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

PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA
A.1. Title of the PoA

Title: South Africa Renewable Energy Programme (SA-REP)
Version: Version 07
Date: 21/09/2012

A.2. Purpose and general description of the PoA

Policy/measure or stated goal of the PoA

The purpose of the South Africa Renewable Energy Programme (SA-REP) is to support the development and implementation of small-scale renewable energy projects in South Africa in order to displace grid-connected, fossil fuel based electricity generation through the promotion of grid-connected renewable energy based electricity generation, thereby reducing greenhouse gas (GHG) emissions.

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

Renewable energy technologies implemented under the programme will include small hydro, wind, solar photovoltaic and geothermal The project activities will consist of the installation of new power plants at sites where no renewable energy power plant was operated prior to the implementation of the CPA (greenfield plants). Biomass projects are excluded from the programme. The first CPA will take place in Pixley ka Seme District Municipality, Northern Cape Province.

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

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

Projects using renewable energy technology for electricity generation only represent less than 1.5% of the total installed capacity in South Africa. Hydro is practically the only technology deployed in this category, together with two small wind energy projects of 3.2 MW and 5.2 MW that constitute 0.02% of the total installed capacity.

Standard Bank Plc is, therefore, establishing a CDM Programme of Activities (PoA), which will reduce CDM transaction costs and facilitate the route to market for Certified Emission Reductions (CERs) generated by small-scale renewable energy projects in South Africa. This will ensure that financial

viability of projects will be enhanced and access to capital facilitated. In addition, the PoA is expected to contribute to sustainable development in South Africa in various ways, including:

- The PoA is expected to support the national policy goal of achieving 10% penetration for wind and solar PV technologies as a share of total installed capacity in 2020, and 20% in 2030[1].
- The CPA's included under this PoA are expected to provide local employment opportunities during the construction and operation phase.
- The CPA's included under this PoA are expected to contribute to South Africa's fiscal revenues through payment of taxes and attract foreign direct investment.
- The CPA's included under this PoA will have a positive impact on the transfer of renewable energy technologies to South Africa, as well as know-how skills of local workers. The transfer of technology and know-how will be directly replicable to other future renewable energy projects.
- The PoA will reduce South Africa's CO_2 footprint meanwhile increasing the electricity generation capacity of the country.

Framework for the implementation of the proposed PoA

Standard Bank Plc will act as the Coordinating/Managing Entity (CME) for the PoA. The CME will be responsible for:

- Development of the PoA Design Document (CDM-PoA-DD) and Component Project Activity (CPA) Design Documents (CDM-CPA-DD) for CPAs that are developed under the PoA;
- Obtaining a Letter of Approval for the implementation of the PoA from the host country;
- Obtaining a Letter of Authorization of the coordination of the PoA from the host country;
- Liaise with the Designated National Authority (DNA) on matters related to the implementation of the PoA and inclusion of CPAs
- Carry out a quality check on CPAs to be included in the PoA;
- Collect and compile monitoring records from all the CPA entities;
- Coordinate monitoring activities and data management during the lifetime of the PoA;
- Prepare and submit monitoring reports and facilitate the verification of the same;
- Act as the focal point with the CDM Executive Board for matters related to the PoA;
- During the lifetime of the PoA, maintenance of all monitoring reports of all CPAs in accordance with record keeping systems outlined in the CDM-PoA-DD;

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

- Operate the CPA for the duration of the project;
- Keep records of parameters as per the monitoring plan and provide hard and electronic records to the CME on a regular basis;
- Make available staff for validation and verification where applicable;

The CME will enter into agreements with all CPA entities. The contractual agreements will summarize roles and responsibilities regarding the implementation of the individual project activities as a Component Project Activity (CPA). The agreements will ensure that the CME will have control of all records and information related to the implementation of individual CPAs and will be in a position to ensure that each CPA is being implemented according to the provisions as outlined in the PoA-DD.

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

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

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

A.3. CMEs and participants of PoA

Standard Bank Plc will act as the coordinating/managing entity. Standard Bank Plc is the sole project participant of the PoA.

A.4. Party(ies)

Name of Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
South Africa (host)	Standard Bank Plc	No

A.5. Physical/ Geographical boundary of the PoA

The geographical area within which small-scale Component Project Activities (SSC-CPAs) included in the PoA will be implemented is defined by the national boundaries of the host country, South Africa. The geographic coordinates of South Africa are (See figure and table below):

Figure 1: Map of South Africa

Table 1. Coordinates of South Africa

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

In line with EB 60, Annex 26 *Clarification regarding the "Procedures for registration of a Programme of Activities as a single CDM project and issuance of certified emission reductions for a Programme of Activities*" and the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 01.0, EB 65, Annex 3), the programme boundary might be amended post-registration to include additional host parties.

A.6. Technologies/measures

SSC-CPAs under the PoA will use renewable energy technologies to generate electricity. Renewable energy technologies and measures to be employed by a SSC-CPA will include hydro, wind, solar photovoltaic (PV) and geothermal. Projects using renewable biomass are excluded from the programme. Installed capacities of individual SSC-CPAs will be below or equal to 15 MW.

The renewable energy generation units will either supply electricity to a national or regional grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.

The implementation of SSC-CPAs under the PoA will involve the installation of a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (greenfield plant). Capacity additions, retrofits and replacement of existing plants are not included in the PoA.

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

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *Grid connected renewable electricity generation*, the baseline scenario is "the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid".

In terms of installed capacity, coal power plants' share is about 85% followed by electricity generation based on gas (6%), nuclear (4%) and pumped storage hydro power plants (3%). However, the pumped storage power plants are not considered as power plants for the calculation of the grid emission factor in line with the approved *"Tool to calculate the emission factor for an electricity system*" (version 02.2.1). Pumped storage plants are net consumers of electricity, which pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas etc. are negligible.

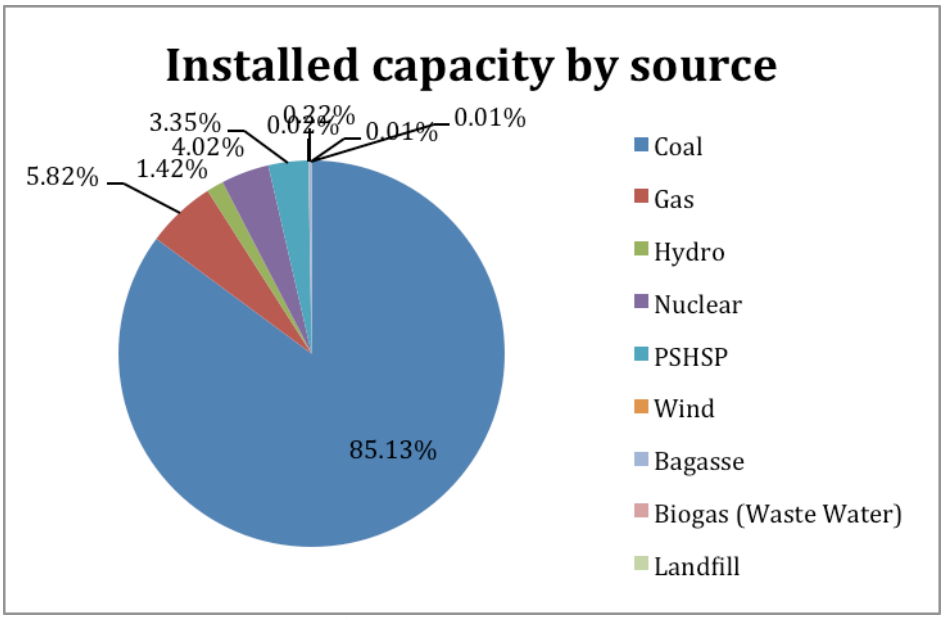


Figure 2: Installed capacity by source

The *Integrated Resource Plan 2010-2030 for Electricity,* which determines the needed capacity and share of technologies in the future proposes the following capacity additions until 2030: [2]

Table 2. Summary of capacity additions 2010-2030

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

More detailed information of the description of the baseline is provided in section B.4 of part II of the PoA-DD. Detailed information about the exact technology and measure applied by the individual SSC-CPAs will be provided in the relevant section of the specific SSC-CPA-DD. The section will also include a description of how environmentally safe and sound technology and know how is being applied by the specific SSC-CPA *inter alia* technology transfer to the host party for application in the SSC-CPA.

A.7. Public funding of PoA

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

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

SECTION B. Demonstration of additionality and development of eligibility criteria
B.1. Demonstration of additionality for PoA

Historically, South Africa has relied heavily on coal-based electricity generation. By 2011, installed capacity of coal power plants amounted to 85%, followed by gas power plants (6%), nuclear (4%) and pumped storage hydro power plants (3%). Currently, there are only two wind power plants connected to the grid. The 3 MW Klipheuwel Wind Farm which is owned by Eskom, and the 5.2 MW Darling Wind Farm which is an IPP owned by private investors. Both wind farms have been developed as demonstration projects and are very small compared to the 47,463 MW of installed capacity. Other energy sources like hydro, biogas, etc. are negligible. By March 2011, there were no grid connected solar powered systems.

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

The first renewable energy projects are currently going through the procurement programme and it is too early to evaluate the success of the programme. However, it is clear that renewable energy projects in South Africa still face many barriers, including technological, institutional and financial.

In this context, it will be demonstrated that each CPA under the PoA is additional following paragraph 9 of the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities* (version 01.0, EB 65, Annex 3) which states:

"*PoAs that consist of one or more small scale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of Attachment A of Appendix B of the "Simplified modalities and procedures for small-scale CDM project activities*".[3]

And paragraph 8 of the same standard that states:

"*PoAs that consist of one or more microscale projects as CPAs shall include eligibility criteria derived from all the relevant requirements of the "Guidelines for demonstrating additionality of microscale project activities".*

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

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

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

[3] The document, *Attachment A of Appendix B* was revised to *Guidelines on the demonstration of additionality of small-scale project activities* in EB 68, Annex 27. In this PoA-DD, the latest version of this document is in used.

As per the *Clean Development Mechanism Project Standard* (version 01.0, EB 65, Annex 5) paragraph 150, the CME has developed eligibility criteria for inclusion of SSC-CPAs under the PoA. The eligibility criteria consists of two sets of criteria: (1) general eligibility criteria as provided in the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for Programme of Activities* (version 01.0, EB 65, Annex 3) and (2) eligibility criteria for the demonstration of additionality.

The eligibility criteria for the demonstration of additionality for each CPA type were derived from the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) or *Guidelines for demonstrating additionality of microscale project activities* (version 04.0, EB 68, Annex 26).

	Topic	PoA eligibility criteria	Means of verification
1)	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA, South Africa.	CPA to provide detailed documentation regarding the exact geographical location of the CPA such as EIA report or feasibility study/project description.
2)	Double counting (b)	The CPA has not yet been included in another programme of activities or has not yet been registered as a single CDM project activity.	Agreement between CME and CPA where the CPA legally confirms its unique adhesion to this PoA as CDM component project activity; and cross-check evidence on the non existence of similar CDM project activities/component project activity, as described in the management system, section C. Thus, each CPA will have a unique name, which will at least refer to the location of the CPA and the installed capacity of the project.
3)	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are excluded from this programme of activities.	Feasibility study or other technical description, EIA report or PPA that the CPA involves the implementation of a technology eligible for inclusion in the PoA.
4)	Start date (d)	The start of the CPA occurs after the start date of the validation of the programme of activities, 13/03/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA or the date on which the CPA is included in the programme of activities, whichever comes earlier.	(Draft) contract with party providing equipment/construction/operation services or a contractual agreement between CME and CPA implementer.

5)	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* as per section B.2, part II of the PoA-DD.	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation.* Explanation is provided in section D.2 of the specific CPA-DD.
6)	Applicability of methodology (e)	The CPA does not use generating equipment, which is transferred from another activity.	Feasibility study report or other relevant project documentation proving that the CPA does not use generating equipment, which is transferred from another activity.
7)	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown in the additionality-related eligibility criteria.	Additionality check in each CPA-DD carried out in line with additionality-related eligibility criteria.
8)	Stakeholder consultation and EIA (g)	(a) The CPA has carried out a local stakeholder consultation. (b) The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations	(a) The report of the meeting that includes summary of concerns raised and clarification provided and other information such as attendance sheet, invitations and photographs shows that a local stakeholder consultation was carried out. (b) Environmental Impact Assessment (EIA) report or EIA license.
9)	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties <u>or</u> confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
10)	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation proving that the CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
11)	Sampling (j)	Sampling will be carried out in line with paragraph 4 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 02.0, EB 65, Annex 2) whereby the requirements from the applicable methodology will have precedence *[Applicable*	Monitoring section B.7 of the PoA-DD and D.7 of the specific CPA-DD. *[Applicable for geothermal project types]*

		for geothermal project types].	
12)	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a CPA is applying the additionality Option A for microscale project activities, the installed capacity of the SSC-CPA will be smaller than or equal to 5 MW.	Feasibility, engineering design or other relevant study reports.
13)	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the *Guidelines on assessment of debundling for SSC project activities* (version 03, EB 54, Annex 13).	Debundling check carried out in line with the *Guidelines on assessment of debundling for SSC project activities* (version 03, EB 54, Annex 13).

