCO_2/MWh)

CPAs shall always apply the fixed parameters of the latest version of the PoA-DD. Following parameters are fixed for all CPAs during the first crediting period of the PoA: [49]

[49] http://cdm.unfccc.int/EB/032/eb32_repan39.pdf

Data / Parameter:	$EG_{m,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y*
Source of data used:	Eskom's statistic data
Value applied:	See Annex 3-3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics, publicly available and reliable data source
Any comment:	The data for the three most recent reporting years is provided.

Data / Parameter:	$FC_{i,m,y}$
Data unit:	mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by power unit *m* in year *y*
Source of data used:	Eskom's statistic data
Value applied:	See Annex 3-3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics, publicly available and reliable data source
Any comment:	The data for the three most recent reporting years is provided.

Data / Parameter:	$NCV_{coal,y}$
Data unit:	GJ/t
Description:	Net calorific value of Other Bituminous Coal
Source of data used:	2006 IPCC Guidelines for National GHG Inventories, volume 2: Energy, chapter 1, Table 1.2
Value applied:	19.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	For the sake of a conservative approach the IPCC default value at the lower limit of the uncertainty at a 95% confidence interval is used.
Any comment:	This value was appointed as a constant.

Data / Parameter:	$EF_{CO2,coal,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of Other Bituminous Coal
Source of data used:	2006 IPCC Guidelines for National GHG Inventories, volume 2: Energy, chapter 1, Table 1.4

Value applied:	0.0895
Justification of the choice of data or description of measurement methods and procedures actually applied :	For the sake of a conservative approach the IPCC default value at the lower limit of the uncertainty at a 95% confidence interval is used.
Any comment:	This value was appointed as a constant.

Data / Parameter:	$EF_{CO2,NG,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of Natural Gas
Source of data used:	2006 IPCC Guidelines for National GHG Inventories, volume 2: Energy, chapter 1, Table 1.4
Value applied:	0.0543
Justification of the choice of data or description of measurement methods and procedures actually applied :	For the sake of a conservative approach the IPCC default value at the lower limit of the uncertainty at a 95% confidence interval is used.
Any comment:	This value was appointed as a constant.

Data / Parameter:	η_{OCGT}
Data unit:	ratio
Description:	Average net energy conversion efficiency of open cycle gas turbine power plant
Source of data used:	Tool to calculate the emission factor for an electricity system, Annex 1
Value applied:	0.395
Justification of the choice of data or description of measurement methods and procedures actually applied :	Default value is used
Any comment:	This value was appointed as a constant.

Data / Parameter:	$\eta_{m,y}$
Data unit:	ratio
Description:	Average net energy conversion efficiency of coal fired power plant that has operated for more than 10 years for calculation of the Build Margin.
Source of data used:	Tool to calculate the emission factor for an electricity system, Annex 1
Value applied:	0.37
Justification of the choice of data or description of measurement methods and procedures	Default value is used

actually applied :	
Any comment:	This value was appointed as a constant to Majuba and Kendal power plants for the calculation of build margin CO_2 emission factor (refer to Annex 3-5).

Data / Parameter:	$EG_{n,y}$
Data unit:	MWh
Description:	Net quantity of electricity generated and delivered to the grid by power unit *n* in year *y*
Source of data used:	Eskom's statistic data
Value applied:	See Annex 3-4
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics, publicly available and reliable data source
Any comment:	The data for 2010 reporting year is provided.

Data / Parameter:	$FC_{i,n,y}$
Data unit:	mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by power unit *n* in year *y*
Source of data used:	Eskom's statistic data
Value applied:	See Annex 3-4
Justification of the choice of data or description of measurement methods and procedures actually applied :	Official statistics, publicly available and reliable data source
Any comment:	The data for 2010 reporting year is provided.

Data / Parameter:	$EF_{grid,CM}$
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor for grid connected power generation calculated ex ante
Source of data used:	Calculated (see Annex 3)
Value applied:	0.988
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated *ex ante* based on the "Tool to calculate the emission factor for an electricity system"
Any comment:	This value was appointed as a constant for the whole crediting period.

