CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

>>
Bokpoort CSP (Concentrating Solar Power) Project, South Africa
Version: 01
Date: 30/01/2012

A.2. Description of the project activity:

>>
(i) Purpose of the project

The purpose of the proposed project activity is to reduce greenhouse gas emissions by installing a greenfield grid-connected parabolic trough concentrated solar thermal power (CSP) plant. This project will be developed by a Consortium of three entities, namely, ACWA Power Africa Holdings (Pty) Ltd ACWA Power Solafrica Bokpoort CSP Power Plant (Pty) and Solafrica Thermal Energy (Pty) Ltd ("Solafrica"). The power plant is proposed to operate with 50 MWe net power output.

The selected site for the installation of the CSP plant is a portion of Farm Bokpoort 390 located in the Northern Cape Province; of South Africa, where solar irradiation rates are good all year round. A key advantage of the site is that Eskom's[1] Garona substation is situated on the site which currently has a spare feeder bay and is therefore able to receive the intended output.

(ii) Greenhouse gas reduction:

The electricity generated from the CSP plant will displace electricity generated from the South African electricity grid. The South African electricity grid is predominantly coal-fired and therefore GHG emissions intensive (coal accounts for more than 92% of the fuel used in South Africa's electricity generation[2]).

The reduction in electricity consumed from the grid will result in a reduction in greenhouse gas emissions, as well as the negative impacts associated with coal mining.

(iii) Contribution to sustainable development:

The South African Designated National Authority (DNA) evaluates sustainability in three categories[3]: economic, environmental, and social. The contribution towards sustainable development by the project activity is discussed below in terms of these three categories:

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[1] Eskom is South Africa's national electricity provider.

[2] Department of Water and Environmental Affairs. (2010). *National Climate Change Response Draft Green Paper, pg 13, para..3.* Retrieved from South Africa Government Online: http://www.environment.gov.za. Date accessed 16/02/2011.

[3] RSA DNA Guideline 2011

Economic

The deployment of the project activity will have a positive macro-economic impact by reducing South Africa's dependence on fossil fuel generated power and assisting the country in meeting its growing electricity demand.

Economic benefits will extend through the local municipalities jurisdiction which will be derived from the project activity's favourable effects on local employment rates, demand for infrastructure and housing as well as the increased contribution to municipal rates and taxes for the !Kheis Local Municipality.

Environmental

Concentrated solar thermal power technology does not produce the sulphur emissions, ash or coal mining concerns associated with conventional coal fired electricity generation technologies resulting in a relatively low level of environmental impacts. It is a clean technology which contributes toward a better quality environment for employees and nearby communities.

On a global scale, the project makes a contribution to greenhouse gas emission reduction and therefore contributes toward climate change mitigation.

Social

The project activity is likely to have significant long-term, indirect positive social impacts that may extend to a regional and even national scale. The larger scale impacts are to be derived in the utilization of solar power and the experience gained through the construction and operation of the power plant. In future, this experience can be employed at other similar solar installations in South Africa.

The operational phase of the solar power plant will create approximately 50 job opportunities. This includes approximately 20 unskilled jobs, 20 moderately-skilled jobs and 10 highly skilled jobs[4].

It is the intention of the project developer to involve the local community directly with the project by including 10% local or regional ownership in the project through a Broad Based Black Economic Empowerment programme. An organisation called loveLife will receive a 5% share in the project with the remaining 5% going into a bespoke community trust benefitting community members within a 50km radius. There will be further socio-economic development contributions of 1, 25% to loveLife in addition to their dividend stream. An enterprise development programme will be established to support Black Economic Empowerment (BEE) farming initiatives for the majority within a 50km radius of the project. The programme will receive 0, 45% of the revenue.
The increase in the demand for services such as accommodation, transportation, security, general maintenance and catering will generate additional indirect socio-economic benefits for the local community members.

[4] Bohlweki SSI Environmental (February 2011). Environmental Impact Assessment for a proposed 75MW Concentrating Solar Thermal Power Plant and associated infrastructure in the Siyanda District, Northern Cape, page 192.

A.3. Project participants:

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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*	Private entity- ACWA Power Solafrica Bokpoort CSP Power Plant (Pty) Private entity-Solafrica Thermal Energy (Pty) Ltd Private entity-ACWA Power Africa Holdings (Pty) Ltd	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

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Republic of South Africa.

A.4.1.2. Region/State/Province etc.:

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Northern Cape Province.

A.4.1.3. City/Town/Community etc.:

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The project is located northwest of Groblershoop.

A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The selected site is situated on a portion of Farm Bokpoort 390, approximately 20 km north of Groblershoop, Division Gordonia, in the Northern Cape Province of South Africa. The nearest medium sized town is Upington. The farm has a total area of approximately 6 700 hectares and a large proportion of this area is suitable for CSP plant development with a gradient less than 2%.

The new plant will be located at the following GPS coordinates:

28°43’26.96”S

21°59’34.88”E

Location of project activity

Figure 1: Map of South Africa[5]

Location of project activity

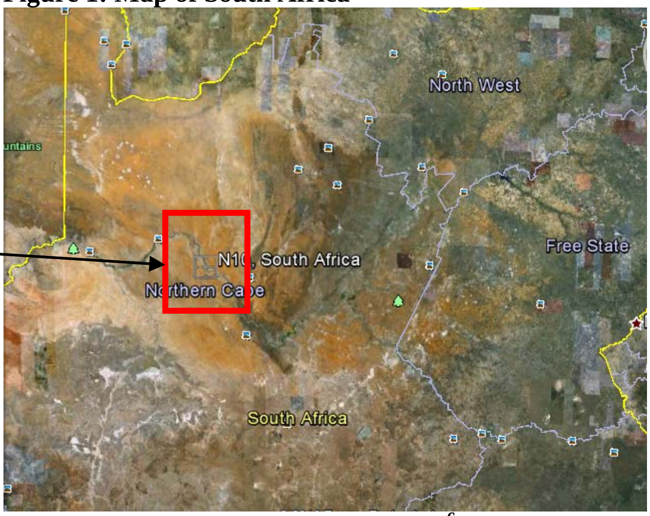

Figure 2: The Northern Cape Province[6]

A.4.2. Category(ies) of project activity:

[5] Retrieved from http://www.nationsonline.org/maps/south_africa_prov_map.jpg

[6] Retrieved from Google Earth

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Sectoral scope 01: Energy industries (renewable-/non-renewable sources)

A.4.3. Technology to be employed by the project activity:

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This project activity will employ parabolic trough concentrated solar thermal technology. The technology generates electricity in a similar way to conventional power stations by using steam to drive a steam turbine generator. The fundamental principle of the technology is to collect the energy carried by sunrays, allowing a heat transfer fluid (HTF) to absorb the collected energy and then converting the thermal energy first into steam and then into electricity. The parabolic trough concentrated solar thermal technology is a clean, safe, sound and environmentally friendly technology in comparison to conventional sources of power generation in South Africa.

The Bokpoort CSP plant was designed for a net capacity of 75MW originally. The REIPPPP RFP released on 3 August 2011 provided an allocation of 200MW for CSP with a maximum capacity limit of 100MW per project. In this regard and with the original intention of submitting the Project to the first round of procurement within the REIPPPP, the Project was compliant and the capacity was maintained at 75MW.

The Bokpoort CSP project was ultimately not submitted in the first procurement phase where Abengoa Solar was awarded 150MW out of the available 200MW for CSP. In order to remain compliant with the remaining capacity for the second phase, the capacity of Bokpoort CSP was reduced to 50MW.

Power plant facilities:

Parabolic trough concentrated solar thermal power (CSP) technology, which will be installed by the project owner, uses very precise parabolic shaped, sun-tracking mirrors to concentrate and collect sunlight on thermally efficient receiver tubes running through the optical focal line of the parabolic mirror troughs. The parabolic troughs, orientated along the north-south directional plane, are designed to track the sun along one axis as it moves from east to west. A heat transfer fluid (HTF), such as synthetic thermal oil, is heated by the focused sunlight as it circulates through the receivers and is then pumped through a series of heat exchangers where thermal energy is transferred to water. This happens until the temperature of the water side of the system is heated sufficiently to generate medium/high-pressure superheated steam. To start up the plant the HTF is circulated through the solar field using auxiliary power until the solar power becomes self-sustaining, after which the oil circulation is powered by the electricity generated by the solar plant.

A stream of the same HTF is also used to heat a molten salt mixture, which is stored in large insulated tanks. The molten salt, thanks to its composition, is able to retain heat for a long time. The heat of the molten salt is then released again to the steam cycle during transitory periods (i.e. clouds passing) and in the evenings when the solar irradiation is lower. This helps to maintain a more constant load in the steam turbine having a more efficient power generation process. At the same time the plant is equipped with storage can produce electricity during the evenings, which are typically high peak periods in South Africa contributing to the reduction of the usage of other polluting generation plants currently used for peak demand management.