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Means of verification*
Installed capacity of the SSC-CPA is smaller than or equal to 5 MW and,	Feasibility study or other relevant project documentation.
The geographic location of the CPA is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country. or The CPA employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	Geographical coordinates of the CPA. Public documentation from the host country delineating special underdeveloped zones (SUZs). or Documentation from the Board recognizing the specific renewable energy technology used by the CPA.
Rationale	
In case the SSC-CPA is a microscale CPA, i.e. project activities up to five megawatts that employ renewable energy technology, additionality will be demonstrated using the *Guidelines for demonstrating additionality of microscale project activities (version* 04, EB 68, Annex 26). SSC-CPAs under the PoA follow the methodology AMS-I.D, therefore eligible SSC-CPAs will have to follow paragraph 2 (a) or paragraph 2 (d) of the guidelines as they are grid-connected renewable energy technologies, in order to demonstrate microscale additionality.	

In case the SSC-CPA is not a microscale CPA, additionality will be demonstrated using *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27) and the *Non-binding best practice examples to demonstrate additionality for SSC project activities* (version 01, EB 35, Annex 34).

Option B.1 Investment Barrier	
Criteria	*Means of verification*

Without the CDM revenue, the SSC-CPA has a less favourable project or equity IRR than the benchmark and,	Investment analysis spread sheet.
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	Investment analysis spread sheet.
Rationale	
Investment barrier: a financially more viable alternative to the CPA would have led to higher emissions. The investment barrier shall be demonstrated using benchmark analysis in accordance with the provisions of the *Tool for the demonstration and assessment of additionality* (06.1.0, EB 69, Annex 20) and *Guidelines on the assessment of investment analysis* (version 05, EB 62, Annex 5).	

Option B.2 Access-to-capital Barrier	
Criteria	*Means of verification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	Incorporation documents of the entity implementing the SSC-CPA.
Investment is done by a company that also purchases the CERs.	Loan or investment agreement.
Rationale	
Access-to-capital barrier: the CPA could not access appropriate capital without consideration of the CDM revenues. The access-to-capital shall be demonstrated by referring to guidelines 1 and 6 of the *Guidelines for objective demonstration and assessment of barriers* (version 01, EB 50, Annex 13), as follows: 1. While demonstrating barriers related to the lack of access to capital, information should include nature of company, organization and its ownership and, financial information. A company that is a subsidiary of a multinational group may have different access to capital, technologies or skilled labour than a local SME company. 2. In case the project proponents make the claim for investment barriers, they should demonstrate in the PDD that the financing of the project was assured only due to the benefit of the CDM. Therefore, it should be demonstrated that the loan approval (or other significant financing decision(s)) by the lender takes explicitly the CDM registration into account. For the cases where the investment is done by a company which also purchases the CERs and the loan agreement mentions that, there is an objective demonstration that the CDM facilitated the lending.	

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

B.3. Application of methodologies

This PoA will include grid-connected renewable power generation units of the following technology types: wind, hydro (run-of-river reservoir and accumulation reservoir), geothermal and solar PV. The

project activities will consist of the installation of new power plants at sites where no renewable energy power plant was operated prior to the implementation of the CPA (greenfield plants).

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

Since the SSC-CPAs to be included in the PoA will be small-scale renewable energy projects, the CME has opted for a verification method that does not use sampling but verifies each SSC-CPA. However, in case of inclusion of a geothermal CPA, sampling for parameters will be carried out in line with paragraph 4 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 02.0, EB 65, Annex 2) whereby the requirements from the applicable methodology will have precedence. An electronic database will be established that contains general information regarding each SSC-CPA as well as data and information, which is monitored on a regular basis and which is used to determine emission reductions achieved by the SSC-CPA. The database will be accessible at any time for verification.

SECTION C. Management system

As per the *Clean Development Mechanism Project Standard* (version 01.0), paragraph 145, the CME shall establish and implement, and provide a description of the operational and management arrangements for the implementation of the proposed PoA in accordance with requirements the in the *Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities* (version 01.0).

Individual CPAs will be developed and implemented by CPA entities. The CPA entities will be responsible for the operation and maintenance of the renewable energy power plant and will enter into a power purchase agreement, wheeling agreement or similar contractual arrangement with the electricity off-taker, and where relevant the end user, for the supply of electricity.

A CPA entity will also enter into a PoA Participation Agreement with the CME for participation in the proposed programme of activities. The CME will establish the following operational and management arrangements for the implementation of the PoA:

a) Personnel involved in the inclusion of CPAs and their competencies

The CME's CPA Inclusion Management System (CPA-IMS) will involve the following parties:

Table 3: Personnel involved in the inclusion of a CPA

Personnel	Definition
SB Lead	The Standard Bank Lead (SB Lead) has authority to represent Standard Bank Plc in managing its responsibilities as a CME. The SB Lead is responsible for engaging the 'IMS operator' (IMS Lead and IMS Staff) and establishing the scope of its delegated tasks. Standard Bank Plc as the CME will nominate the SB Lead.
SB Staff	Standard Bank Staff (SB Staff) will be Standard Bank employees involved in related projects. Standard Bank will nominate the SB staff for each project involved in the management system.
SB Client/ CPA Implementer	The Standard Bank Client (SB Client) is Standard Bank's client who has an involvement/interest in a CPA. For example the SB client may be a company, a CDM project implementer, an NGO or a government, etc.

Personnel	Definition
IMS Lead	The IMS Lead has authority to represent the 'IMS operator' in its engagement with Standard Bank. This person has the accountability for executing the CPA-IMS processes.
IMS Staff	IMS Staff are employees of the 'IMS operator', who execute CPA-IMS processes and tasks under the management of the IMS Lead.

The 'CPA-IMS Operator' are the in-house (Standard Bank) or outsourced resources that are operating the system incorporating the IMS Lead and IMS Staff. Standard Bank will ensure that these resources are suitably qualified and experienced to ensure the efficient and effective operation of the CPA-IMS.

The CPA-IMS will employ a RACI-VS (Responsible, Accountable, Consulted, Informed, Verifier, Signatory) responsibility assignment matrix as a framework for specifying key roles in discharging sub-processes. The addition of the Verifier, Signatory roles to the traditional RACI matrix recognises that while the 'CPA-IMS Operator' (in-house or outsourced resources that are operating the system) is engaged to implement the CPA-IMS, ultimate responsibility lies with the Standard Bank Plc as the CME.

Each sub-process in the CPA-IMS has a process map an associated description, which includes the respective RACI-VS Matrix. An example of the matrix is shown below:

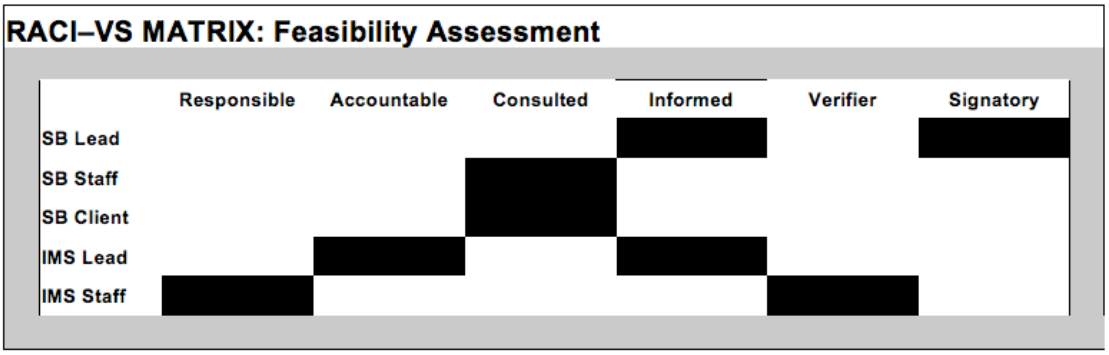


Figure 3: RACI-VS Matrix

Definitions of the roles described in the RACI-VS Matrix are presented below.

Table 4: Roles and responsibilities

ROLE	DEFINITION
Responsible	Those who do the work to achieve the task
Accountable	The one ultimately answerable for the correct and thorough completion of the deliverable or task. The 'Accountable' person 'signs off 'on the work that the 'Responsible' people provide
Consulted	Those whose opinions are sought, and with whom there is two-way communication
Informed	Those who are kept up-to-date on progress, often only on completion of the task, and with whom there is often only one-way communication
Verifier	Those who check whether the service meets standards and required outputs
Signatory	Those who approve the decisions/project outcomes

The CPA-IMS operator will be responsible for the following tasks:

a) Development of CPA-DD in consultation with SB Staff and SB client

b) Carry out a technical review of a proposed CPA to ensure that the CPA meets all the eligibility criteria as formulated in the PoA-DD
c) Managing CPA inclusion process with contracted DOE
d) Collect and compile supporting evidence that are required for the inclusion of the CPA in the PoA, monitoring and verification
e) Verify that the CPA has not yet been developed as a single CDM project or been included in another PoA
f) Prepare the monitoring report and implement the monitoring database
g) Coordinate monitoring activities and data management during the lifetime of the PoA
h) Prepare and submit monitoring reports and facilitate the verification of the same;
i) Training the CPA implementing monitoring personnel
j) Obtaining a letter of approval of a host country in case of an inclusion of another country to the PoA
k) Obtaining letter of authorization of the coordination of the PoA of a host country in case of an inclusion of another country to the PoA
l) Liaise with the Designated National Authority (DNA) on matters related to the implementation of the PoA and inclusion of CPAs

Standard Bank Staff will be responsible for:
a) Review of drafted CPA-DD
b) Contracting DOE to undertake CPA inclusion process
c) Communication with UNFCCC in regards to PoA

The Standard Bank Lead will have the overall authority and responsibility for all entities involved in the CPA IMS including the final authorization of the CPA before submission to the DOE. The Standard Bank Lead will also be responsible for the training and capacity building of the parties involved in the CPA-IMS.

b) Training and capacity building for personnel involved in the inclusion of the CPAs

The CME will further conduct training and capacity building exercises for any entity involved in the IMS based on any identified needs collected in a personnel training and development register in order to ensure that continuous improvements of the PoA management system is taking place. The training will include information on the latest EB guidelines on PoA development, CPA inclusion, monitoring, verification and issuance. An annual review of the CPA IMS staff will take place and appropriate measures will be undertaken to ensure continuous development of their skills.

All CPA-IMS staff will undertake an annual review of their competencies and put in place an appropriate training and development plan. Records of arrangements for training and capacity development as above will be kept.

c) Procedures for technical review of inclusion of CPAs

As part of the responsibilities of the CPA-IMS operator, a technical review of a proposed CPA will be carried out prior to the petition of inclusion to the DOE. The CPA-IMS operator will first collect and compile all the supporting evidences stated in the eligibility criteria, and make sure it complies accordingly with all the eligibility requirements as per the PoA-DD. The CPA-IMS operator will also verify the authenticity of those documents by consulting with national or local authorities if necessary. Finally, the CPA-IMS operator will verify that the CPA has not yet been developed as a single CDM project or been included in another PoA by means of checking the CDM website database, and any other documentation that may lead to such an event. An additional quality check will be done whereby another staff member from the IMS operator, not directly involved in the development of the CPA-DD will review the CPA-DD in line with CPA-DD Internal Review Checklist as shown below.

If a CPA complies with all the technical requirements and provides the necessary documentary evidences required by the eligibility criteria as estimated by the IMS operator, its inclusion will be approved in line with the CME responsibilities outlined as above as it waits for the final assessment from the DOE.

CPA DD Internal Review Checklist

POA TITLE:	*Insert PoA title here*

Review Criteria	**Compliance?**		
	YES	**NO**	**Not applicable**
Have all eligibility criteria for inclusion in the PoA been met?			
Have the procedures to avoid double counting been checked?			
Have all relevant sections in the 'Generic CPA DD been completed?			
Have emission reduction calculations been checked by the reviewer?			
If required under Section B of the CPA DD – has an environmental analysis been undertaken?			
If required under Section C of the CPA DD – has a stakeholder consultation been undertaken?			
If required under the CPA DD – has a GEF calculation been undertaken and checked by the reviewer?			
Has all supporting documentation been sited by the reviewer?			

CPA DD is:
Complete and finalized / Requires further revision
(Delete appropriate option)

Comments:

Internal Reviewer:	
Date:	

Signature:	

d) Procedure to avoid double accounting

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

1. Entities implementing a CPA will sign a confirmation, confirming that the project has not yet been included in another programme of activities or has not yet been registered as a single CDM project activity
2. Before inclusion of a CPA, the CME will check the UNFCCC CDM project database[4] for registered projects applying the same technology and methodology, and implemented in the same location. In case similar projects are found in the same location, the available project documentation will be further scrutinized to confirm that the registered project is different from the proposed CPA.

e) Record keeping system for each CPA under the PoA

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

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

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

The CPA-IMS Lead operator appointed by the CME will be responsible for entering, updating and maintaining data and information regarding CPAs into the electronic database and will have read and write access. Other CPA-IMS Lead staff will only have read access to the data and records. Standard

[4] http://cdm.unfccc.int/Projects/projsearch.html

Bank (and the 'SB Lead' as its representative), as the ultimate 'owner' of the system, has full ownership and access to all data and systems.