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

The following parameters will be reported in the CDM-CPA-DD for the CPA.

Data / Parameter:	P_y
Data unit:	MW
Description:	Power capacity of the CPA in year *y*
Source of data used:	Solar park developer
Value applied:	–
Justification of the choice of data or description of measurement methods and procedures actually applied :	Evaluated by the solar park developer
Any comment:	The value reflects the expected maximum power output of the activity.

Data / Parameter:	***LF***
Data unit:	Ratio
Description:	Load factor of the CPA
Source of data used:	Solar park developer or independent verification
Value applied:	–
Justification of the choice of data or description of measurement methods and procedures actually applied :	Evaluated by the solar park developer based on solar irradiation data. The results should be verified by a qualified third party.
Any comment:	This value will be used for the initial estimation of the amount of electricity that will be delivered to the grid by the CPA.

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

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

Data / Parameter:	$EG_{CPA,y}$
Data unit:	MWh/yr
Description:	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CPA in year *y*
Source of data to be used:	On-site measurement with electricity meters
Value of data:	–
Description of measurement methods and procedures to be applied:	Measurement by means of electricity meters installed for the CPA at the point of supply which defines the commercial boundary between the national grid and the solar park owner. The generated electricity will be continuously measured and recorded at least on a monthly basis by the CPA personnel. Data on electricity

	supply will be digitally archived and submitted to the CME.
QA/QC procedures to be applied:	Electricity meters will be calibrated according to South African Bureau of Standards (SABS)[50] (relevant industry standards in the RSA). Readings are cross-checked with records for sold electricity.
Any comment:	-

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

The monitoring plan is devised as per approved consolidated baseline and monitoring methodology ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources". Each CPA will be monitored. The following procedures shall be applied:

1. Monitoring period

The monitoring period starts from the date of commissioning of the CPA or the date of registration of the proposed CPA under the PoA (whichever is later).

2. Data monitored and sources

The quantity of net electricity generation that is produced and fed into the grid by the CPA in year *y* shall be determined on the basis of electricity meters. The generated electricity will be continuously measured and recorded at least on a monthly basis by the CPA personnel. The metering instruments shall be installed in accordance with the requirements of the Grid and the Distribution Metering Codes at the point of supply which defines the commercial boundary between the solar park owner and the grid. Readings of the electricity meters shall be cross-checked with records for sold electricity. Data on electricity supply will be digitally archived and submitted to the CME.

The sources of data for calculation of GHG emission reductions in the course of monitoring shall be the internal electricity billing reports of the solar parks.

The emission reductions shall be calculated using the Formula (B.6-13).

3. The monitoring team

The solar park staff shall undergo the necessary training related to operation and maintenance of the solar park and all of the installed equipment[51]. The maintenance personnel of the solar park are responsible for daily control over the monitoring plan implementation.

The Chief Engineer of the solar park is responsible for timely calibration of all instrumentation in accordance with the manufacturer's requirements and requirements of the South African Bureau of Standards[52]. The respective CPA entity will be responsible for implementation and overall control as well as collection of all data, and submit the data to the CME.

Specialists of BWC will calculate GHG emission reductions with data that will be provided by the respective CPA entity.

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[50] According to the SABS the SANS 474 regulation should be followed.

[51] The CME shall facilitate training for CPA management and personel to ensure that that monitoring and data capture is done in accordance with this PoA.

[52] According to the SABS the SANS 474 regulation should be followed.

In case of any doubts as to the accuracy of the data, the specialists of the respective CPA entity shall check and correct the data. The preliminary version of the monitoring report shall be submitted to the specialists of respective CPA entities for review. In case any mistakes are found in the calculations of GHG emission reductions, the specialists of BWC shall correct these calculations accordingly.

Specialists of BWC shall regularly (at least annually) carry out "test verifications" with a view to ensure that the monitoring plan of the respective CPA entity is applied correctly.