After passing through the heat exchangers and transferring the absorbed thermal heat, the cooled HTF is re-circulated through the solar field receivers to repeat the process. The heat transfer (exchange) system is a closed system resulting in the re-use of the same HTF for the heat collection.

The high-pressure steam is directed to a conventional Rankine-cycle steam turbine/generator set where the steam provides the energy to rotate the steam turbine and drive the generator producing electricity. The remaining steam is then transported to a condenser which cools the steam back to a liquid state. The low-pressure (spent) steam from the turbine is condensed by a cooling system as it flows through the cooling loop. After being cooled and condensed, the condensed water – or condensate - is returned to the HTF heat exchangers by feedwater pumps to again be turned into steam for electricity generation.

The main components of the plant are the solar collector assembly, heat exchanger system, molten salt energy storage system, cooling towers and generator. Associated infrastructure will include the auxiliary power plant, sub-transmission power line and water pipeline. The CSP components and process are depicted in Figure 3 below.

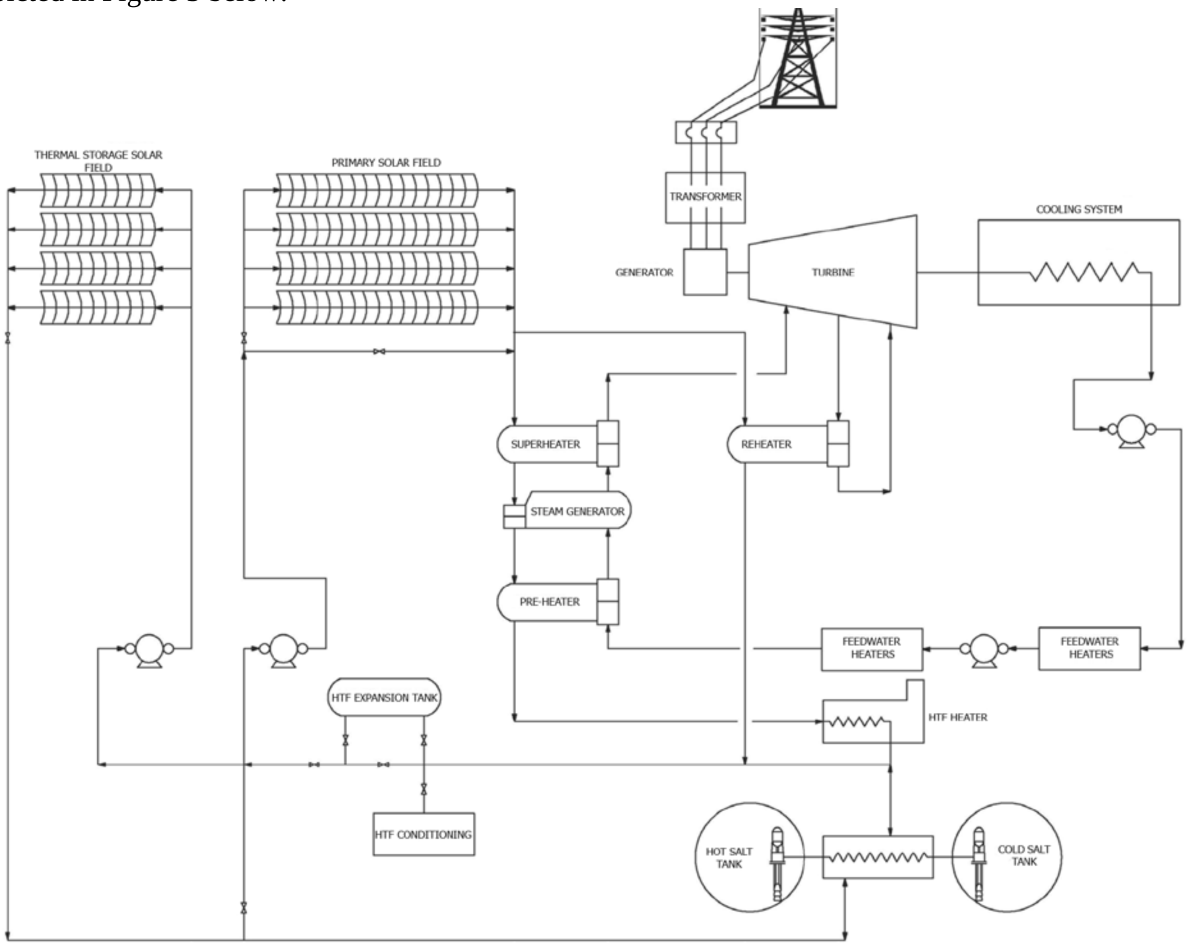

Figure 3 CSP process schematic diagram

Auxiliary Heaters:

A liquid fuel fired boiler will also be constructed in order to provide heat directly to the HTF to prevent the crystallisation of the molten salt during cold nights.

Back-up gas fired heaters are used to maintain the temperature of the HTF above its freezing point of 12°C. Fired heaters are used in the petrochemical and hydrocarbon industries to heat fluids in tubes for further processing. In this type of process, fluids flow through an array of tubes located inside a furnace or heater. The tubes are heated by direct-fired burners. Using tubes to contain the load is somewhat unique compared to the other types of industrial combustion applications.

Process heaters are sometimes referred to as process furnaces or direct-fired heaters. They are heat transfer units designed to heat petroleum products, chemicals, and other liquids and gases flowing through tubes. For this plant the heating is done to raise the temperature of the fluid to prevent freezing in the CSP plant.

The operator will start up the auxiliary heaters when it is not possible to maintain the minimum temperature at an appropriate value by means of oil circulation. In this mode, the operator will select the Boiler output temperature (approximately 120 °C).

Ancillary Facilities:

A river water intake and water transmission pipeline will be constructed to support the water usage condensing requirements of the CSP facility. Water usage is minimized by the increase of the recirculation cycles within the cooling towers. Wastewater (pre-treated) will then be collected into evaporation ponds at site.

After sunset, the collected energy levels decline. The solar plant, thanks to the thermal storage, can stay connected to the grid until the critical turbine power output level is reached, at which point the solar plant is disconnected from the grid, either manually or by the automated control system. Once disconnected from the grid, the power block and solar fields are in stand-by for the next day operation.

Turbine and generator:

The steam turbine will be a tandem-compound reheat condensing unit with the highspeed/ high-pressure section connected by a speed reduction gear to a single-flow-singlecasing low pressure section.

A single turbine capable of the mechanical input required for a net power output of 50 MWe will be included in the Power Block.

The turbine has two rotors (high and low pressure) connected to one another through a speed reduction gear and to the generator rotor with a solid bolted coupling. The steam turbine will be connected to a high-pressure steam inlet (supplying working steam from the steam generator) and a steam outlet (transferring spent steam to the cooling system). The turbine will also be connected, via a common axial shaft, to a single generator to which it supplies the input power that is converted to electricity.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

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Year	Annual estimation of emission reductions in tonnes of CO_2e
01 July 2015 to 31June 2016	185,745
01 July 2016 to 31 June 2017	207,400
01 July 2017 to 31 June 2018	217,974
01 July 2018 to 31 June 2019	209,665
01 July 2019 to 31 June 2020	217,642
01 July 2020 to 31 June 2021	215,979
01 July 2021 to 31 June 2022	217,642
01 July 2022 to 31 June 2023	209,65
01 July 2023 to 31 June 2024	217,642
01 July 2024 to 31 June 2025	215,979
Total estimated reductions (tonnes of CO_2e)	2,115,333
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	211,533

A.4.5. Public funding of the project activity:

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No public funding has been used in the development of this project and no public funding will be used in its implementation[7].

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

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The approved baseline and monitoring methodology is ACM0002: “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”, Version 13.0.0, Sectoral Scope: 01, EB 66.

[7] Solafrica ODA Letter 9 February 2012

The following methodological tools are used:

"Tool to calculate the emission factor for an electricity system" (Version 12.2.1).
"Tool for the demonstration and assessment of additionality" (Version 06).
"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (Version 02).

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

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The following table summarises the main applicability criteria's for projects using ACM0002 (version 13.0.0) is intended. This project activity meets all of the criteria as reflected in the table below.

Item	ACM0002 (version 13.0.0)	Project Activity
1	*This methodology is applicable to grid-connected renewable power generation project activities that (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s).*	**Meets the applicability criterion** This project involves the installation of a new power plant at a site where no renewable power plant was operated prior to implementation of the project activity therefore criterion (a) is applicable.

2	*The methodology is applicable under the following conditions:* • *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;* • *In the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of the existing power plant(s) or unit(s) is not affected): 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 addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;*	**Meets the applicability criterion** The project activity does not involve a capacity addition, retrofit or replacement.
3	*In case of hydro power plants:* • *One of the following conditions must apply:* o *The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of reservoirs; or* o *The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m2; or* o *The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 W/m2.*	**Not relevant** This project activity does not involve a hydro power plant.