The CPA-IMS record keeping and document processes are based on standards for quality management systems (e.g. ISO 9001) documentation requirements, which consist of:
a) Establishing and maintaining a 'Quality Manual';
b) Procedures for control of documents; and
c) Procedures for control of records.

This database and other records applicable will be stored in a market leading cloud based management system that will provide the necessary infrastructure for managing document security, access and version control.

f) Measures for continuous improvement of the PoA management system

In the course of the PoA lifetime, it is likely that some of those procedures mentioned will result in insufficient control of the CME management system. In this case, the CME will keep improving its standards always taking a conservative and stricter approach with the aim of meeting the procedures described in this section. Once the crediting period is over, those new procedures in the management system will be updated in the PoA-DD.

As per standards for quality management systems (e.g. ISO 9001) the 'CPA-IMS operator' will therefore plan and implement monitoring and improvement processes needed to achieve the following
- Demonstrate conformity and quality to the agreed specification
- Ensure conformity to the management system and
- Continually improve the management system

In order to achieve continual improvement, data will be collected in areas of customer satisfaction (where the customer is the CPA implementer), process performance, and product quality (where the product is the CPA-DD development process and management of the inclusion of the CPA) and the implementation of the overall management system.

The results from this collection will be analysed and action taken to improve the effectiveness and efficiency of the system. A Management System Improvement Plan will be developed every 6 months, which will detail the actions to improve the management system based on analysis of the measurement and monitoring activities.

Additionally, training and capacity building for personnel involved in the inclusion of the CPAs will be carried out as outlined as above.

g) PoA subscription

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

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

In line with the *Glossary of CDM terms* (version 06.0, EB 66, Annex 63), the start date of the PoA is 27/02/2012, which is the day when the validation contract between the CME and the DOE came into

force. The start date of any future SSC-CPA is not, or will not be, prior to the commencement of the validation of the PoA.

D.2. Length of the PoA

28 years

SECTION E. Environmental impacts
E.1. Level at which environmental analysis is undertaken

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

E.2. Analysis of the environmental impacts

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

SECTION F. Local stakeholder comments
F.1. Solicitation of comments from local stakeholders

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

F.2. Summary of comments received

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

F.3. Report on consideration of comments received

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

SECTION G. Approval and authorization

At the time of submission of this PoA-DD to the DOE for start of validation, the letter of approval from the South African DNA was not available. Letter of Approval was issued on 19/09/2012.

PART II. Generic component project activity (CPA)

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

The small-scale component project activity (SSC-CPA) which will be implemented under the South Africa Renewable Energy Programme (SA-REP) is a grid-connected renewable energy project as follows (please choose the applicable option):

Table 5: Type of CPA

	Type of CPA
Type of renewable energy project	Greenfield activity
Hydro (run-of- river reservoir)	☐

Hydro (accumulation reservoir)	☐
Wind	☐
Solar PV	☐
Geothermal	☐

The generic SSC-CPA compromises the implementation and operation of a hydro (either run-of-river reservoir or accumulation reservoir), wind, geothermal, solar PV power plant implemented at a site where no renewable power plant was operated prior to the implementation of the CPA. The CPA will generate electricity, which will be feed into to South Africa's national electricity grid or be supplied to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling. By replacing fossil fuel based electricity, the CPA will lead to emission reductions.

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

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

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

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

The approved SSC baseline and monitoring methodology AMS-I.D is approved for use in a PoA by the CDM Executive Board.

B.2. Application of methodology(ies)

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

Applicability criteria	**Generic CPA justification**
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass: (a) Supplying electricity to a national or a regional grid; or (b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	The generic SSC-CPA under the programme will use grid-connected renewable generation units, including hydro, geothermal, solar PV or wind power generation, that will supply electricity to a national or a regional grid, or to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
This methodology is applicable to project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity	The generic SSC-CPA will include activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPAs (greenfield plant).

addition; (c) Involve a retrofit of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s).	
Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2.	For SSC-CPAs that implement hydropower plants with a reservoir, at least one of the following conditions will be satisfied: • The SSC-CPA is implemented in an existing reservoir with no change in the volume of reservoir; • The SSC-CPA is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the SCC-CPA, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The SSC-CPA results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m2. In the case of SSC-CPA with power projects that are not hydro powered, or involve the implementation of hydro power plants without reservoirs, this condition is not applicable.
If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	The programme of activities does not include CPAs that will use both renewable and non-renewable components, therefore this condition in not applicable.
Combined heat and power (co-generation) systems are not eligible under this category.	The programme of activities does not include combined heat and power (co-generation) systems.
In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The programme of activities does not include capacity additions.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The programme of activities does not include retrofits or replacements.

In addition, the project meets the applicability criteria of the *Tool to calculate the emission factor for an electricity system* (version 02.2.1) as follows:

This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e. where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This tool is applicable since the generic CPAs involves the generation of electricity from wind, solar and hydro energy and its supply to the South African grid system.
The tool is not applicable if the project electricity system is located partially or totally in an Annex-I country.	The project electricity system is located in South Africa. South Africa is not an Annex-I country.

The project also meets the applicability criteria of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (*version 02) as follows:

The tool can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties.	Project emissions from fossil fuel combustion from geothermal CPAs will be calculated based on the fuel combusted and its properties

B.3. Sources and GHGs

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

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

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the 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 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	CO2	[*In case of geothermal*] Yes [*Other Project*]	Main emission source

			No	
		CH_4	[*In case of geothermal*] Yes [*Other Project*] No	Main emission source
		N_2O	No	Minor emission source
	CO_2 emissions from combustion of fossil fuels for electricity generation in geothermal power plants	CO_2	[*In case of geothermal*] Yes [*Other Project*] No	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	Minor emission source
		CH_4	[*For hydro projects with reservoirs*] Yes [*Other Projects*] No	Main emission source
		N_2O	No	Minor emission source

The figures below provide flow charts of the equipment and systems, emissions sources and gases included in the project boundary as well as the monitoring variables in the project boundary of the different CPAs eligible under this PoA.