4. Data storage

All data collected as part of monitoring plan should be archived electronically and be kept at least for 2 years after the end of the crediting period.

5. Instrumentation calibration

The instrumentation calibration and check-out shall be carried out by contracted specialized organisations that are licenced for this type of activity, according to the requirements of the manufacturing company, and the South African Bureau of Standards (SABS).

6. Emergency situations

If any instrument that is used in the monitoring process fails, the respective CPA entity shall remedy the situation as soon as possible and if necessary shall replace the instrument. In case of breakdown of any vital electricity generation equipment the electricity generation will go down, and amount of electricity supplied to the grid by the solar park will be reduced. All accidents that occur at the solar park shall be recorded by the respective CPA entity. Information on major accidents shall be included in the monitoring report.

E.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

The date of completing the baseline study and monitoring methodology: 01/04/2012

Baseline was developed by Blue World Carbon Asset Management (Pty) Ltd (BWC is not the project participant).

Contact persons for baseline and monitoring:

- Ilya Goryashin (i.goryashin@ccgs.ru); and
- Tom Hugo (tom.hugo@blueworldcarbon.com)

Contact person/ and entity responsible for the PoA:

- Blue World Carbon Asset Management (Pty) Ltd (The CME), Joost van Lier (Head of CME) (joost.van.lier@blueworldcarbon.com).

Annex 1

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

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

Annex 3-1. Eskom electricity network[53]

53 http://www.eskom.co.za/content/2008EskomPoster.jpg

Annex 3-2. Data on Eskom's grid-connected power plants (at the 31st of March 2010)[54,55]

Name of power plant	Location	Type of power plant (PP)	Type of fuel	Date of commissioning/ (Re-commissioning)*	Total net maximum capacity, MW
Arnot	Middelburg, Mpumalanga	Thermal PP	Coal	1971.09.21	2 232
Camden[56]	Ermelo, Mpumalanga	Thermal PP	Coal	(2005.03.31)	1 440
Duvha	Witbank, Mpumalanga	Thermal PP	Coal	1980.01.18	3 450
Grootvlei[57]	Balfour, Mpumalanga	Thermal PP	Coal	(2008.03.31)	760
Hendrina	Mpumalanga	Thermal PP	Coal	1970.05.12	1 865
Kendal	Witbank, Mpumalanga	Thermal PP	Coal	1988.10.01	3 840
Komati[58]	Middelburg, Mpumalanga	Thermal PP	Coal	(2009.01.05)	170
Kriel	Bethal, Mpumalanga	Thermal PP	Coal	1976.05.06	2 850
Lethabo	Viljoensdrift, Free State	Thermal PP	Coal	1985.12.22	3 558
Majuba	Volksrust, Mpumalanga	Thermal PP	Coal	1996.04.01	3 843
Matimba	Lephalale, Limpopo	Thermal PP	Coal	1987.12.04	3 690
Matla	Bethal, Mpumalanga	Thermal PP	Coal	1979.09.29	3 450
Tutuka	Standerton, Mpumalanga	Thermal PP	Coal	1985.06.01	3 510
Acacia	Cape Town, Western Cape	Gas turbine PP	Kerosene	1976.05.13	171

[54] Eskom Annual Report 2010, page 298, http://financialresults.co.za/2010/eskom_ar2010/index.htm
[55] Data Requirements for Calculating the Carbon Emission Factor (CEF) for the South African Grid, General Information, http://www.eskom.co.za/content/calculationTable.htm
[56] Re-commissioned power plant, Eskom Annual Report 2009, page 63 http://www.financialresults.co.za/eskom_ar2009/ar_2009/downloads.htm
[57] Re-commissioned power plant, Eskom Annual Report 2010, page 126, http://financialresults.co.za/2010/eskom_ar2010/index.htm
[58] Re-commissioned power plant, Eskom Annual Report 2010, page 127, http://financialresults.co.za/2010/eskom_ar2010/index.htm