4	*In case of hydro power plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 W/m2 all the following conditions must apply:* • *The power density calculated for the entire project activity using equation 5 is greater than 4 W/m2;* • *Multiple reservoirs and hydro power plants located at the same river and where are designed together to function as an integrated project[1] 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/m2, is lower than 15MW;* • *Total installed capacity of the power units, which are driven using water from reservoirs with power density lower than 4 W/m2, is less than 10% of the total installed capacity of the project activity from multiple reservoirs.*	**Not relevant** This project activity does not involve a hydro power plant.
5	*The methodology is not applicable to the following:* • *Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;* • *Biomass fired power plants;* • *A hydro power plant[2] that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of the power plant is less than 4 W/m2.*	**Meets the applicability criterion** This is a greenfield project and therefore does not involve switching from fossil fuels to renewable energy sources at the site of the project activity. Furthermore, this project activity does not include a biomass fired power plant or a hydro power plant.
6	*In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is .the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance.*	**Not relevant** This project does not involve a retrofit, a replacement or a capacity addition.

7	*In addition, the applicability conditions included in the tools referred to above apply.*	**Meets the applicability criterion** The applicability conditions included in the tools have been met. This is shown in Section B 01 Annex 3.

B.3. Description of the sources and gases included in the project boundary:

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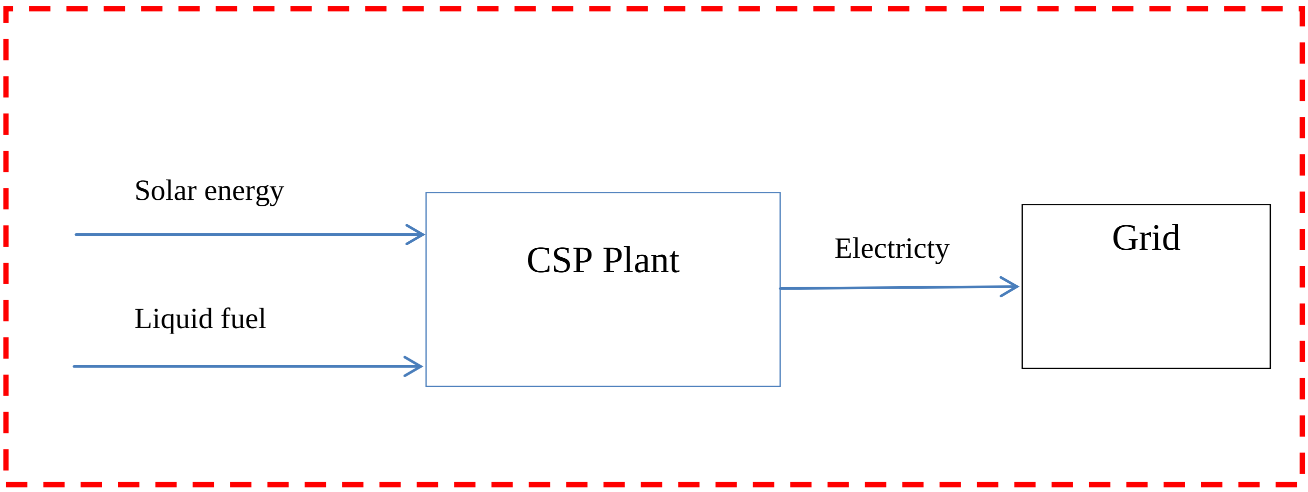
As per methodology ACM0002, the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.



The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the table below.

	Source	Gas	Included?	Justification / Explanation
Baseline	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For geothermal power plants, fugitive emissions of CH_4 and CO_2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable as project activity is not a geothermal power plant.
		CH_4	No	Not applicable as project activity is not a geothermal power plant.
		N_2O	No	Not applicable as project activity is not a geothermal power plant.
	CO_2 emissions from combustion of liquid fuel (diesel) for electricity generation in solar thermal power plants and geothermal power plants	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Not applicable as project activity is not a hydro power plant.
		CH_4	No	Not applicable as project activity is not a hydro power plant.
		N_2O	No	Not applicable as project activity is not a hydro power plant.

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

>>

As per the approved methodology ACM0002/Version 13.0.0, this project activity does not include a capacity addition, retrofit or replacement to an existing grid-connected renewable power plant.

In accordance with the description in the approved baseline methodology ACM0002/Version 13.0.0, for a project activity involving the installation of a new grid-connected renewable power plant as in this project activity, the baseline 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" (Version 02.2.1). These calculations are shown in Annex 3.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

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ACM0002 (Version 13.0.0) directs that the additionality of a project activity shall be demonstrated and assessed using the latest version of the "*Tool for the demonstration and assessment of additionality*", which is available. Version 06.0.0 is the latest version at the time, used in the analysis below.

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

The objective of Step 1 is to define realistic and credible alternatives to the project activity that can be part of the baseline scenario through the following sub-steps:

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

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

P2: The continuation of the current situation, i.e. to use all power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance. The additional power generated under the project would be generated in existing and new grid-connected power plants in the electricity system.

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

The alternatives shall be assessed in terms of their compliance with applicable mandatory legal and regulatory requirements. Both of the above mentioned alternatives comply with the legal and regulatory requirements of the host country, South Africa.

Step 3: Barrier analysis

Step 3 has been opted for as per the tool to demonstrate additionality.

This step serves to identify barriers and to assess which alternatives are prevented by these barriers. The "Tool for demonstration and assessment of additionality" (Version 06.0.0) requests that the latest version of the "Guidelines for objective demonstration and assessment of barriers" shall be taken into account when applying this step.

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity:

Barriers due to prevailing practice, inter alia:

The project activity is the "first of its kind"

Criteria	Choice/ Selection	Existing/ Alternatives (as applicable)	Justification
1. Applicable geographical area	South Africa	Southern African Power Pool.	It is the host country and can be used as the default. In addition, decisions around policies, regulations and licensing concerning the applicable geographical area would only relate to South Africa.
2. Measure	Option B. Switch of technology with change of energy source.		Bokpoort CSP is a renewable energy project and the grid is based on the combustion of coal. Thus the technology switch is from combustion to concentrated parabolic trough technology and the energy source changes from fossil fuel to solar energy.
3. Output	Solar energy is used to create steam to drive steam turbine generators supplying electricity to the grid.	During the first round of the Renewable Energy Procurement Plan (REPP), Abengoa's two CSP projects, namely, the Ikhi 50MW tower plant and the 100 MW !KaXu trough plant were awarded preferred bidder status[8].	These two projects represent 75% of the 200 MW allocated to CSP in the first rounds of the bidding process and are scheduled for commissioning in 2014.
4. Different technologies	Similar types of solar thermal technologies include solar tower systems, linear Fresnel systems and Dish Stirling systems.	Not applicable	There are no plants in commercial operation in South Africa.
5. Timing	Start date of December 2012 when financial close takes place.		Currently there are no grid connected solar thermal projects, of a similar size[9]. Preferred bidders for Independent Power Producer status announced in November 2011 included some solar thermal plants mentioned above. The expected commissioning date of these projects is scheduled for 2014.

[8] http://www.sessa.org.za/news/item/csp-in-south-africa

[9] IRENA Renewable Energy Country Profile-South Africa

The applicable geographical area is selected as the host country, South Africa, where the regulatory and policy framework applies to all its provinces. The investment climate10 is similar across the regions of South Africa11.

The type of technology installed by the project activity is large scale, parabolic trough concentrated solar thermal technology. Similar types of solar thermal technologies include solar tower systems, linear Fresnel systems and Dish Stirling systems. There are no similar examples of technology in commercial operation within the applicable geographical area currently12.

As per the "Tool for demonstration and assessment of additionality" (Version 06.0.0), the proposed project activity is the First-of-its-kind in the applicable geographical area if:

a. The project is the first in the applicable geographical area that applies a technology that is different from any other technologies able to deliver the same output and that have started commercial operation in the applicable geographical area before the start date of the project.

In South Africa, electricity is supplied by the parastatal ESKOM13, whose electricity generation is derived predominantly from coal-fired power stations. Coal accounts for more than 92%14 of the fuel used in South Africa's electricity generation. South Africa has large reserves of coal; therefore, it has been favourable economically to utilize these reserves as a fuel source in the electricity generation process previously. The type of technology employed by the project activity is a relatively new, sound and clean technology.

This project activity's solar thermal power plant is the first in South Africa (which is the "applicable geographical area"). There are at present (February 2012)15 no large scale, grid-connected solar thermal power plants in commercial operation that are exporting electricity to the grid. The project activity is thus additional as a first-of-its-kind project activity.

b. Project participants selected a crediting period for the project activity that is "a maximum of 10 years with no option of renewal."

The project participants have selected a ten year crediting period with no option for renewal.