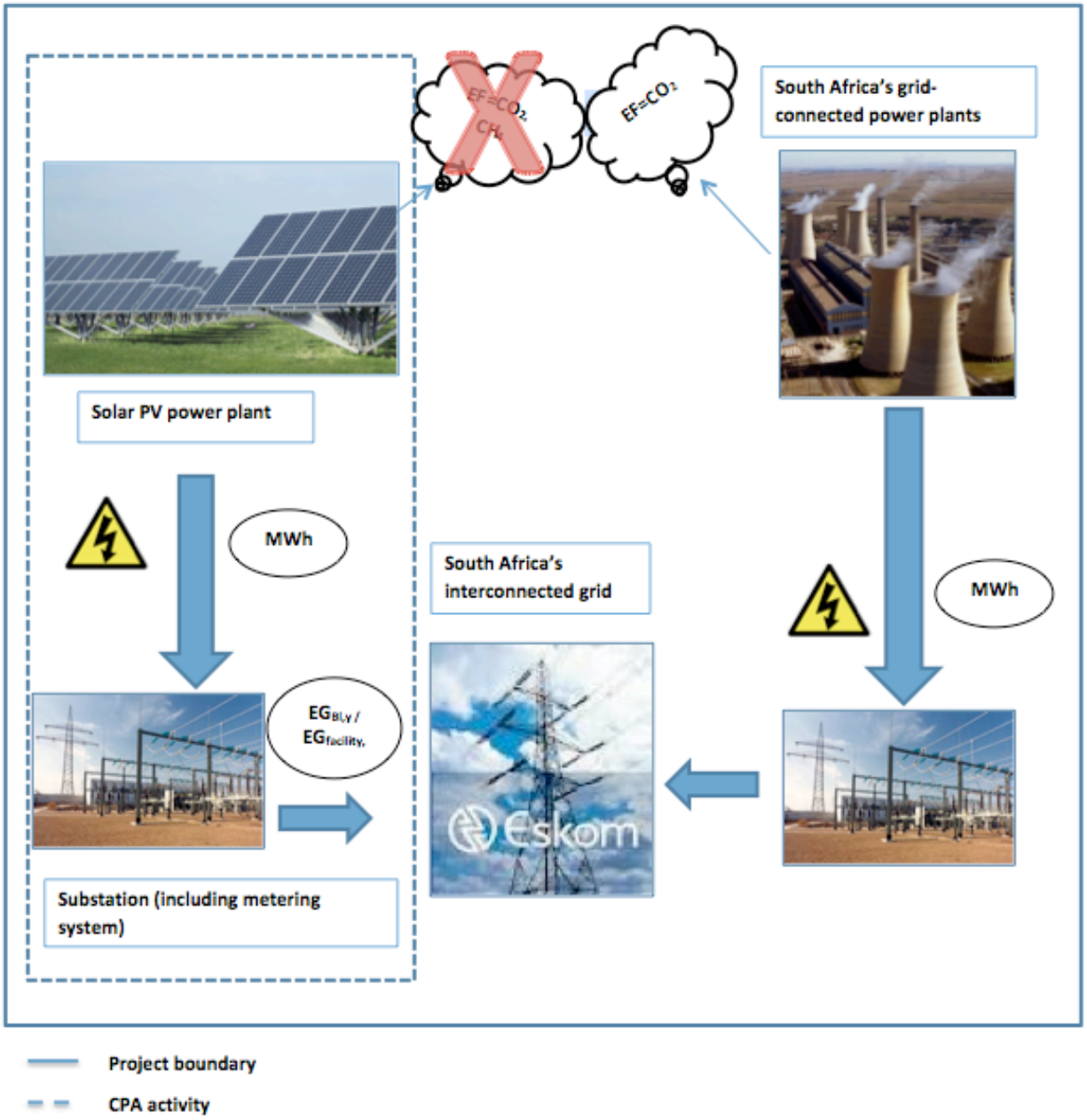


Figure 4: Solar PV CPA

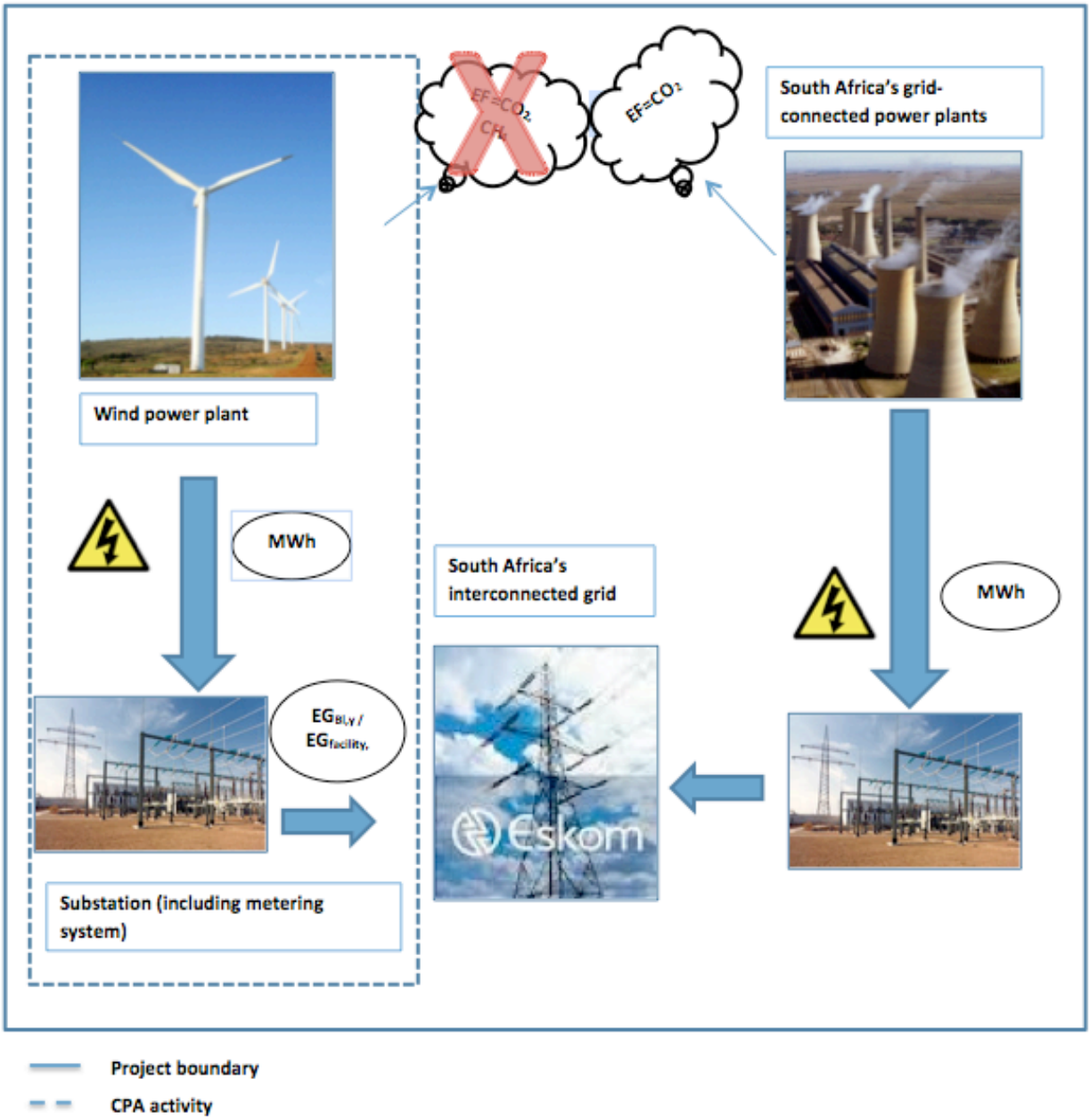


Figure 5: Wind CPA

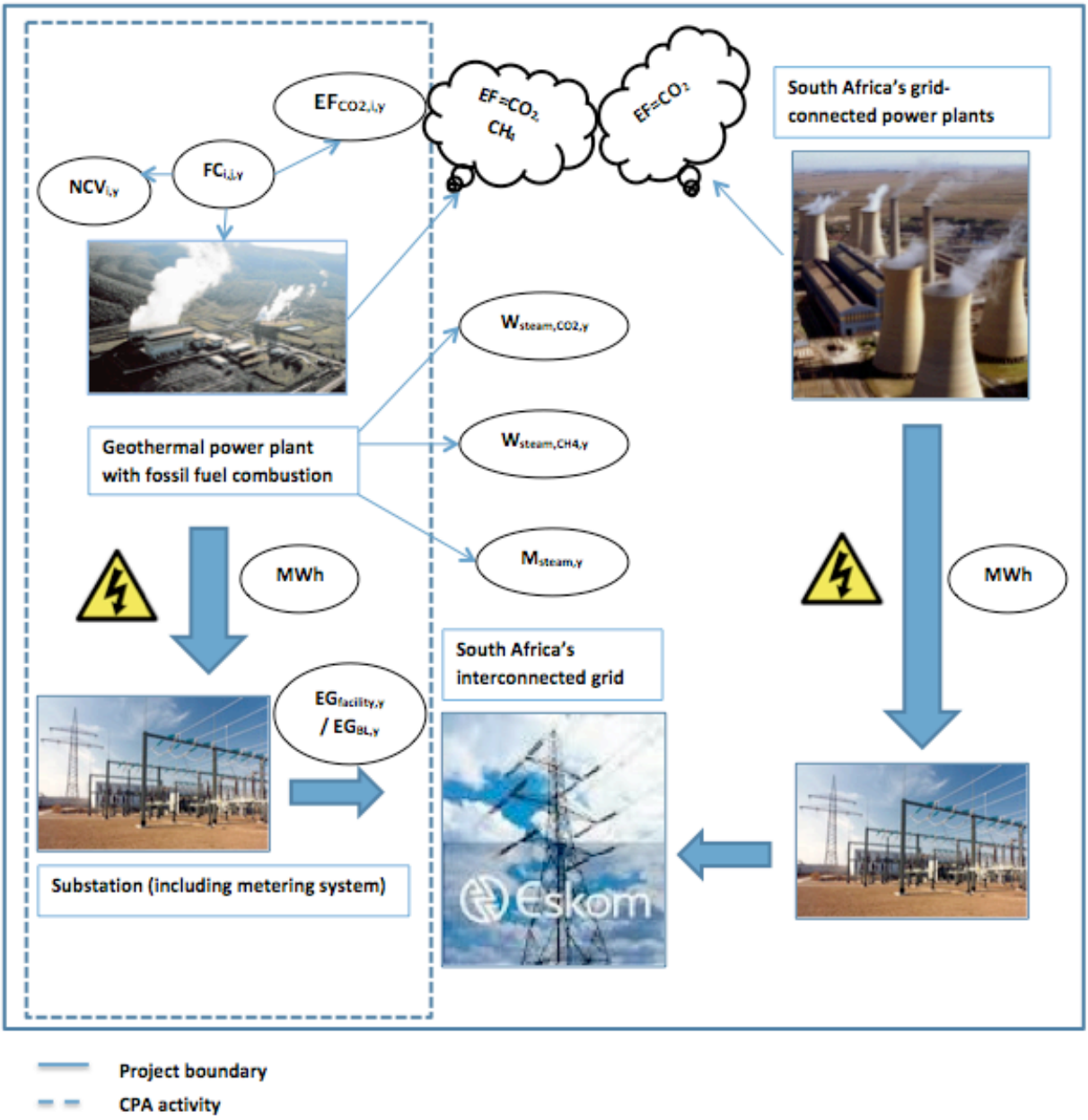
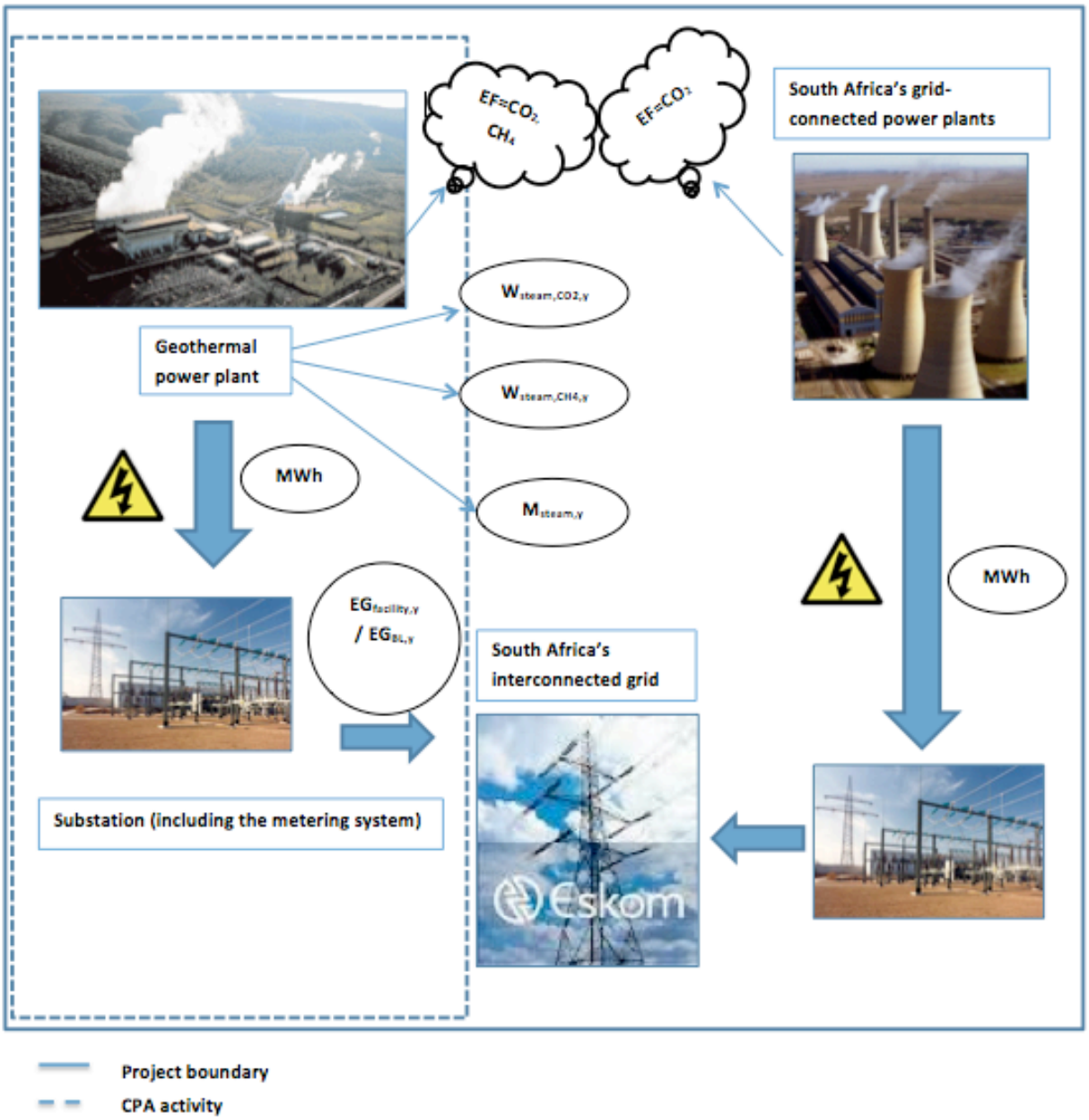