Name of power plant	Location	Type of power plant (PP)	Type of fuel	Date of commissioning/ (Re-commissioning)*	Total net maximum capacity, MW
Port Rex	East London, Eastern Cape	Gas turbine PP	Kerosene	1976.09.30	171
Ankerlig	Atlantis, Western Cape	Gas turbine PP	Natural gas	2007.03.29	1 327
Gourikwa	Mossel Bay, Western Cape	Gas turbine PP	Natural gas	2007.03.30	740
Colley Wobbles	Mbashe River, Eastern Cape	Hydro PP	-	1900.01.01	0
Ncora	Ncora River, Eastern Cape	Hydro PP	-	1900.03.01	0
First Falls	Umtata River, Eastern Cape	Hydro PP	-	1900.02.01	0
Gariep	Norvalspont, Free State	Hydro PP	-	1971.09.08	360
Second Falls	Umtata River, Eastern Cape	Hydro PP	-	1900.04.01	0
Vanderkloof	Petrusville, Northern Cape	Hydro PP	-	1977.01.01	240
Drakensberg	Bergville Kwazulu-Natal	Hydroelectric Pumped Storage PP	-	1981.06.17	1 000
Palmiet	Grabouw, Western Cape	Hydroelectric Pumped Storage PP	-	1988.04.18	400
Koeberg	Cape Town, Western Cape	Nuclear PP	-	1984.07.21	1 800
Klipheuwel	Klipheuwel, Western Cape	Wind farm	-	**	3

* Re-commissioned units are: Camden, Grootvlei and Komati.

**No data available

Annex 3-3. Data on operation of Eskom's grid-connected power plants included into the operating margin for the 3 most recent reporting years

The list of power plants included into the operating margin[59]

Name of power plant	Type of power plant (PP)	Type of fuel	Total net maximum capacity, MW
Arnot	Thermal PP	Coal	2 232
Camden	Thermal PP	Coal	1 440
Duvha	Thermal PP	Coal	3 450
Grootvlei	Thermal PP	Coal	760
Hendrina	Thermal PP	Coal	1 865
Kendal	Thermal PP	Coal	3 840
Komati	Thermal PP	Coal	170
Kriel	Thermal PP	Coal	2 850
Lethabo	Thermal PP	Coal	3 558
Majuba	Thermal PP	Coal	3 843
Matimba	Thermal PP	Coal	3 690
Matla	Thermal PP	Coal	3 450
Tutuka	Thermal PP	Coal	3 510
Ankerlig	Gas turbine PP	Natural gas	1 327
Gourikwa	Gas turbine PP	Natural gas	740

[59] Kerosene-fired gas turbine power plants were excluded from the operating margin since they were not operated for the 3 most recent reporting years.

Net quantity of electricity generated and delivered to the grid by the power plants included into the operating margin ($EG_{m,y}$)[60]

Name of power plant	Type of fuel	Unit	Years*			Total 04.2007 - 03.2010
			04.2007 - 03.2008	04.2008 - 03.2009	04.2009 - 03.2010	
Arnot	Coal	MWh	11 905 060	11 987 281	13 227 864	37 120 205
Camden	Coal	MWh	5 171 057	6 509 079	7 472 070	19 152 206
Duvha	Coal	MWh	23 622 732	21 769 489	22 581 228	67 973 449
Grootvlei	Coal	MWh	237 138	1 249 556	2 656 230	4 142 924
Hendrina	Coal	MWh	13 756 351	12 296 687	12 143 292	38 196 330
Kendal	Coal	MWh	26 517 420	23 841 401	23 307 031	73 665 852
Komati	Coal	MWh	0	0	1 016 023	1 016 023
Kriel	Coal	MWh	17 762 398	18 156 686	15 906 816	51 825 900
Lethabo	Coal	MWh	25 701 723	23 580 232	25 522 698	74 804 653
Majuba	Coal	MWh	23 680 971	22 676 924	22 340 081	68 697 976
Matimba	Coal	MWh	29 021 742	26 256 068	27 964 141	83 241 951
Matla	Coal	MWh	24 549 833	21 863 400	21 954 536	68 367 769
Tutuka	Coal	MWh	20 980 242	21 504 122	19 847 894	62 332 258
Ankerlig**	Natural gas	MWh	1 153 000	143 000	49 000	1 345 000
Gourikwa**	Natural gas	MWh				
					Total net electricity generation:	651 882 496

*A reporting year for Eskom starts on the 1st of April and finishes on the 31st of March.