Step 4: Common practice analysis

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[10] http://www.rbidz.co.za/Publications_Downloads/Documents/Investment%20Climate%20AssessmentII.pdf

[11]http://www.npconline.co.za/MediaLib/Downloads/Home/Tabs/Diagnostic/Economy2/Investment%20Climate%20Survey%20of%20South%20Africa.pdf

[12] http://en.wikipedia.org/wiki/List_of_power_stations_in_South_Africa

[13] http://www.eskom.co.za/live/index.php

[14] Department of Water and Environmental Affairs. (2010). *National Climate Change Response Draft Green Paper, pg 13, para..3.* Retrieved from South Africa Government Online: http://www.environment.gov.za. Date accessed 16/02/2011.

[15] Letter from SESSA Letter-10 February 2012

Sub-step 4a: Analyse other activities similar to the proposed project activity
After conducting analysis on any similar project activities that rely on similar technologies undertaken in a comparable environment, it can be concluded that similar activities have not been carried out in the region.

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

No options are occurring in the region.
The project activity is the first of its kind and no common practice is available in the region. The proposed project activity is additional and not part of the baseline scenario.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The emission reductions were calculated in accordance with ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources", Version 13.0.0, Sectoral Scope: 01, EB 66.

Baseline emissions:

Baseline emissions include only CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants. The baseline emissions will be calculated as follows:

$$BE_y = EG_{PJ,y} . EF_{grid,CM,y}$$ ACM 0002 Equation 6

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2)
$EG_{PJ,y}$	=	Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{grid,CM,y}$	=	Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2/MWh)

The methodological choices made regarding the 'Tool to calculate the emission factor for an electricity system' (Version 02.2.1) are as follows:

- In terms of data vintages, the ex ante option was chosen to calculate the simple OM. In this option a 3 year generation-weighted average are used for the grid power plants. Using this option also means that the emission factor is determined only once at the validation stage, thus no monitoring and recalculation is required during the crediting period.
- The simple operating margin emission factor ($EF_{grid,OMsimple,y}$) is chosen for the calculation method, seeing as low-cost/must-run resources constitute less than 50% of total grid generation in average of the five most recent years.
- For calculating of the combined margin emission factor: w_{OM} = 0.75 and w_{BM} = 0.25 (as specified by the applied tool – it is a 'solar power generation project activity').

Since the proposed project activity 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 project activity, the quantity of net electricity generation is calculated as follows:

$EG_{PJ,y} = EG_{facility,y}$ ACM 0002 Equation 7

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

Project emissions:

For most renewable power generation project activities, PEy = 0. However, some project activities may involve project emissions that can be significant. These emissions shall be accounted for as project emissions by using equation (1) of the applied methodology:

$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y}$ ACM0002 Equation 1

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

But $PE_{GP,y}$ and $PE_{HP,y} = 0$ because emissions from this project activity do not include emissions arising from the operation of geothermal or hydro plants.

Therefore:
$PE_y = PE_{FF,y}$

Where:
PE_y = Project emissions in year y (tCO2e/yr)
$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year y (tCO2/yr)

Fossil Fuel Combustion ($PE_{FF,y}$)
For solar thermal projects, which also use fossil fuels for electricity generation, CO2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$).

$PE_{FF,y}$ is calculated as per the latest version of the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" (Version02), as shown below.

CO_2 emissions from fossil fuel combustion in the CSP plant are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, as follows:

$PE_{FC,y} = FC_{i,y} \times COEF_{i,y}$ Applied tool Equation 1

Where:
$PE_{FC,y}$ = Are the CO_2 emissions from fossil fuel combustion during the year y (t CO_2/yr);
$FC_{i,y}$ = Is the quantity of diesel fuel combusted during the year *y* (mass or volume unit/ yr);
$COEF_{i,y}$ = Is the CO_2 emission coefficient of fuel type *i* in year *y* (t CO_2/mass or volume unit);
i = Are the fuel types (diesel) combusted during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ can be calculated using one of the following two Options, depending on the availability of data on the fossil fuel type *i*, as follows:
Depending on the availability of data on the fossil fuel type *i*, as follows:
Option B:
The CO2 emission coefficient COEFi,y is calculated based on net calorific value and CO2 emission factor of the fuel type i, as follows:

$COEF_{i,y} = NCV_{i,} \times EF_{CO2,i,y}$ Applied tool Equation 4

Where:
$COEF_{i,y}$ = Is the CO_2 emission coefficient of fuel type *i* in year *y* (t CO_2/mass or volume unit)
NCV_i = Is the weighted average net calorific value of the fuel type *i* in the year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$ = Is the weighted average CO_2 emission factor of fuel type *i* in year *y* (t CO_2/GJ)
i = Are the fuel types (diesel) combusted during the year *y*

Leakage:

No leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport). These emission sources are neglected, in accordance with ACM 0002.

Emission reductions:

Emission reductions are calculated as follows:

$ER_y = BE_y – PE_y$ ACM 0002 Equation 11

Where:
ER_y = Emission reductions in year *y* (t CO_2e)
BE_y = Baseline emissions in year *y* (t CO_2)
PE_y = Project emissions in year *y* (t CO_2e)

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	$EF_{grid,CM}$
Data unit:	t CO_2/MWh

Description:	Combined margin CO_2 emission factor for grid connected power generation.
Source of data used:	Calculated from the “Tool to calculate the emissions factor for an electricity system” (Version 02.2.1).
Value applied:	0.936
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the applied tool this value can be used ex ante.
Any comment:	The fuel used for coal power stations is other bituminous coal. In *“Eskom Fact Sheet – Formation of Coal”*[16] it is stated that coal in South Africa is “mostly classified as ‘bituminous’ coals”. The article *“What is the carbon emission factor for the South African electricity grid? (Spaldin-Fecher, 2011)”*[17] also specifies the use of “other bituminous coal” as the fuel used in the Eskom power stations.

Data / Parameter:	$EF_{grid,OMsimple,y}$
Data unit:	t CO_2/MWh
Description:	Operating margin CO_2 emission factor for grid connected power generation.
Source of data used:	Calculated from the “Tool to calculate the emissions factor for an electricity system” (Version 02.2.1).
Value applied:	0.923
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the applied tool this value can be used ex ante.
Any comment:	-

Data / Parameter:	$EF_{grid,BM,y}$
Data unit:	t CO_2/MWh
Description:	Build margin CO_2 emission factor for grid connected power generation.
Source of data used:	Calculated from the “Tool to calculate the emissions factor for an electricity system” (Version 02.2.1).
Value applied:	0.976
Justification of the choice of data or description of measurement methods and procedures	As per the applied tool this value can be used ex ante.

[16] http://recruitment.eskom.co/live/content.php?Category_ID=60

[17] Supplied to validators.

actually applied :	
Any comment:	-

B.6.3. Ex-ante calculation of emission reductions:

>>

Baseline emissions:

Equation 4:

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

Year	BE_y	EGPJ,y	EFgrid,CM,y
	(t CO2/yr)	(MWh/yr)	(t CO2/MWh)
01 July 2015 to 31 June 2016	187,625	200,365	0.936
01 July 2016 to 31 June 2017	209,280	223,490	0.936
01 July 2017 to 31 June 2018	219,854	234,782	0.936
01 July 2018 to 31 June 2019	211,545	225,909	0.936
01 July 2019 to 31 June 2020	219,521	234,427	0.936
01 July 2020 to 31 June 2021	217,859	232,652	0.936
01 July 2021 to 31 June 2022	219,521	234,427	0.936
01 July 2022 to 31 June 20123	211,545	225,909	0.936
01 July 2023 to 31 June 2024	219,521	234,427	0.936
01 July 2024 to 31 June 2025	217,859	232,652	0.936

Project emissions:

Equation 4:

$PE_{FC,j,y} = FC_{i,j,y} \text{ x } COEF_{i,y}$

Year	NCVi,y	EFCO2,i,y	COEFi,y	FCi,j,y	PEFC,j,y
	(GJ/L)	(tCO2/GJ)	(tCO2/L)	(L/Yr)	(tCO2/Yr)
01 July 2015 to 31June 2016	0.03655	0.07410	0.00271	694 118	1880
01 July 2016 to 31 June 2017	0.03655	0.07410	0.00271	694 118	1880

01 July 2017 to 31 June 2018	0.03655	0.07410	0.00271	694 118	1880
01 July 2018 to 31 June 2019	0.03655	0.07410	0.00271	694 118	1880
01 July 2019 to 31 June 2020	0.03655	0.07410	0.00271	694 118	1880
01 July 2020 to 31 June 2021	0.03655	0.07410	0.00271	694 118	1880
01 July 2021 to 31 June 2022	0.03655	0.07410	0.00271	694 118	1880
01 July 2022 to 31 June 2023	0.03655	0.07410	0.00271	694 118	1880
01 July 2023 to 31 June 2024	0.03655	0.07410	0.00271	694 118	1880
01 July 2024 to 31 June 2025	0.03655	0.07410	0.00271	694 118	1880