Figure 6: Geothermal CPA involving fossil fuel combustion



Project boundary

CPA activity

Figure 7: Geothermal CPA

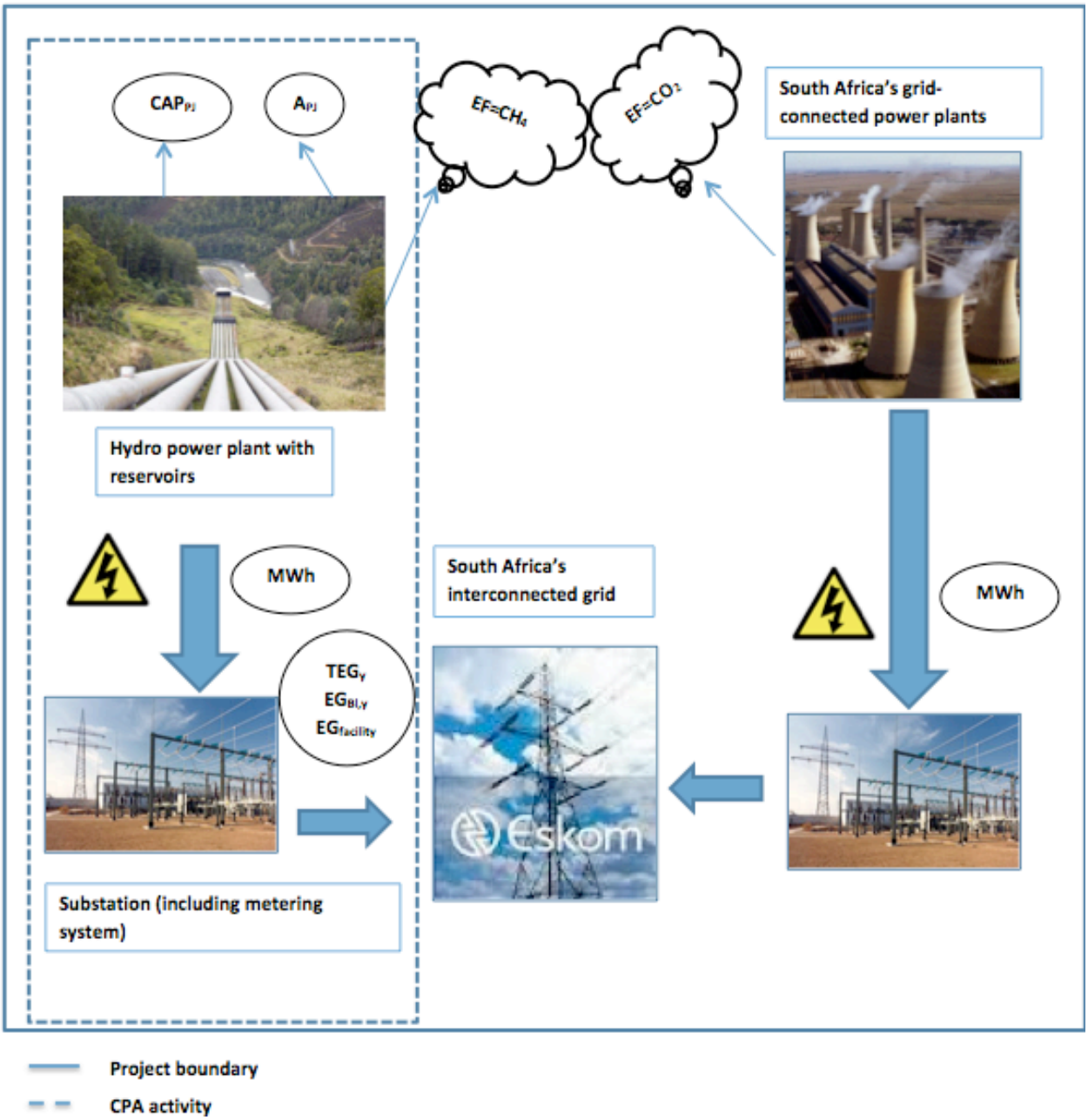


Figure 8: Hydro power CPA involving a reservoir

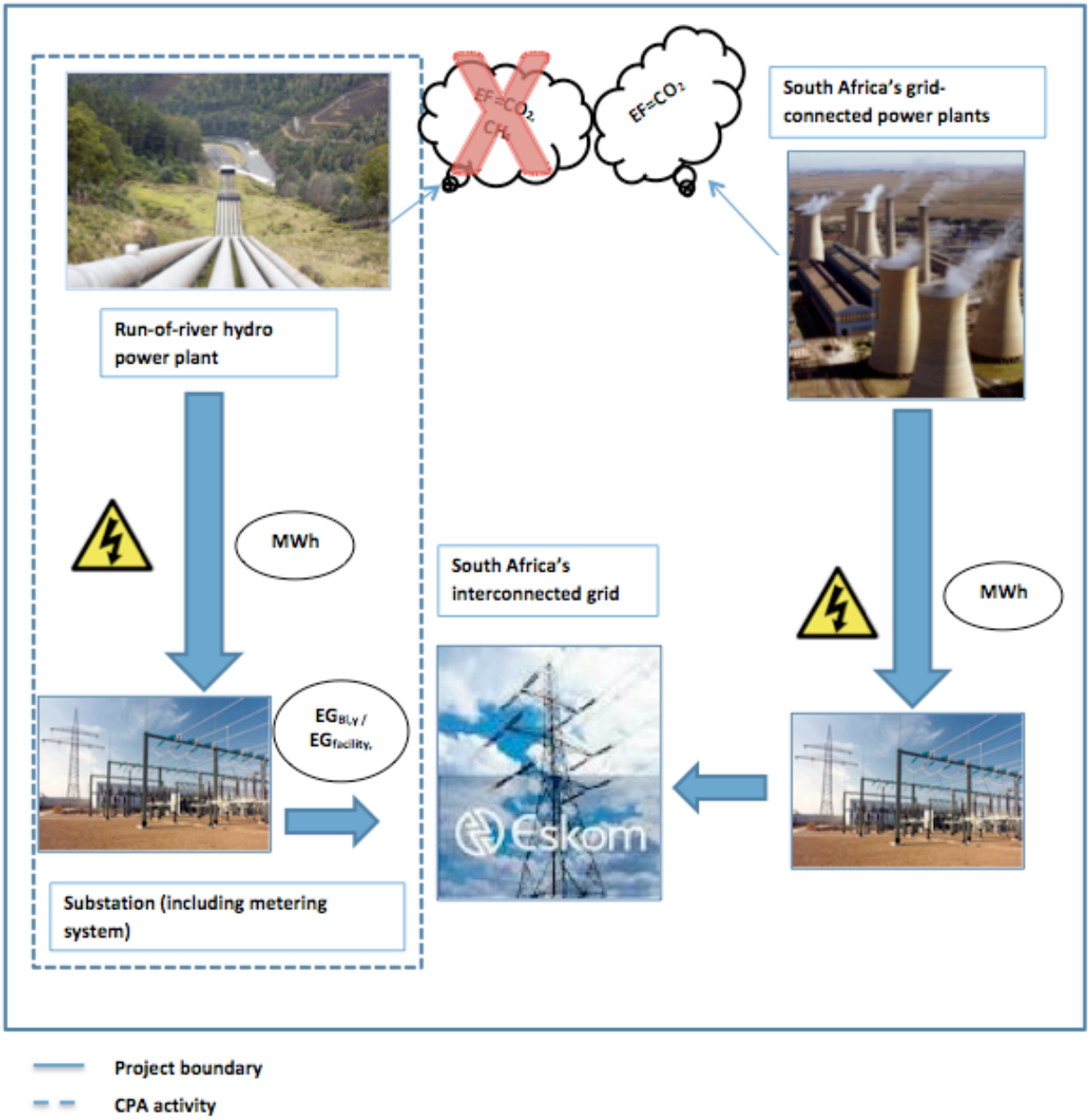


Figure 9: Run-of river hydro power plant

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

B.4. Description of baseline scenario

In accordance with simplified baseline and monitoring methodology AMS-I.D (version 17) *Grid connected renewable electricity generation*, the baseline scenario is "the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid".

The baseline scenario can be further described as follows:

<u>Policies and regulations of the South African electricity system</u>

The South African Department of Energy (DoE) is the legislative entity responsible for the South African energy sector. The energy sector is determined by the *National Energy Act of 2008 (No.34 of 2008)*[5]. The key objectives stated in the *National Energy Act of 2008* are:

- *Ensure uninterrupted supply of energy to the Republic;*
- *Promote diversity of supply of energy and its sources;*
- *Facilitate effective management of energy demand and its conservation;*
- *Promote energy research;*
- *Promote appropriate standards and specifications for the equipment, systems and processes used for producing, supplying and consuming energy;*
- *Ensure collection of data and information relating to energy supply, transportation and demand;*
- *Provide for optimal supply, transformation, transportation, storage and demand of energy that are planned, organized and implemented in accordance with a balanced consideration of security of supply, economics, consumer protection and a sustainable development;*
- *Provide for certain safety, health and environment matters that pertain to energy:*
- *Facilitate energy access for improvement of the quality of life of the people of Republic;*
- *Commercialize energy-related technologies;*
- *Ensure effective planning for energy supply, transportation and consumption: and*
- *Contribute to sustainable development of South Africa's economy.*

Specifically for the electricity sector of South Africa, the *Electricity Regulation Act of 2006 (No. 4 of 2006)*[6] determines the framework of the electricity sector. The act states the following key objectives for the South African electricity sector:

- *Achieve the efficient, effective, sustainable and orderly development and operation of electricity supply infrastructure in South Africa;*
- *Ensure that the interests and needs of present and future electricity customers and end users are safeguarded and met, having regard to the governance, efficiency, effectiveness and long-term sustainability of the electricity supply industry within the broader context of economic energy regulation in the Republic;*
- *Facilitate investment in the electricity supply industry;*
- *Facilitate universal access to electricity;*
- *Promote the use of diverse energy sources and energy efficiency;*
- *Promote competitiveness and customer and end user choice; and*
- *Facilitate a fair balance between the interests of customers and end users, licensees, investors in the electricity supply industry and the public.*

The regulation of the South African electricity, piped-gas and petroleum pipelines is the responsibility of the National Energy Regulator of South Africa (NERSA). NERSA was established under the *National Energy Regulator Act, 2004 (Act No.40 of 2004)*[7]. To reach the objectives described in the *Electricity Regulation Act of 2006*, NERSA has been granted the following power and duties as the regulator of the electricity market:

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

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

[7] Department of Energy (2004), National Energy Regulator Act 2004, http://www.info.gov.za/view/DownloadFileAction?id=67980, accessed on 30.12.2011

- *The regulator must consider applications for licenses and may issue licenses for the operation of generation, transmission and distribution facilities, the import and export of electricity and trading.*
- *Regulate prices and tariffs*
- *Register persons who are required to register with the regulator where they are not required to hold a license*
- *Issue rules designed to implement the national government's electricity policy framework, the integrated resources plan and this Act*
- *Establish and manage monitoring and information systems and a national information system, and co-ordinate the integration thereof with other relevant information systems.*
- *Enforce performance and compliance, and take appropriate steps in the case of non-performance.*

Regarding the installation of new generation capacity, the *Electricity Regulation Act of 2006* states that:

The minister may, in consultation with the regulator [NERSA]*:*

- *Determine that new generation capacity is needed to ensure the continued uninterrupted supply of electricity;*
- *Determine the types of energy sources from which electricity must be generated, and the percentages of electricity that must be generated from such sources;*
- *Determine that electricity thus produced may only be sold to the persons or in the manner set out in such notice;*
- *Determine that electricity thus produced must be purchased by the persons set out in such notice;*
- *Require that new generation capacity must be established through a tendering procedure which is fair, equitable transparent, competitive and cost-effective and provides participation for the private sector*

For this purpose, the Department of Energy, acting as the legislative entity, put into force the *Electricity Regulations on New Generation Capacity*[8] in November 2010 under the *Electricity Regulation Act of 2006.* In line with the current regulation, 70% of the new generation capacity must be implemented by the state-owned utility company Eskom, and 30% by Independent Power Producers (IPPs).[9] The Department of Energy has the mandate to decide which planned capacity addition will be implemented by Eskom, and which will be determined by a bidding process between IPPs. However, all IPPs are mandated to sell the generated electricity to Eskom (Single-Buyer-Model) through the signing of long-term Power Purchase Agreements (PPAs) with Eskom.

The Department of Energy determines the needed capacity additions after consultation with the regulator NERSA. The DoE regularly develops an "*Integrated Resource Plan for Electricity"* which is updated every two years, the latest one being the *"Integrated Resource Plan 2010-2030 for Electricity*[10]*"* under the *Electricity Regulation Act No. 4 of 2006.* In its current version, from the year 2010, the Integrated Resource Plan determines the proposed specific amount of each technology in the electricity generation from 2010 to 2030.

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

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

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

The *Electricity Regulation on New Generation Capacity* replaced the former *Renewable Energy Feed-in Tariff (REFIT)*[11], which came into force on the 26 of March 2009.

Structure of the South African Power Sector

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

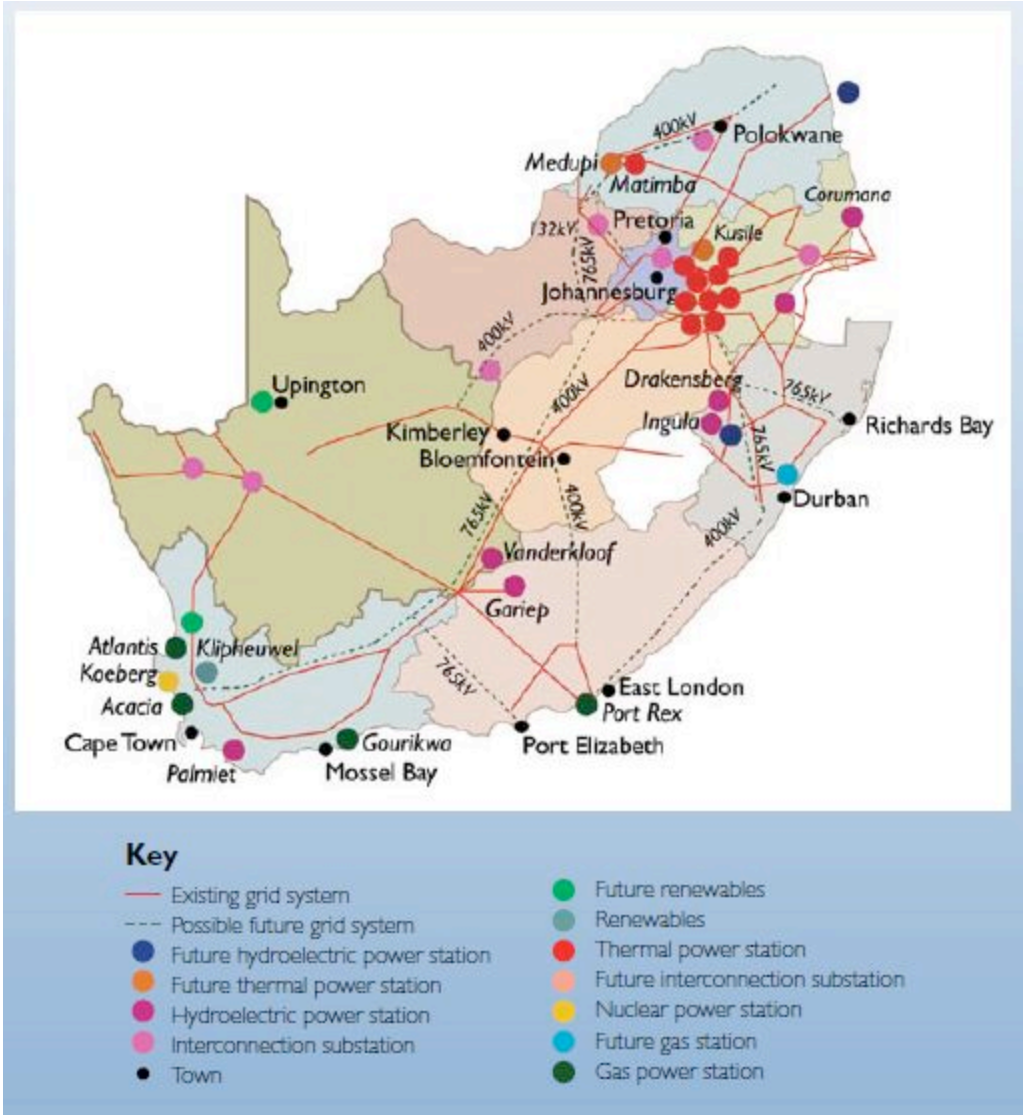


Figure 10. South African Power Sector

Generation

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

As mentioned before, generation is dominated by Eskom, which supplies about 95% of South Africa's electricity. Municipal owned power plants and IPPs supply the remaining 5%. Approximately 90% of the total generated electricity is based on coal.[12]

Detail description of the installed capacity for each technology is presented in the following tables. Data from Eskom's power plants is dated from 2011.[13] The latest published data for IPPs and municipal generation is from 2006[14].

Table 6. Eskom Electricity Generation Capacity

Installed Eskom capacity by source 2011	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	37,745	35,052
Gas	2,426	2,409
Hydro	661	600
Nuclear	1,910	1,830
PSHPP	1,400	1,400
Wind	3	3

Table 7. Municipalities Electricity Generation Capacity

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

Table 8. IPP Electricity Generation Capacity

Installed private capacity by source 2006	Nominal Capacity [MW]	Net maximum capacity [MW]
Coal	1,339	933
Bagasse / Coal Fired Stations	105	66
Hydro	10	7
Wind	5.2	5.2
Waste Water / Biogas	4.25	4.25
Landfill	5	5

Accordingly, Eskom owns 93% of the total installed capacity in South Africa of 47,463.45 MW whereby IPPs (inlcuding CDM) and municipalities own a share of 3 % and 4 % respectivily of the installed capacity.