**Data was taken from Table B.6-1.

[60]Data Requirements for Calculating the Carbon Emission Factor (CEF) for the South African Grid, General Information, http://www.eskom.co.za/content/calculationTable.htm

Amount of fossil fuel consumed by the power plants included into the operating margin ($FC_{i,m,y}$)[61]

Name of power plant	Type of fuel	Unit	Years*			Total 04.2007 - 03.2010
			04.2007 - 03.2008	04.2008 - 03.2009	04.2009 - 03.2010	
Arnot	Coal	tonnes	6 210 700	6 395 805	6 794 134	19 400 639
Camden	Coal	tonnes	3 218 873	3 876 211	4 732 163	11 827 247
Duvha	Coal	tonnes	12 425 531	11 393 553	11 744 606	35 563 690
Grootvlei	Coal	tonnes	130 748	674 538	1 637 371	2 442 657
Hendrina	Coal	tonnes	7 794 220	7 122 918	6 905 917	21 823 055
Kendal	Coal	tonnes	15 986 131	15 356 595	13 866 514	45 209 240
Komati	Coal	tonnes	0	0	664 497	664 497
Kriel	Coal	tonnes	9 059 934	9 420 764	8 504 715	26 985 413
Lethabo	Coal	tonnes	18 314 572	16 715 323	18 170 227	53 200 122
Majuba	Coal	tonnes	12 853 342	12 554 406	12 261 833	37 669 581
Matimba	Coal	tonnes	14 862 323	13 991 453	14 637 481	43 491 257
Matla	Coal	tonnes	13 795 309	12 689 387	12 438 391	38 923 087
Tutuka	Coal	tonnes	10 627 575	11 231 583	10 602 839	32 461 997
Ankerlig	Natural gas	thousand m^3	N/A**	N/A	N/A	N/A
Gourikwa	Natural gas	thousand m^3	N/A	N/A	N/A	N/A
					Total coal consumption:	369 662 482

*A reporting year for Eskom starts on the 1st of April and finishes on the 31st of March.

**No data available

[61] Data Requirements for Calculating the Carbon Emission Factor (CEF) for the South African Grid, General Information, http://www.eskom.co.za/content/calculationTable.htm

Annex 3-4. Determination of power units included into the build margin[62]

Determination of the set of power units SET_{sample}

<table>
<tr><th></th><th></th><th></th><th>Name of power plant</th><th>Type of power plant (PP)</th><th>Type of fuel</th><th>Date of commissioning</th><th>Net electricity generation ($EG_{n,y}$), MWh</th><th>Weight fraction in total net electricity generation*</th><th>Accumulated weight fraction</th></tr>
<tr><td rowspan="7">SET_{sample}</td><td rowspan="7">$SET_{\geq 20\%}$</td><td rowspan="5">$SET_{5\text{-units}}$</td><td>Komati</td><td>Thermal PP</td><td>Coal</td><td>2009.01.05</td><td>1 016 023</td><td>0.0044</td><td>0.0044</td></tr>
<tr><td>Grootvlei</td><td>Thermal PP</td><td>Coal</td><td>2008.03.31</td><td>2 656 230</td><td>0.0114</td><td>0.0158</td></tr>
<tr><td>Gourikwa</td><td>Gas turbine PP</td><td>Natural gas</td><td>2007.03.30</td><td rowspan="2">49 000</td><td rowspan="2">0.0002</td><td rowspan="2">0.0160</td></tr>
<tr><td>Ankerlig</td><td>Gas turbine PP</td><td>Natural gas</td><td>2007.03.29</td></tr>
<tr><td>Camden</td><td>Thermal PP</td><td>Coal</td><td>2005.03.31</td><td>7 472 070</td><td>0.0321</td><td>0.0481</td></tr>
<tr><td></td><td>Majuba</td><td>Thermal PP</td><td>Coal</td><td>1996.04.01</td><td>22 340 081</td><td>0.0960</td><td>0.1440</td></tr>
<tr><td></td><td>Kendal</td><td>Thermal PP</td><td>Coal</td><td>1988.10.01</td><td>23 307 031</td><td>0.1001</td><td>0.2441</td></tr>
</table>