Emission reductions:

Equation 11:

$ER_y = BE_y - PE_y$

Year	BEy	PEy	ERy
	(tCO2/yr)	(tCO2e/yr)	(tCO2e/yr)
01 July 2015 to 31 June 2016	187,625	1,880	185,745
01 July 2016 to 31 June 2017	209,280	1,880	207,400
01 July 2017 to 31 June 2018	219,854	1,880	217,974
01 July 2018 to 31 June 2019	211,545	1,880	209,665
01 July 2019 to 31 June 2020	219,521	1,880	217,642
01 July 2020 to 31 June 2021	217,859	1,880	215,979
01 July 2021 to 31 June 2022	219,521	1,880	217,642
01 July 2022 to 31 June 20123	211,545	1,880	209,665
01 July 2023 to 31 June 2024	219,521	1,880	217,642
01 July 2024 to 31 June 2025	217,859	1,880	215,979

B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

Year	**Estimation of project activity emissions (tonnes of CO_2 e)**	**Estimation of baseline emissions (tonnes of CO_2 e)**	**Estimation of leakage (tonnes of CO_2 e)**	**Estimation of overall emission reductions (tonnes of CO_2 e)**
01 July 2015 to 31June 2016	1,880	187,625	0	185,745
01 July 2016 to 31 June 2017	1,880	209,280	0	207,400
01 July 2017 to 31 June 2018	1,880	219,854	0	217,974
01 July 2018 to 31 June 2019	1,880	211,545	0	209,665
01 July 2019 to 31 June 2020	1,880	219,521	0	217,642
01 July 2020 to 31 June 2021	1,880	217,859	0	215,979
01 July 2021 to 31 June 2022	1,880	219,521	0	217,642
01 July 2022 to 31 June 2023	1,880	211,545	0	209,665
01 July 2023 to 31 June 2024	1,880	219,521	0	217,642
01 July 2024 to 31 June 2025	1,880	217,859	0	215,979
Total (tonnes of CO_2 e)	18,800	2,134,132	**0**	2,115,333

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

B.7.1 Data and parameters monitored:

Data / Parameter:	$EG_{facility,y}$
Data unit:	MWh
Description:	Quantity of net electricity generation supplied by the project plant to the grid in year *y*.
Source of data to be used:	Measured during the project activity.
Value of data applied for the purpose of calculating expected	01 July 2015 to 31 June 2016: 200 365 01 July 2016 to 31 June 2017: 223 490

emission reductions in section B.5	01 July 2017 to 31 June 2018: 234 782 01 July 2018 to 31 June 2019: 225 909 01 July 2019 to 31 June 2020: 234 427 01 July 2020 to 31 June 2021: 232 652 01 July 2021 to 31 June 2022: 234 427 01 July 2022 to 31 June 2023: 225 909 01 July 2023 to 31 June 2024: 234 427 01 July 2024 to 31 June 2025: 232 652
Description of measurement methods and procedures to be applied:	The quantity of net electricity generated by the project will be measured continuously, logged electronically and aggregated monthly for the purposes of calculating the emission reductions.
QA/QC procedures to be applied:	The electricity meter will be calibrated in accordance with manufacturer specifications.
Any comment:	-

Data / Parameter:	$FC_{i,j,y}$
Data unit:	l/yr
Description:	Is the quantity of diesel combusted in the CSP plant during the year *y*
Source of data to be used:	Measured during the project activity. The initial calculations were done on diesel.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	01 July 2015 to 31 June 2016: 694 118 01 July 2016 to 31 June 2017: 694 118 01 July 2017 to 31 June 2018: 694 118 01 July 2018 to 31 June 2019: 694 118 01 July 2019 to 31 June 2020: 694 118 01 July 2020 to 31 June 2021: 694 118 01 July 2021 to 31 June 2022: 694 118 01 July 2022 to 31 June 2023: 694 118 01 July 2023 to 31 June 2024: 694 118 01 July 2024 to 31 June 2025: 694 118
Description of measurement methods and procedures to be applied:	The quantity of net diesel consumed by the project will be measured continuously, logged electronically and aggregated monthly for the purposes of calculating the emission reductions.
QA/QC procedures to be applied:	The purchase invoices will be checked monthly. Differences exceeding 1% will be discussed in the monitoring report.
Any comment:	-

Data / Parameter:	NCV_{diesel}
Data unit:	GJ/L

Description:	Is the weighted average net calorific value of diesel.
Source of data to be used:	IPCC default value provided in table 1.2 Chapter 1 of Volume 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. The initial calculations were done on diesel.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	01 July 2015 to 31 June 2016: 0.03655 01 July 2016 to 31 June 2017: 0.03655 01 July 2017 to 31 June 2018: 0.03655 01 July 2018 to 31 June 2019: 0.03655 01 July 2019 to 31 June 2020: 0.03655 01 July 2020 to 31 June 2021: 0.03655 01 July 2021 to 31 June 2022: 0.03655 01 July 2022 to 31 June 2023: 0.03655 01 July 2023 to 31 June 2024: 0.03655 01 July 2024 to 31 June 2025: 0.03655
Measurement procedures:	-
Monitoring frequency:	Any future revision of the IPCC Guidelines will be taken into account.
Any comment:	The IPCC default values were selected as a data source as values are not provided by the fuel supplier invoice, measurements will not be undertaken by the project participants and no regional or national default values are available.

Data / Parameter:	$EF_{CO2,diesel}$
Data unit:	t CO_2/GJ
Description:	Is the weighted average CO_2 emission factor of diesel.
Source of data to be used:	IPCC default value provided in table 1.4 of Chapter 1 of Volume 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	01 July 2015 to 31 June 2016: 0.0741 01 July 2016 to 31 June 2017: 0.0741 01 July 2017 to 31 June 2018: 0.0741 01 July 2018 to 31 June 2019: 0.0741 01 July 2019 to 31 June 2020: 0.0741 01 July 2020 to 31 June 2021: 0.0741 01 July 2021 to 31 June 2022: 0.0741 01 July 2022 to 31 June 2023: 0.0741 01 July 2023 to 31 June 2024: 0.0741 01 July 2024 to 31 June 2025: 0.0741
Monitoring procedures:	-
Monitoring frequency:	Any future revision of the IPCC Guidelines will be taken into account.
Any comment:	The IPCC default values were selected as a data source as values are not provided by the fuel supplier invoice, measurements will not be undertaken by

	the project participants and no regional or national default values are available.

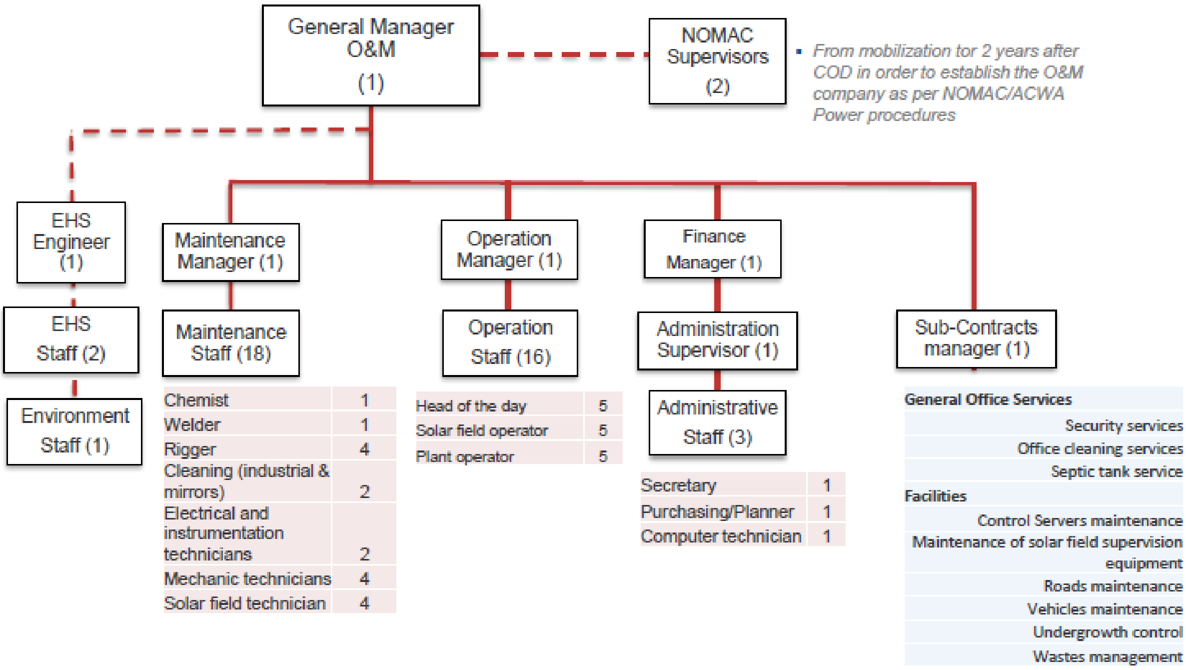
B.7.2. Description of the monitoring plan:

>>

The approved monitoring methodology ACM0002 is used for the monitoring plan. The monitoring tasks must be implemented according to the monitoring plan in order to ensure that real, measurable and long-term greenhouse gas (GHG) emission reductions for the proposed project is monitored and reported. As per the methodology ACM0002 the following parameters will be monitored:

1. The quantity of diesel (l/yr) combusted in the CSP plant.
2. The quantity of net electricity generation (MWh/yr) supplied by the project plant to the grid.