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

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

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

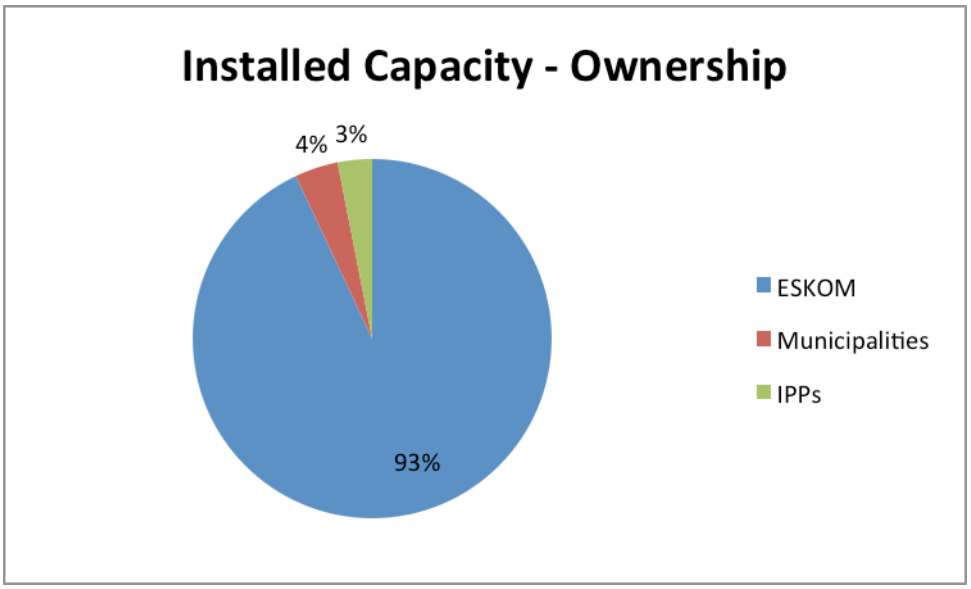


Figure 11: Installed capacity - Ownership

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

In terms of installed capacity, coal power plants' share is about 85% followed by electricity generation based on gas (6%), nuclear (4%) and pumped storage hydro power plants (3%). However, the pumped storage power plants are not considered as power plants for the calculation of the Grid Emission Factor in line with the approved *Tool to calculate the emission factor for an electricity system* (version 02.2.1). Pumped storage plants are net consumers of electricity, which pump water during off-peak periods to a reservoir so that electricity can be generated during peak periods. Other energy sources like hydro, biogas etc. are negligible.

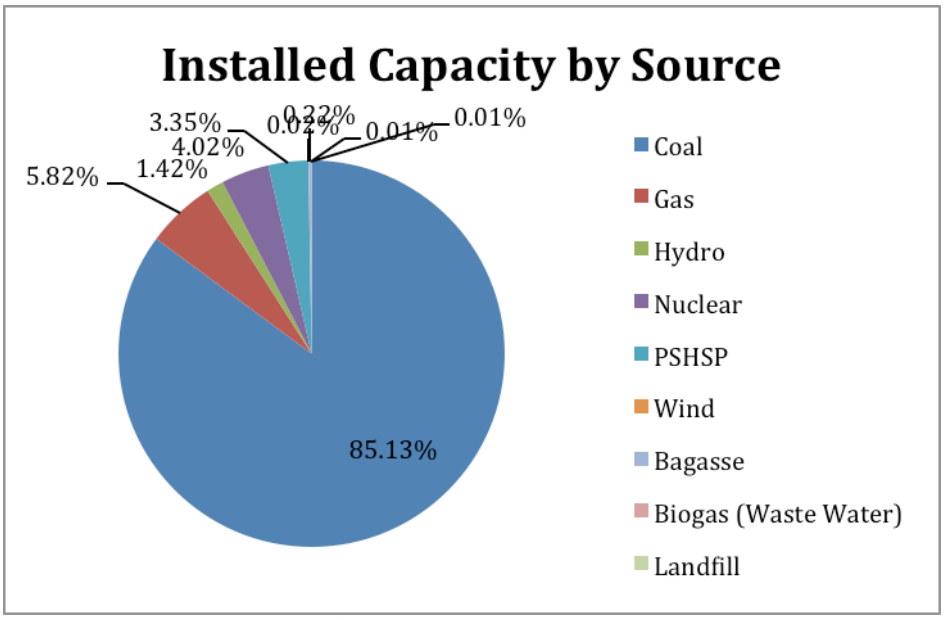


Figure 12: Installed capacity by source

The *Integrated Resource Plan 2010-2030 for Electricity,* which determines the needed capacity and share of technologies in the future proposes the following capacity additions until 2030: [15]

Table 9. Summary of capacity additions 2010-2030

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

The current installed capacity of 47,463 MW is therefore expected to double up to 89,532 MW by the year 2030 in order to meet the estimated rising electricity demand in the country, which is expected to have a peak demand of 80,272 MW by then. Besides the domestic generation, the *Integrated Resource Plan for Electricity* 2010-2030 forecasts increasing imports of electricity generated from hydro power plants located in Zambia and Mozambique from 2022 onwards. However, the *Integrated Resource Plan for Electricity 2010-2030* also mentions that in order to reach this objective cross-border negotiations and an upgrade in transnational transmission infrastructure would be necessary. Additional risks regarding imports are delays from hydro power plants in the construction of the power plants and long-lasting droughts.

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

The *Integrated Resource Plan for Electricity 2010 - 2030* also forecasts the continuation of the current power shortage until the year 2016 when newly installed power plants in line with *Integrated Resource Plan for Electricity 2010-2030* will start operation. By year 2012 a supply shortfall of 9 TWh is estimated meanwhile for the year 2013 the shortfall is expected to be only 3 TWh. However, several steps have been taken to decrease the risk of shortfalls, such as the implementation of a demand site management by Eskom or a Solar Water Heater programme[16].

Transmission and Distribution

Eskom operates the integrated national high-voltage transmission system and supplies electricity directly to large consumers such as mines and other large industries, to commercial farmers and also, through the Integrated National Electrification Programme (INEP), to a large number of residential consumers. Eskom provides electricity directly to about 45% of all end-users in South Africa. The other 55% of end-users have their electricity distributed by redistributors (including municipalities).[17] Eskom sells in bulk to certain municipalities, which distribute to the consumers within their boundaries. Those municipalities, own the distribution lines in their areas, and some also own their own generation power plants. There are also a few private entities that have the licence to distribute electricity as shown below: [18]

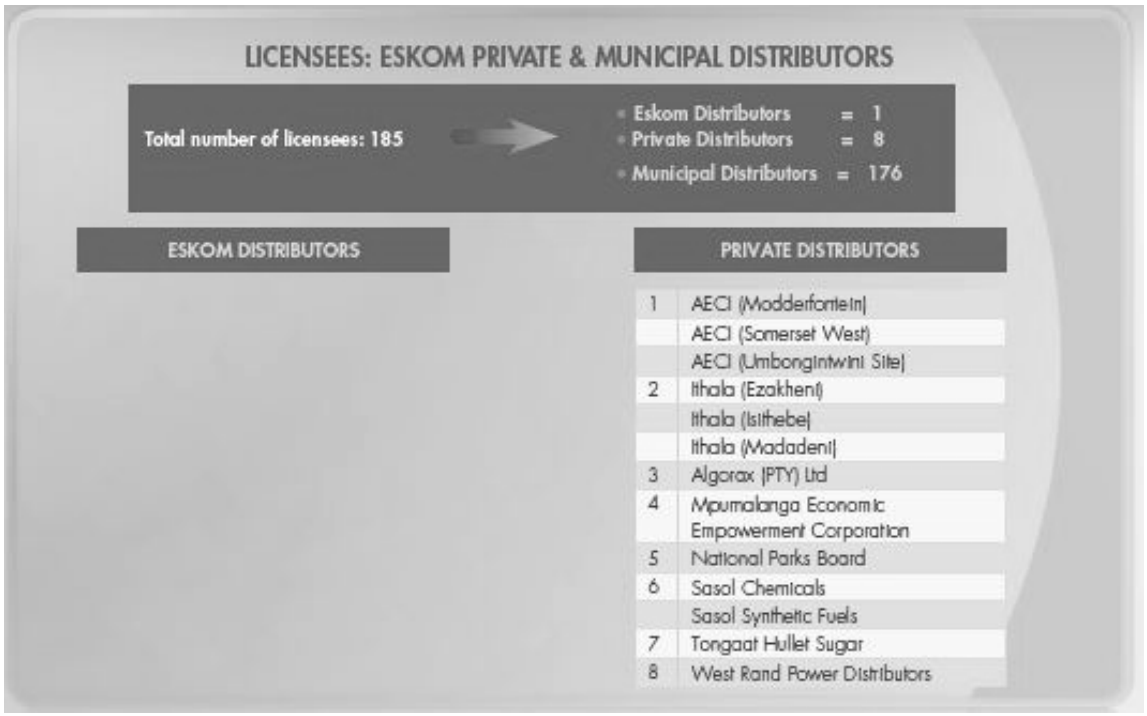


Figure 13. Distribution licenses

The government's policy on the Electricity Distribution Industry (EDI) requires the transmission of electricity to be separated from Eskom and merged with the electricity departments of municipalities to form a number of financially viable regional electricity distributors (REDs)[19]. An interim body, called

[16] http://www.eskom.co.za/, accessed on 30.12.2011

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

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

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

EDI Holdings Company, was intended to oversee the transition period. This plan would have required Eskom to transfer its distribution assets and business to these entities. The restructuring proposal was formally revoked on 8 December 2010 by the government[20]. Therefore transmission lines are still owned and operated by Eskom.

As for transmission of the electricity, to meet the forecasted additional generation capacity in the *Integrated Resource Plan for Electricity 2010 - 2030*, the *"Transmission Ten-Year Development Plan 2012-2021"*[21] published by the Transmission Division of Eskom determines the required additional transmission capacity as follows:

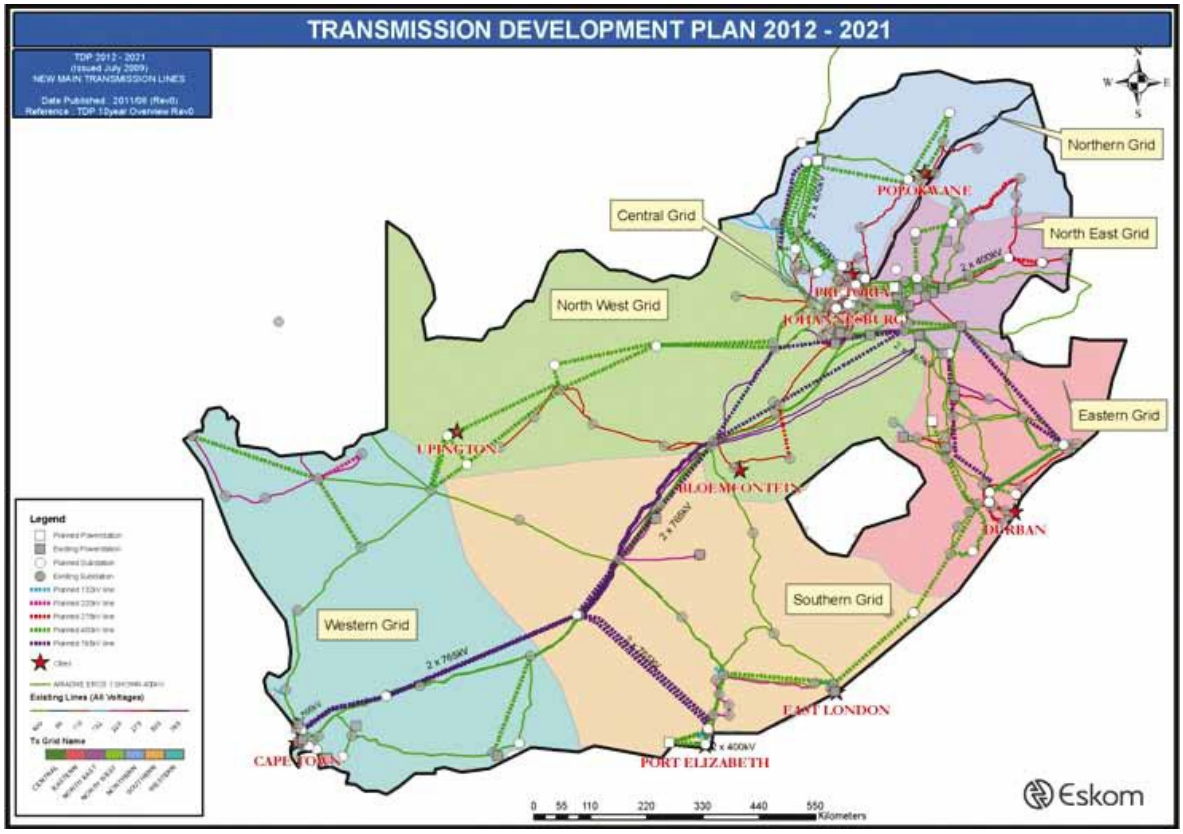


Figure 14. Transmission Development Plan 2012-2021

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

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

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

The addition of over 73,000 MVA of transformer capacity to the transmission system is an indication of the increase in load demand and in the capacity requirements of the customers. This figure also includes the transformation capacity required to integrate renewable energy generation. Approximately 2,000 MVArs of capacitive support are required to support areas of the network under contingency conditions to ensure that the required voltage levels are maintained. They also improve system efficiency by reducing network losses.