*Total net electricity generation in 2010 reporting year is 232 812 GWh (see Table B.6-1).

$AEG_{SET\text{-}5\text{-}units}$ = 11 193 323 MWh,

$AEG_{SET\text{-}\geq 20\%}$ = 56 840 435 MWh.

[62]Based on data presented in Annexes 3-2 and 3-3

The sets of power units $SET_{sample\text{-}CDM}$

	Name of power plant	Type of power plant (PP)	Type of fuel	Date of commissioning	Net electricity generation ($EG_{n,y}$), MWh	Weight fraction in total net electricity generation*	Accumulated weight fraction
$SET_{sample\text{-}CDM}$	Bethlehem Hydro	Small Scale Hydro	Renewable	2009.07.18	34 031	0.0001	0.0001
	Komati	Thermal PP	Coal	2009.01.05	1 016 023	0.0044	0.0045
	Grootvlei	Thermal PP	Coal	2008.03.31	2 656 230	0.0114	0.0159
	Gourikwa	Gas turbine PP	Natural gas	2007.03.30	49 000	0.0002	0.0161
	Ankerlig	Gas turbine PP	Natural gas	2007.03.29			
	Camden	Thermal PP	Coal	2005.03.31	7 472 070	0.0321	0.0482

*Total net electricity generation in 2010 reporting year including power units registered as CDM project activities is 232 846 GWh (see Annex 3-5)

$AEG_{SET\text{-}sample\text{-}CDM}$ = 11 227 354 MWh

Data on operation of Eskom's grid-connected power plants and power plants registered as CDM project activities included into the build margin during 2010 reporting year

Name of power plant	Type of power plant (PP)	Type of fuel	Date of commissioning	Fuel consumption ($FC_{i,n,y}$), tonnes	Net electricity generation ($EG_{n,y}$), MWh	Weight fraction in total net electricity generation*	Accumulated weight fraction
Bethlehem Hydro[63]	Small Scale Hydro	Renewable	2009.07.18	0	34 031	0.0001	0.0001
Komati	Thermal PP	Coal	2009.01.05	664 497	1 016 023	0.0044	0.0045
Grootvlei	Thermal PP	Coal	2008.03.31	1 637 371	2 656 230	0.0114	0.0159
Gourikwa	Gas turbine PP	Natural gas	2007.03.30	N/A**	49 000	0.0002	0.0161
Ankerlig	Gas turbine PP	Natural gas	2007.03.29				
Camden	Thermal PP	Coal	2005.03.31	4 732 163	7 472 070	0.0321	0.0482
Majuba	Thermal PP	Coal	1996.04.01	12 261 833	22 340 081	0.0959	0.1442
Kendal	Thermal PP	Coal	1988.10.01	13 866 514	23 307 031	0.1001	**0.2443**

*Total net electricity generation in 2010 reporting year including power units registered as CDM project activities is 232 846 GWh (see Annex 3-5)

**No data available

[63] http://cdm.unfccc.int/Projects/DB/SGS-UKL1245061289.99, CDM PDD, page 12

Annex 3-5. The calculation of the combined margin emission factor

Total net electricity generation in 2010 reporting year including power units registered as CDM project activities, MWh

Net electricity generation	Value
Total Eskom	232 812 000
Bethlehem Hydro	34 031
Total	**232 846 031**