The provisional organizational structure of the project activity is depicted in the manning and services plan below.



The following roles and responsibilities, summarized in the table below, will be designated to staff members so that the monitoring requirements of the project activity are adhered to:

ROLES AND RESPONSIBILITIES

Task	Responsibility	Task Description
Facility Metering	EPC Contractor	Installation of all required

Installation		metering equipment
Overall Metering Responsibilities	O&M Contractor	The O&M Contractor shall perform the Owner's obligations in relation to metering pursuant to and in accordance with the PPA and in particular shall, in accordance with the standard of a reasonable and prudent operator and good utility practice operate and maintain the facility metering Installation.
• Meter Operation and Maintenance	Electrical and Instrumentation Technicians	Daily operation and maintenance of metering and data recording equipment
• Data Recording	Head of Operations	Oversight of accurate and up-to-date logging of data
• Recordkeeping	Operation Manager	Recordkeeping of all data, including calibration records and logs including collation of data for CDM verification purposes. Data will be kept in electronic format until two years after the crediting period.

The project data will include the following:

1. Supplementary liquid fuel consumption (diesel in litres) by the facility shall be measured monthly using an appropriately calibrated measurement device. Calibration and cleaning of the

device shall be undertaken on a regular basis and in line with the manufacturer's recommendations.
2. The energy output will be monitored continuously, integrated hourly and aggregated monthly for the purpose of calculating emission reductions.

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

>>
Date of completion of application: 30/01/2012

Contact information for the entity responsible for the application of the baseline and monitoring information:
Promethium Carbon (Pty) Ltd
Telephone: +27 11 706 8185
www.promethium.co.za

This entity is not a project participant.

SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
According to the CDM Glossary (Version 06) the start date, in the context of a CDM project activity, shall be considered to be the earliest date on which the project participant has committed to the implementation.

The estimated start date of the project activity is December 2012 when financial close will take place.

C.1.2. Expected operational lifetime of the project activity:

>>
The expected operational lifetime of the project is twenty years from the commercial operation date, therefore exceeding the crediting period.

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

>>
Not applicable.

C.2.1.2. Length of the first crediting period:

>>
Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
The starting date of the crediting period is 01/07/2015.

C.2.2.2. Length:

>>
10 years 0 months.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>
The following environmental impacts were evaluated as part of a full Environmental Impact Assessment (EIA):

1. Potential impacts on surface and groundwater resources;
2. Potential visual impacts associated with the proposed project and associated impacts;
3. Potential impacts on tourism in the region;
4. Potential noise impacts on surrounding landowner;
5. Potential impacts on biodiversity (i.e. flora and fauna);
6. Potential impacts on avifaunal species;
7. Potential social impacts;
8. Potential impacts on cultural and heritage resources.

There will be no transboundary effects from this project activity as any potential impacts are confined within the borders of South Africa.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>
The Environmental Impact Assessment (EIA) process for the proposed establishment of a Concentrating Solar Power (CSP) Plant in the Northern Cape Province has been undertaken by Bohlweki SSI Environmental in accordance with the EIA Regulations published in Government Notice R385 to R387 (as amended), in terms of the National Environmental Management Act (No 107 of 1998).

In assessing the environmental feasibility of the project activity, the requirements of all relevant legislation has been considered. This relevant legislation has informed the identification and development of appropriate management and mitigation measures that will be implemented through the environmental management plan (EMP)[18] in order to minimise the potential impacts associated with the project activity.

Impacts likely to occur during the construction and operational phases of the CSP plant can be mitigated to acceptable levels. The EMP will form part of the contract with the contractors appointed to construct and maintain the proposed plant and associated infrastructure. The EMP will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases (i.e. construction, operation and de-commissioning) of the project activity is required in accordance with the project activity's environmental impact assessment.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

>>

The following stakeholders were identified and informed of the potential development through the scoping phase public participation process (PPP) and the Water Use License PPP:

1. National and Provincial Government Representatives:
   Department of Environmental Affairs (DEA);
   Department of Water Affairs (DWA);
   Department of Agriculture;
   Department of Public Enterprises;
   Department of Trade and Industry (DTI);
   Department of Minerals and Resources(DMR);
   South African Heritage Resources Agency (SAHRA); and
   Relevant Northern Cape Provincial Authorities (ex. Environment & Conservation, Agriculture).

2. Relevant Local and District Municipalities:
   Siyanda District Municipality
   //Khara Hais Local Municipality; and
   !Kheis Local Municipality.

3. Parastatals-Eskom.
4. Affected and surrounding landowners.
5. Environmental Non-Governmental Organizations (ex. Endangered Wildlife Trust, World Wildlife Fund).

Subsequent to the identification of the relevant stakeholders the following meetings were organised.

[18] Bohlweki SSI Environmental Draft Environmental Management Plan (EMP) - SolAfrica Concentrating Solar Thermal Power Plant on a Portion of the Farm Bokpoort 390 in the Siyanda District, Northern Cape (November 2010)

A Public Meeting advertised in "The Gemsbok", a local Afrikaans newspaper, was held at the Orange River Cellars in Groblershoop on the 12th of October 2010 with the objective of informing Interested and Affected Parties (I&APs) of the proposed construction of the CSP plant in the Siyanda District Municipality. Information on the Environmental Impact Assessment process was provided in the form of a Microsoft PowerPoint presentation. Bohlweki-SSI Environmental presented in Afrikaans which is the preferred language in the region.
Reference to CDM was included in the Environmental Impact Assessment, at the public meeting[19] and in a letter which was sent to stakeholders inviting them to register as I&APs ahead of the Public Meeting.

Pamphlets referring to the project activity being registered under CDM were distributed at the site and at the Interested and Affected Parties (I&AP) meetings.

A meeting was held on the 13th of October 2010 with the !Kheis District Municipality to inform local government officials as well as provincial and national departments of the proposed construction and operation of the CSP plant in the Siyanda District Municipality.

Another meeting was held on the 14th September 2011 with the Department of Water Affairs to present the project activity and the technology to be employed.

Stakeholders were invited to make oral comments during the local stakeholder consultations on 12 October 2010, 13 October 2010, 28 September 2011 and 14 September 2011. Queries and comments were noted in the minutes of the meeting[20], along with the details of the stakeholder enquiring.

An attendance register was compiled and recorded at the three meetings.

E.2. Summary of the comments received:

>>
The Public Meeting attendees expressed their support for the project as a whole[21].

E.3. Report on how due account was taken of any comments received:

>>
A summary of the comments received by I&AP's and the responses from the project owner's representatives can be seen in the minutes of all three of the meetings[22]. The comments did not impact on the CDM part of the project.

[19] Environmental Impact Assessment for a proposed 75MW Concentrating Solar Thermal Power plant and associated infrastructure in the Siyanda District, Northern Cape, Page 60

[20] Environmental Impact Assessment Study for a proposed CSP plant in the Syanda District, Northern Cape Apendix B4-4 Meeting Minutes.

[21] Minutes of the Public Meeting: Orange River Cellars 12 October 2010, page 4.