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

Figure 15. New grid assets 2022

More information regarding the baseline situation in South Africa is provided in Appendix 6

B.5. Demonstration of eligibility for a generic CPA

	Topic	PoA eligibility criteria	Justification
1)	Geographical boundary (a)	The geographical boundary of the CPA including any time-induced boundary is located within the geographical boundary set in the PoA, South Africa.	CPA to provide detailed documentation regarding the exact geographical location of the CPA such as EIA report or feasibility study/project description.
2)	Double counting (b)	The CPA has not yet been included in another programme of activities or has not yet been registered as a single CDM project activity.	Signed confirmation from the entity implementing the CPA, confirming that the project has not yet been included in another programme of activities or has not yet been registered as a single CDM project activity. A contract between CME and CPA might be proof of that signed confirmation. A cross-check evidence on the non existence of similar CDM project activities/component project activity, as described in the management system, section C will be proof that the CME has not find the same project already registered as a CDM project activity.

			Each CPA will have a unique name, which will at least refer to the location of the CPA and the installed capacity of the project.
3)	Technology (c)	The CPA involves the implementation of a renewable energy technology, including solar PV, wind, geothermal and hydro. CPAs involving the use of biomass for generating electricity are excluded from this programme of activities.	Feasibility study or other project documentation proving that the CPA involves the implementation of a technology eligible for inclusion in the PoA.
4)	Start date (d)	The start of the CPA occurs after the start date of the validation of the programme of activities, 13/03/2012. The start date will be defined as the date on which a contract has been signed for equipment, construction or operation services required for the CPA or the date on which the CPA is included in the programme of activities, whichever comes earlier.	(Draft) contract with the party providing equipment/construction/operation services or contractual agreements between the CME and the CPA implementer will be provided.
5)	Applicability of methodology (e)	The CPA meets all the applicability criteria of version 17 of AMS-I.D *Grid connected renewable electricity generation* as per section B.2, part II of the PoA-DD.	Detailed assessment that the project meets all the applicability criteria of version 17 of AMS I.D *Grid connected renewable electricity generation*. Explanation is provided in section D.2 of the specific CPA-DD
6)	Applicability of methodology (e)	The CPA does not use generating equipment, which is transferred from another activity.	The feasibility study or other project documentation proves that the SSC-CPA does not use generating equipment, which is transferred from another activity.
7)	Additionality (f)	The CPA meets the eligibility criteria pertaining to the demonstration of additionality as shown in the additionality-related eligibility criteria.	Additionality check carried out in section D.5 of the SSC-CPA-DD demonstrates that the project is additional.
8)	Stakeholder consultation and EIA (g)	(a) The CPA has carried out a local stakeholder consultation. (b) The CPA has carried out an Environmental Impact Assessment in line with host country laws and regulations	(a) The report of the meeting that includes summary of concerns raised and clarification provided thereof, attendance sheet, invitations and photographs shows that a local stakeholder consultation was carried out. (b) Environmental Impact Assessment report and license are provided by the SSC-CPA and show that the SSC-CPA

			has carried out and EIA.
9)	ODA (h)	The CPA has not received funding from Annex I parties that results in a diversion of official development assistance	Confirmation letter from CPA entity that the CPA has not received funding from Annex I parties or confirmation letter from Annex I party that funding to the CPA does not result in a diversion of official development assistance.
10)	Target group (i)	The CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	Power Purchase Agreement, wheeling contract or any other project documentation proving that the CPA supplies electricity to a national or regional grid; or supplies electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.
11)	Sampling (j)	Sampling will be carried out in line with paragraph 4 of the *Standard for sampling and surveys for CDM project activities and Programme of Activities* (version 02.0, EB 65, Annex 2) whereby the requirements from the applicable methodology will have precedence *[Applicable for geothermal project types]*.	Monitoring section B.7 of the PoA-DD and D.7 of the specific CPA-DD *[Applicable for geothermal project types]*
12)	Installed capacity limits (k)	The installed capacity of the CPA is smaller than or equal to 15 MW. However, if a CPA is applying the additionality Option A for microscale project activities, the installed capacity of the SSC-CPA will be smaller than or equal to 5 MW.	The feasibility, engineering design or other relevant study reports show that the project meets the small-scale or the micro-scale project threshold.
13)	Debundling (l)	The CPA is not a debundled component of a large-scale project activity in accordance with the *Guidelines on assessment of debundling for SSC project activities* (version 03, EB 54, Annex 13).	Debundling check carried out in line with the *Guidelines on assessment of debundling for SSC project activities* (version 03, EB54, Annex 13*)* shows that the project is not a debundled component of a large-scale project activity.

ADDITIONALITY-RELATED ELIGIBILITY CRITERIA

Option A: Microscale additionality	
Criteria	*Justification*
Installed capacity of the SSC-CPA is smaller than or equal to 5 MW and,	The installed capacity is [insert] MW as evidenced in the feasibility study report/environmental impact assessment and/or other project documentation.
The geographic location of the CPA is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a special underdeveloped zone (SUZ) of the host country; or The CPA employs specific renewable energy technologies/measures recommended by the host country designated national authority (DNA) and approved by the Board to be additional in the host country.	The CPA is located in [district] whose geographical coordinates are [insert] that is a special underdeveloped zone in South Africa. or The CPA employs [technology] which is a recommended technology by the South African DNA approved by the Board.

Option B.1 Investment Barrier	
Criteria	*Justification*
Without the CDM revenue, the SSC-CPA has a less favourable project or equity IRR than the benchmark and,	The CPA is not financially viable without the revenues from the CERs as demonstrated by the investment analysis carried out following the guidelines in the *Tool for the demonstration and assessment of additionality* (version 6.1.0).
Sensitivity analysis shows whether the conclusion regarding the financial/economic attractiveness is robust to reasonable variations in the critical assumptions.	The CPA is not financially viable after applying the sensitivity analysis.

Option B.2 Access-to-capital Barrier	
Criteria	*Justification*
The SSC-CPA is not implemented by a subsidiary of a multinational group and,	The CPA is not a subsidiary of a multinational group as shown in the incorporation documents of the entity implementing the SSC-CPA.
Investment is done by a company that also purchases the CERs.	Investment in the CPA is done by a company that purchases the CERs as shown by the loan or investment agreements.

Option C: Automatic additionality	
Criteria	*Justification*
The CPA uses a technology which is on the positive list of grid-connected renewable electricity generation technologies as specified in the *Guidelines on the demonstration of additionality of small-scale project activities* (version 09.0, EB 68, Annex 27)	The CPA uses [technology] with is a technology on the positive list of grid-connected renewable electricity generation technologies.

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

The PoA will focus on grid-connected renewable electricity generation from solar photovoltaic, hydro (either run-of-river reservoir or accumulation reservoir), wind and geothermal. Grid-connected renewable electricity generation from biomass and tidal/wave is excluded from this PoA.

The PoA will focus on project activities that install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the CPA (greenfield plant).

The following equations and fixed parametric values will be used for the calculation of emission reductions of a SSC-CPA:

Baseline emissions

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

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

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

Where:

BE_y	=	Baseline Emissions in year y (t CO_2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2,grid,y}$	=	CO_2 emission factor of the grid in year y (t CO_2/MWh)

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

The grid emission factor is calculated for the South African electricity system at PoA level and will be updated every seven years of the PoA. Equations and fixed parameter values to calculate the grid emission factor for South Africa are provided in Appendix 4.

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water reservoirs. These project emissions shall be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS.I-D (version 17).

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

Where:

PE_y	=	Project emissions in year y (tCO_2e/yr)

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

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

For geothermal projects that also use fossil fuels for electricity generation, CO_2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$). The use of fossil fuels for the back up or emergency purposes (e.g. diesel generators) shall be neglected. $PE_{FF,y}$ shall be calculated as per the latest version of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion* (version 02).

CO_2 emissions from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, using **equation (1)** of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion* (version 02):

$$PE_{FC,j,y} = \Sigma_i FC_{i,j,y} * COEF_{i,y}$$

Where:

$PE_{FC,j,y}$	=	Are the CO_2 emissions from fossil fuel combustion in process j during the year *y* (tCO_2/yr);
$FC_{i,j,y}$	=	Is the quantity of fuel type *i* combusted in process *j* 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* (tCO_2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ will be calculated using Option B (**equation 4**) in the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion* (version 02). Under Option B, the CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the net calorific value and CO_2 emission factor of the fuel type *i*, as follows:

$$COEF_{i,y} = NCV_{i,y} * EF_{CO2,i,y}$$

$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit);
$NCV_{i,y}$	=	Is the weighted average net calorific value of the fuel type *i* in 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* (tCO_2/GJ)
i	=	Are the fuel types combusted in process *j* during the year *y*

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

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam ($PE_{GP,y}$). $PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 (version 13.0.0) as follows:

$$PE_{GP,y} = (w_{steam,CO2,y} + w_{steam,CH4,y} * GWP_{CH4}) * M_{steam,y}$$

Where:

$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$w_{steam,CO2,y}$	=	Average mass fraction of carbon dioxide in the produced steam in year *y* (tCO_2/t steam)
$w_{steam,CH4,y}$	=	Average mass fraction of methane in the produced steam in year *y* (tCH_4/t steam)
GWP_{CH4}	=	Global warming potential of methane valid for the relevant commitment period (tCO_2e/tCH_4)
$M_{steam,y}$	=	Quantity of steam produced in year *y* (t steam/y)

According to the methodology, the default value for GWP_{CH4} is used, $21tCO_2e/tCH_4$.

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

For hydro power project activities that result in new single or multiple reservoirs and hydro power project activities that result in the increase of single or multiple existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoirs, estimated as follows:

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

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

Where:

$PE_{HP,y}$	=	Project emissions from water reservoirs (tCO2e/yr)
EF_{Res}	=	Default emission factor for emissions from reservoirs of hydro power plants in year *y* ($kgCO_2e/MWh$)
TEG_y	=	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y* (MWh)

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

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

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

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

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

Where:

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

Leakage emissions

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

Emission reductions

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

$$ER_y = BE_y - PE_y - LE_y$$

Where:

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

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

SPECIFIC PARAMETERS FOR GRID EMISSION FACTOR CALCULATIONS

Data / Parameter	**$NCV_{i,y}$**
Unit	GJ/mass or volume unit
Description	Net calorific value (energy content) of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	<table><tr><th>Fuel Type</th><th>NCV (GJ/kg)</th></tr><tr><td>Coal (other bituminous coal)</td><td>0.0199</td></tr><tr><td>Gas/Jet kerosene</td><td>0.042</td></tr><tr><td>Gas/Diesel Oil</td><td>0.0414</td></tr></table>
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values. Average OM: Calculated once for each crediting period during validation stage using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

Data / Parameter	**$EF_{CO2,i,y}$ and $EF_{CO2,m,i,y}$**
Unit	tCO2/GJ
Description	CO_2 emission factor of fossil fuel type *i* in year *y*
Source of data	IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	<table><tr><th>Fuel Type</th><th>EFCO2 (tCO2/GJ)</th></tr><tr><td>Coal (other bituminous coal)</td><td>0.0895</td></tr><tr><td>Gas/Jet kerosene</td><td>0.0697</td></tr><tr><td>Gas/Diesel Oil</td><td>0.0726</td></tr></table>
Choice of data or Measurement methods and procedures	IPCC default values are used as there is no specific data from the fuel suppliers of the power plants and also not regional default values. Average OM: Calculated once for each crediting period during validation stage using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5. For the second and third crediting period, only once *ex ante* at the start of the second crediting period
Purpose of data	Calculation of baseline emissions
Additional comment	Applicable only to grid emission factor calculations

Data / Parameter	$\eta_{m,y}$
Unit	-
Description	Average net conversion efficiency of power unit *m* in year *y*
Source of data	Default value for open cycle gas turbines built before and after 2000 and Fluidised Bed System (FBS) coal generation technology for units built before and in 2000 is used as per Annex 1 of the *Tool to calculate the emission factor for an electricity system.*
Value(s) applied	

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

Choice of data or Measurement methods and procedures	There is no data published on the efficiency of Eskom's gas power plants, therefore default values as provided in Annex 1 of the *Tool to calculate the emission factor for an electricity system* shall be used.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	$EG_{m,y}$
Unit	MWh
Description	Net electricity generated by power plant/unit *m* in year *y*
Source of data	Eskom published data and CDM Monitoring Reports for the CDM project activities

Value(s) applied

		Generation Data (MWh)		
Name	**Type**	**2008-2009**	**2009-2010**	**2010-2011**
Arnot	Coal	11,987,281	13,227,864	12,194,878
Camden	Coal	6,509,079	7,472,070	7,490,836
Duvha	Coal	21,769,489	22,581,228	20,267,508
Grootvlei	Coal	1,249,556	2,656,230	3,546,952
Hendrina	Coal	12,296,687	12,143,292	11,938,206
Kendal	Coal	23,841,401	23,307,031	25,648,258
Komati	Coal	-	1,016,023	2,060,141
Kriel	Coal	18,156,686	15,906,816	18,204,910
Lethabo	Coal	23,580,232	25,522,698	25,500,366
Majuba	Coal	22,676,924	22,340,081	24,632,585
Matimba	Coal	26,256,068	27,964,141	28,163,040
Matla	Coal	21,863,400	21,954,536	21,504,422
Tutuka	Coal	21,504,122	19,847,894	19,067,501
Acacia	Gas (Jet kerosene)	-	971.00	992.00
Port Rex	Gas (Jet kerosene)	-	322.00	5,507.00
Ankerlig	Gas/Diesel Oil	-	6,303.00	-
Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-
Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,756,730**	**228,828,053**	**232,394,838**