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

Name of power plant	Years		
	04.2007 - 03.2008	04.2008 - 03.2009	04.2009 - 03.2010
Arnot	0.929	0.950	0.915
Camden	1.109	1.061	1.128
Duvha	0.937	0.932	0.926
Grootvlei	0.982	0.961	1.098
Hendrina	1.009	1.032	1.013
Kendal	1.074	1.147	1.060
Komati	-	-	1.165
Kriel	0.908	0.924	0.952
Lethabo	1.269	1.263	1.268
Majuba	0.967	0.986	0.978
Matimba	0.912	0.949	0.932
Matla	1.001	1.034	1.009
Tutuka	0.902	0.930	0.951
Ankerlig Gourikwa	0.495	0.495	0.495

CO_2 emissions of power units *m* in year *y* ($EG_{m,y} \cdot EF_{EL,m,y}$), tCO_2

Name of power plant	Years			Total 04.2007 - 03.2010
	04.2007 - 03.2008	04.2008 - 03.2009	04.2009 - 03.2010	
Arnot	11 061 567	11 391 248	12 100 692	34 553 508
Camden	5 732 974	6 903 726	8 428 219	21 064 918
Duvha	22 130 492	20 292 488	20 917 731	63 340 710
Grootvlei	232 868	1 201 386	2 916 240	4 350 494
Hendrina	13 881 896	12 686 273	12 299 783	38 867 952
Kendal	28 472 099	27 350 864	24 696 955	80 519 917
Komati	0	0	1 183 502	1 183 502
Kriel	16 136 195	16 778 852	15 147 323	48 062 370
Lethabo	32 619 168	29 770 826	32 362 083	94 752 077
Majuba	22 892 445	22 360 025	21 838 938	67 091 407
Matimba	26 470 540	24 919 477	26 070 086	77 460 103
Matla	24 570 135	22 600 433	22 153 396	69 323 964
Tutuka	18 928 242	20 004 011	18 884 186	57 816 440
Ankerlig Gourikwa	570 604	70 769	24 249	665 622
			Total emissions:	659 052 985

Calculation of simple operating margin CO_2 emission factor ($EF_{grid,OMsimple}$)

Parameter	Unit	Value
Total net electricity generation of power units *m* for the 3 most recent reporting years	MWh	651 882 496
Total CO_2 emissions of power units *m* for the 3 most recent reporting years	tCO_2	659 052 985
Simple operating margin CO_2 emission factor	**tCO_2/MWh**	**1.011**

Calculation of build margin CO_2 emission factor ($EF_{grid,BM,y}$)

Name of power plant	Net electricity generation ($EG_{n,y}$), MWh	CO_2 emission factor ($EF_{EL,n,y}$), tCO_2/MWh	CO_2 emissions ($EG_{n,y} \cdot EF_{EL,n,y}$), tCO_2	Build margin CO_2 emission factor ($EF_{grid,BM,y}$), tCO_2/MWh
Bethlehem Hydro	34 031	0	0	
Komati	1 016 023	1.165	1 183 502	
Grootvlei	2 656 230	1.098	2 916 240	
Gourikwa	49 000	0.495	24 249	
Ankerlig				
Camden	7 472 070	1.128	8 428 219	
Majuba	22 340 081	0.871*	19 453 984	
Kendal	23 307 031	0.871*	20 296 015	
Total	**56 874 466**		**52 302 209**	**0.920**

*Recalculated emission factor for power plants which started to supply electricity to the grid more than 10 years ago

Calculation of combined margin CO_2 emission factor ($EF_{grid,CM}$)

Parameter	Unit	Value
Operating margin CO_2 emission factor	tCO_2/MWh	1.011
Weighting of operating margin emission factor	-	0.75
Build margin CO_2 emission factor	tCO_2/MWh	0.920
Weighting of build margin emission factor	-	0.25
Combined margin CO_2 emission factor	**tCO_2/MWh**	**0.988**

Annex 4

MONITORING INFORMATION

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