[22] Environmental Impact Assessment Study for a proposed CSP plant in the Syanda District, Northern Cape Apendix B4-4 Meeting Minutes.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	ACWA Power Solafrica Bokpoort CSP Power Plant (Pty) Ltd
Street/P.O.Box:	8 Greenstone Place
Building:	1st Floor Block B, Stoneridge Office Park
City:	Edenvale, Johannesburg
State/Region:	Gauteng
Postcode/ZIP:	1065
Country:	South Africa
Telephone:	+27 11 524 8400
FAX:	+27 11 524 8498
E-Mail:	pgovender@acwapower.com
URL:	http://www.acwapi.com
Represented by:	Prabashen Govender
Title:	-
Salutation:	-
Last name:	Govender
Middle name:	-
First name:	Prabashen
Department:	-
Mobile:	-
Direct FAX:	-
Direct tel:	-
Personal e-mail:	-

Organization:	ACWA Power Africa Holdings (Pty) Ltd
Street/P.O.Box:	8 Greenstone Place
Building:	1st Floor Block B, Stoneridge Office Park
City:	Edenvale, Johannesburg
State/Region:	Gauteng
Postcode/ZIP:	1065
Country:	South Africa
Telephone:	+27 11 524 8400
FAX:	+27 11 524 8498
E-Mail:	pgovender@acwapower.com
URL:	-
Represented by:	Prabashen Govender
Title:	-
Salutation:	-
Last name:	Govender
Middle name:	-
First name:	Prabashen

Department:	-
Mobile:	-
Direct FAX:	-
Direct tel:	-
Personal e-mail:	pgovender@acwapower.com

Organization:	Solafrica Thermal Energy (Pty) Ltd
Street/P.O.Box:	39 Rivonia Road
Building:	2nd Floor, 5 Commerce Square
City:	Johannesburg
State/Region:	Gauteng
Postcode/ZIP:	2196
Country:	South Africa
Telephone:	+27 11 268 4074
FAX:	+27 86 648 1006
E-Mail:	info@solafrica.co.za
URL:	-
Represented by:	-
Title:	Mr
Salutation:	-
Last name:	Rwigema
Middle name:	-
First name:	Nasi
Department:	-
Mobile:	+27 83 324 2097
Direct FAX:	+27 86 648 1006
Direct tel:	+27 11 268 4074
Personal e-mail:	nasi@solafrica.co.za

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding has been used in the development of this project and no public funding will be used in its implementation.

Annex 3

BASELINE INFORMATION

This section presents the calculations for the South African grid emission factor.

STEP 1: IDENTIFY THE RELEVANT ELECTRICITY SYSTEMS

This tool will serve project activities that will displace grid electricity in South Africa.

The **project electricity system** is defined by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be displaced without significant transmission constraints.

Similarly, a **connected electricity system**, e.g. national or international, is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints, but transmission to the project electricity system has significant transmission constraints.

The DNA of South Africa has not published a delineation of the project electricity system and connected electricity systems. Also, the application of the criteria with regards to determining significant transmission constraints does not result in a clear grid boundary due to a lack of sufficient data. For these reasons the following was chosen for the reference system of this project:

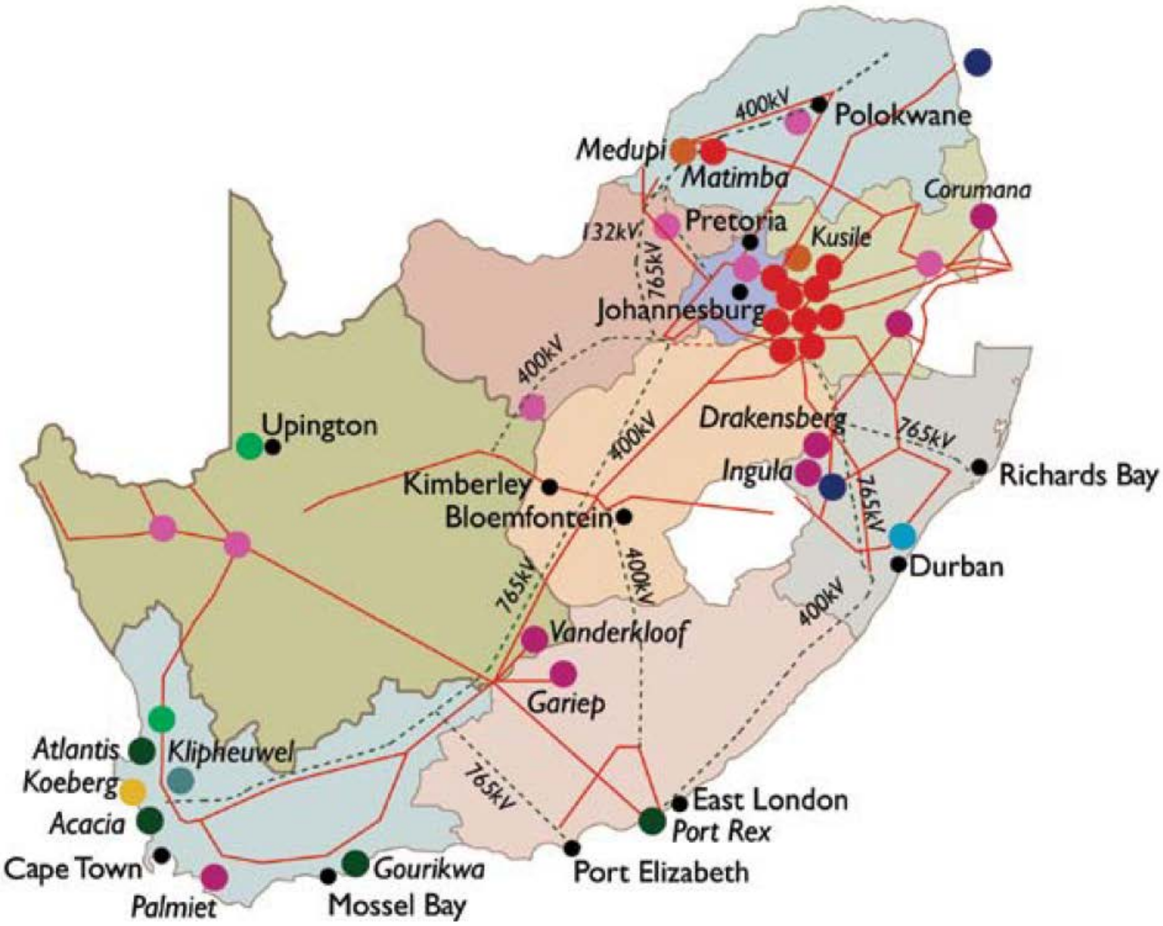
- The **project electricity system** entails all the Eskom power plants in the South African electricity grid.
- Due to a lack of data available in the public domain (in order to evaluate significant transmission constraints), all other power stations (non-Eskom) and countries with power grids connected to South Africa, are treated as **connected electricity systems**, and emission factors for imports from these systems are conservatively assumed to be 0 tCO_2/MWh.

All electricity generated by the Eskom power stations is taken into consideration when calculating the grid emission factor; exports are not subtracted.

All the data for the Eskom power stations are obtained from the Eskom website, where they have a specific webpage dedicated to CDM grid emission factor related data[23]. This data includes commissioning dates, electricity generated, and fuel consumed.

Data for the imported electricity are obtained from the Eskom annual report, where "*Total purchased for the Eskom system (GWh)*" is shown in the "*Statistical overview*" table on pg. 324 of the report[24].

[23] Eskom Holdings SOC Limited . (2011). *CDM Calculations*. Retrieved October 06, 2011, from Eskom: http://www.eskom.co.za/c/article/236/cdm-calculations/
[24] Eskom Holdings SOC Limited. (2011). *Annual Report 2011*.



STEP 2: CHOSE WHETHER TO INCLUDE OFF-GRID POWER PLANTS IN THE PROJECT ELECTRICITY SYSTEM

This step is optional according to the tool. The grid emission factor is calculated from only grid power plants (**Option I**). Off-grid power plants are not included in the calculations.

STEP 3: SELECT A METHOD TO DETERMINE THE OPERATING MARGIN (OM)

The OM is calculated using the **simple OM method (Option a)**. The simple OM method can be used provided that the low-cost/must-run resources constitute less than 50% of the total grid generation in average of the five most recent years.

The average percentage of low-cost/must-run resources amount to 0.00% of the total grid generation for this project electricity system. Therefore, Option (a) is applicable.

In terms of data vintages, the *ex ante* option were chosen to calculate the simple OM. In this option a 3 year generation-weighted average are used for the grid power plants. Using this option also means that

the emission factor is determined only once at the validation stage, thus no monitoring and recalculation is required during the crediting period.
The data used in OM calculations are for the 3 year period of 1 April 2008 – 31 March 2011 (Eskom financial year runs from 1 April – 31 March). This is the latest available data.

STEP 4: CALCULATE THE OPERATING MARGIN EMISSION FACTOR ACCORDING TO THE SELECTED METHOD

The simple OM emission factor ($EF_{grid,OMsimple,y}$) 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. Hence, the hydro and nuclear power plants are excluded from the calculation of the OM.

Option A is used for calculating the simple OM. The calculations in this option are based on the total net electricity generation and a CO2 emission factor of each power plant.

Option A – Calculation based on average efficiency and electricity generation of each plant

Under this option, the simple OM emission factor is calculated based on the net electricity generation of each power plant and an emission factor of each power plant, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

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

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

The emission factor for each power plant *m* were determined as follows (**Option A1**):

$$EF_{grid,OMsimple,y} = \frac{\sum_i \left(FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}\right)}{EG_y} \quad \textbf{(6)}$$

Where:

$EF_{grid,OMsimple,y}$	= Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh)
$FC_{i,y}$	= Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)
$NCV_{i,y}$	= Net calorific value (energy content) fossil fuel type *i* in year *y* (GJ/mass or volume unit)
$EF_{CO2,i,y}$	= CO_2 emission factor of fossil fuel type *i* in year *y* (tCO_2/GJ)

EG_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y* (MWh)

i = All fossil fuel types combusted in power sources in the project electricity system in year *y*

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

Electricity imports are treated as one power plant, as per the tool guidance.

The parameters used in calculations appear in Table 1.

Table 1: Constants used in calculations

Constants		
$NCV_{other\ bituminous\ coal,\ 2009}$[25]	19.10	GJ/T
$NCV_{other\ bituminous\ coal,\ 2010}$[26]	19.22	GJ/T
$NCV_{other\ bituminous\ coal,\ 2011}$[27]	19.45	GJ/T
$NCV_{other\ kerosene}$[28]	42.4	GJ/T
$EF_{CO2other\ bituminous\ coal}$[29]	0.0895	tCO_2/GJ
$EF_{CO2,other\ kerosene}$[30]	0.0708	tCO_2/GJ

The fuel used for coal power stations is other bituminous coal. In *"Eskom Fact Sheet – Formation of Coal"*[31] it is stated that coal in South Africa is "mostly classified as 'bituminous' coals". The article *"What is the carbon emission factor for the South African electricity grid? (Spaldin-Fecher, 2011)"*[32] also specifies the use of "other bituminous coal" as the fuel used in the Eskom power stations.

The fuel used for Acacia and Port Rex power stations is kerosene. This is stated in *"Eskom Fact Sheet – Port Rex and Acacia Power Stations"*[33]. Also, in the source data for electricity generation and fuel consumption the fuel consumption for these two power stations are specified in units of "liters kerosene/year"[34].

Using equation 6, the OM is calculated as **0.923** tCO_2e/MWh.

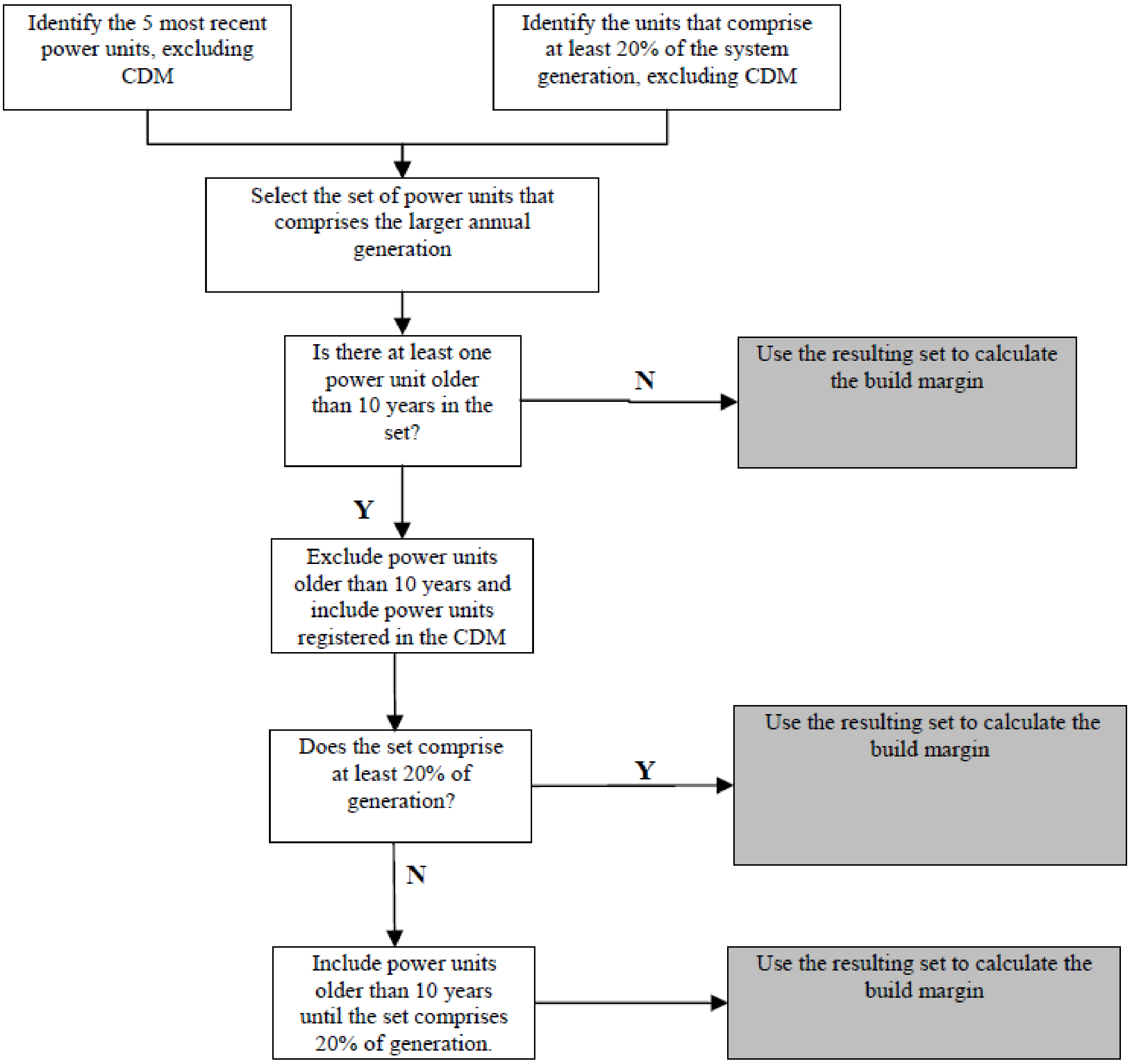
[25] Eskom Holdings SOC Limited. (2011). *Annual Report 2011*.
[26] Eskom Holdings SOC Limited. (2011). *Annual Report 2011*.
[27] Eskom Holdings SOC Limited. (2011). *Annual Report 2011*.
[28] IPCC, 2006
[29] IPCC, 2006
[30] IPCC, 2006
[31] http://recruitment.eskom.co/live/content.php?Category_ID=60
[32] Supplied to validators.
[33] http://www.eskom.co.za/content/GS_0001GasTurbAcaciaPortRexRev6~1~1.pdf
[34] Eskom Holdings SOC Limited . (2011). *CDM Calculations*. Retrieved October 06, 2011, from Eskom: http://www.eskom.co.za/c/article/236/cdm-calculations/

STEP 5: CALCULATE THE BUILD MARGIN (BM) EMISSION FACTOR

In terms of vintage of data, one **Option 1** was selected: 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.

The sample group of power units *m* used to calculate the build margin were determined as per the procedure delineated in the tool, consistent with the data vintages selected.

The following diagram summarizes the procedure of identifying the sample group:



According to the above diagram, the only two power stations that are included in the build margin are Majuba (1996) and Kendal (1988). There is no power generation data available for power units registered in the CDM, therefore these could not be included. Majuba and Kendal comprises 23% of generation.

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

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(13)}$$

Where:

$EF_{grid,BM,y}$	= Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$	= CO_2 emission factor of power unit *m* in year *y* (tCO_2/GJ)
m	= Power units included in the build margin
y	= Most recent historical year for which power generation data is available.

The CO_2 emission factor of each power unit m ($EL_{EL,m,y}$) should be determined as per the guidance in Step 4 (a) for the simple OM, using **Option A1** using for *y* the most recent historical year for which power generation data is available, and using for *m* the power units included in the build margin.

If for a power unit *m* data on fuel consumption and electricity generation is available the emission factor ($EF_{EL,m,y}$) should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{\sum_m EG_{m,y}} \quad \textbf{(2)}$$

Where:

$EF_{EL,m,y}$	= CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$FC_{i,m,y}$	= Amount of fossil fuel type *i* consumed by power unit *m* in year *y* (mass or volume unit)
$NCV_{i,y}$	= Net calorific value (energy content) fossil fuel type *i* in year y (GJ/mass or volume)
$EF_{CO2,i,y}$	= CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ)
$EG_{m,y}$	= Net electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
m	= All power plants/units serving the grid in year y except low-cost/must-run power plants/units
i	= All fossil fuel types combusted in power plant/unit m in year y
y	= The relevant year as per data vintage chosen in Step 3.

Using equation 13, the BM is calculated as **0.976** tCO_2e/MWh.

STEP 6: CALCULATE THE COMBINED MARGIN (CM) EMISSION FACTOR

The combined margin factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \textbf{(14)}$$

Where:

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

The emission factors for the final combined margin appear in Table 8.

Table 1: CM emission factor

	w_{OM}	w_{BM}	**Combined Margin Emission Factor**
Wind and solar power generation project activities for the first crediting period and for subsequent crediting periods.	0.75	0.25	**0.936**
All other projects for the first crediting period.	0.5	0.5	**0.950**
All other projects for the second and third crediting period.	0.25	0.75	**0.963**

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Eskom Holdings SOC Limited. (2011). *Annual Report 2011*.

<u>Annex 4</u>

MONITORING INFORMATION

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