Choice of data or Measurement methods and procedures	Data on electricity generation has been obtained from Eskom, the main utility company in South Africa and owner of the power plants. For the CDM power plants, that are not owned by Eskom, generation data had to be calculated from the CDM Monitoring Reports. Average OM: Calculated once for each crediting period using the most recent three historical years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (*ex ante* option) BM: For the first crediting period, once *ex ante* following the guidance included in Step 5 of the *Tool to calculate the emission factor for an electricity system*. For the second and third crediting period, only once *ex ante* at the start of the second crediting period.
Purpose of data	Calculation of baseline emissions
Additional comment	-

Data / Parameter	**$FC_{i,m,y}$**
Unit	Kg/year
Description	Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y*
Source of data	Eskom published data, other utility and government records
Value(s) applied	

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

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

SPECIFIC PARAMETERS FOR HYDRO CPA

Data / Parameter	Cap_{BL}
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data	Project site
Value(s) applied	To be reported in the specific CPA-DD
Choice of data or Measurement methods and procedures	Determine the installed capacity based on recognized standards
Purpose of data	Calculation of project emissions
Additional comment	Applicable to hydro power project activities with a power density of the project activity (*PD*) greater than 10 W/m2

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

B.6.3. Ex-ante calculations of emission reductions

Baseline Emissions

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

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

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

Where:

BE_y	=	Baseline Emissions in year *y* (tCO_2)
$EG_{BL,y}$	=	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM programme in year *y* (MWh)

$EF_{CO2,grid,y}$ = CO_2 emission factor of the grid in year y (tCO_2/MWh)

Calculation of $EG_{BL,y}$

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

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

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

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

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

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

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	0.9100	tCO_2/MWh	GEF calculations
w_{BM}	0.25		Default value
$EF_{grid,OM-DD,y}$	0.9585	tCO_2/MWh	GEF calculations
w_{OM}	0.75		Default value
$EF_{grid,CM,y}$	0.9464	tCO_2/MWh	GEF calculations

Values to determine $EF_{grid,CM,y}$ for hydro and geothermal SSC-CPAs:

Parameter	Value	Unit	Source
$EF_{grid,BM,y}$	0.9100	tCO_2/MWh	GEF calculations
w_{BM}	0.5		Default value
$EF_{grid,OM-DD,y}$	0.9585	tCO_2/MWh	GEF calculations
w_{OM}	0.5		Default value
$EF_{grid,CM,y}$	0.9343	tCO_2/MWh	GEF calculations

Therefore:

$EF_{CO2,grid,y}$ = [Insert] tCO_2/MWh

BE_y = [Insert] * [Insert] = [Insert] $tCO_2/year$

Project emissions

For most renewable energy project activities PE_y = 0. However, as per the provisions in AMS-I.D (version 17), project emissions will be considered for geothermal and hydro power plants with water reservoirs. These project emissions will be calculated using **equation (1)** in ACM0002 (version 13.0.0) taking only those parameters applicable under AMS.I-D (version 17).

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

Where:

PE_y = Project emissions in year y (tCO_2e/yr)

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

[*include one of the following sections, if applicable*]

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

For geothermal projects, which also use fossil fuels for electricity generation, CO_2 emissions from the combustion of fossil fuels shall be accounted for as project emissions ($PE_{FF,y}$). $PE_{FF,y}$ shall be calculated as per the of the *Tool to calculate project or leakage CO2 emissions from fossil fuel combustion* (version 02).

CO_2 emissions from fossil fuel combustion in process *j* are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels, using **equation (1)** of the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*:

$$PE_{FC,j,y} = \Sigma_i FC_{i,j,y} \times COEF_{i,y}$$

Where:

$PE_{FC,j,y}$	=	Are the CO_2 emissions from fossil fuel combustion in process *j* during the year *y* (tCO_2/y);
$FC_{i,j,y}$	=	Is the quantity of fuel type *i* combusted in process *j* during the year *y* (mass or volume unit/y);
$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit)
i	=	Are the fuel types combusted in process *j* during the year *y*

The CO_2 emission coefficient $COEF_{i,y}$ will be calculated using Option B **(equation 4)** in the *Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*. Under Option B, the CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the net calorific value and CO_2 emission factor of the fuel type *i*, as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

$COEF_{i,y}$	=	Is the CO_2 emission coefficient of fuel type *i* in year *y* (tCO_2/mass or volume unit);
$NCV_{i,y}$	=	Is the weighted average net calorific value of the fuel type *i* in 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* (tCO_2/GJ)
i	=	Are the fuel types combusted in process *j* during the year *y*

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from fossil fuel combustion:

Parameter	Value	Unit	Source
$NCV_{i,y}$	[insert value]	[insert unit]	[insert source]
$EF_{CO2,i,y}$	[insert value]	tCO_2/GJ	[insert source]
$FC_{i,j,y}$	[insert value]	[insert value]	[insert source]
$COEF_{i,y}$	[insert value]	[insert value]	Calculated
$PE_{FC,j,y}$	[insert value]	tCO2/y	Calculated

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

For geothermal project activities, project participants shall account fugitive emissions of carbon dioxide and methane due to release of non-condensable gases from produced steam ($PE_{GP,y}$). $PE_{GP,y}$ will be calculated using **equation (2)** in ACM0002 (version 13.0.0) as follows:

$$PE_{GP,y} = (w_{steam,CO2,y} + w_{steam,CH4,y} * GWP_{CH4}) * M_{Steam,y}$$

Where:

$PE_{GP,y}$	=	Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr)
$w_{steam,CO2,y}$	=	Average mass fraction of carbon dioxide in the produced steam in year *y* (tCO_2/t steam)
$w_{steam,CH4,y}$	=	Average mass fraction of methane in the produced steam in year *y* (tCH_4/t steam)
GWP_{CH4}	=	Global warming potential of methane valid for the relevant commitment period (tCO_2e/tCH_4)
$M_{sSteam,y}$	=	Quantity of steam produced in year *y* (t steam/y)

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from the operation of the geothermal power plant:

Parameter	Value	Unit	Source
$w_{steam,CO2,y}$	[insert value]	tCO_2/t steam	[insert source]
$w_{steam,CH4,y}$	[insert value]	tCH_4/t steam	[insert source]
GWP_{CH4}	21	tCO2e/tCH4	Default value
$M_{steam,y}$	[insert value]	t steam/y	[insert source]
$PE_{GP,y}$	[insert value]	tCO2e/y	Calculated

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

For hydro power project activities that result in new reservoirs and hydro power project activities that result in the increase of existing reservoirs, project proponents shall account for CH_4 and CO_2 emissions from the reservoir. The project emissions will depend on the power density of the single or multiple reservoirs.

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

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:

PD = Power density of the single or multiple reservoirs (W/m^2)

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2)

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero

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

Parameter	Value	Unit	Source
Cap_{PJ}	[insert value]	W	[insert source]
Cap_{BL}	[insert value]	W	[insert source]
A_{PJ}	[insert value]	m^2	[insert source]
A_{BL}	[insert value]	m^2	[insert source]

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

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

$$PE_{HP,y} = \frac{EF_{Res} * TEG_y}{1000}$$

Where:

$PE_{HP,y}$ = Project emissions from water reservoirs (tCO2e/yr)

EF_{Res} = Default emission factor for emissions from reservoirs of hydro power plants in year y (kgCO2e/MWh)

TEG_y = Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year y (MWh)

The table(s) provide(s) an overview of the parameter values used to calculate the project emissions from the water reservoir:

Parameter	Value	Unit	Source

EF_{Res}	90	kgCO2e/MWh	Default
TEG_y	[insert value]	MWh	[insert source]
$PE_{HP,y}$	[insert value]	tCO2e/yr	Calculated

b) If the power density of the single or multiple reservoirs (*PD*) is greater than 10 W/m^2:

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

Total Project Emission for the CPA equal:

PE_y = [insert value] + [insert value] + [insert value]

PE_y = [insert value]

Leakage emissions

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

Emission reductions

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

$$ER_y = BE_y - PE_y - LE_y$$

Where:

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

Therefore, emission reductions equal:

[insert value of BE_y] – [insert value of PE_y] – 0 = [insert value of ER_y]

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

GENERAL PARAMETERS

Data / Parameter	**$EG_{BL,y}$**
Unit	MWh
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*
Source of data	Main and backup metering equipment installed at project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	The electricity delivered to the grid will be measured continuously (hourly measurement and at least monthly recording) by a main-meter owned and operated by the project owner and back-up meter owned and operated by the National Transmission Company or the distributor (as applicable). The metering system is installed at the point of connection with grid as agreed by the grid operator. High-precision equipment will be used to achieve high level of accuracy of the measurements.
Monitoring frequency	The quantity of electricity supplied to the grid will be measured continuously (hourly measurement) and recorded monthly. The basic measurement period shall be carried out in line with PPA.
QA/QC procedures	Measurement results shall be cross-checked with records for sold/purchased electricity (e.g. copy of invoices). The Facility Metering Installation and the System Metering Installation shall be treated as working satisfactorily so long as the errors are within the limits prescribed for meters of the particular standard and specification or in the PPA. In case the values differ, testing and inspection will also be carried out in line with the procedures described in the PPA. The final value that will be used for calculation of emission reductions will be the value agreed by the CPA entity and the National Transmission Company or distributor, in line with the PPA.
Purpose of data	Calculation of baseline emissions
Additional comment	The net electricity supplied to a grid is the difference between the measured quantities of the grid electricity export and import. If applicable, the CPA will cross check net electricity supplied to a grid as gross energy generation in the project activity power plant minus the auxiliary/station electricity consumption, technical losses and electricity import from the grid to the project power plant measured at the grid interface/connection used for billing purposes.

SPECIFIC PARAMETERS FOR CPAs THAT USE FOSSIL FUELS (GEOTHERMAL)

Data / Parameter	$FC_{i,j,y}$
Unit	Mass or volume unit per year (e.g. ton/yr or m^3/yr)
Description	Quantity of fuel type *i* combusted in process *j* during the year *y*
Source of data	Onsite measurement
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	• Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.
Monitoring frequency	Measurement must be done continuously
QA/QC procedures	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchased quantities and stock changes. Where the purchased fuel invoices can be identified specifically for the CDM project, the metered fuel consumption quantities should also be cross-checked with available purchase invoices from the financial records.
Purpose of data	Calculation of project emissions
Additional comments	Applicable for geothermal projects using fossil fuels.

Data / Parameter	$EF_{CO2,i,y}$
Unit	tCO_2/GJ
Description	Weighted average CO_2 emission factor of fuel type *i* in year *y*
Source of data	The following data sources may be used if the relevant conditions apply: **Data source** / **Conditions for using the data source** a) Values provided by the fuel supplier in invoices — This is the preferred source b) Measurements by the project participants — If a) is not available c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances) d) IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	For a) and b): Measurements should be undertaken in line with national or international fuel standards
Monitoring frequency	Monitoring Frequency: • For a) and b): The CO_2 emission factor should be obtained for each fuel delivery, from which weighted average annual values should be calculated. • For c): Review appropriateness of the values annually. • For d): Any future revision of the IPCC Guidelines should be taken into account.
QA/QC procedures	If a), b) of c) are used, the project will verify if the values are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.
Purpose of data	Calculation of project emissions

Additional comment	Applicable for geothermal projects using fossil fuels. For a): If the fuel supplier does provide the NCV value and the CO_2 emission factor on the invoice and these two values are based on measurements for this specific fuel, this CO_2 factor should be used. If another source for the CO_2 emission factor is used or no CO_2 emission factor is provided, Options b), c) or d) should be used.

Data / Parameter	**$NCV_{i,y}$**
Unit	GJ per mass or volume unit (e.g. GJ/m³, GJ/ton)
Description	Weighted average net calorific value of fuel type *i* in year *y*
Source of data	The following data sources may be used if the relevant conditions apply: **Data source** / **Conditions for using the data source** a) Values provided by the fuel supplier in invoices — This is the preferred source if the carbon fraction of the fuel is not provided (Option A) b) Measurements by the project participants — If a) is not available c) Regional or national default values — If a) is not available These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances) d) IPCC default values at the upper limit of the uncertainty at 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories — If a) is not available
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	For a) and b): Measurements should be undertaken in line with national or international fuel standards
Monitoring frequency	Monitoring Frequency: • For a) and b): The NCV should be obtained for each fuel delivery, from which weighted average annual values should be calculated • For c): Review appropriateness of the values annually • For d): Any future revision of the IPCC Guidelines should be taken into account
QA/QC procedures	If a), b) of c) are used, the project will verify if the values are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in a), b) or c) should have ISO17025 accreditation or justify that they can comply with similar quality standards.
Purpose of data	Calculation of project emissions
Additional comment	Applicable for geothermal projects using fossil fuels.

SPECIFIC PARAMETERS FOR HYDRO PROJECTS

Data / Parameter	**TEG_Y**
Unit	MWh/yr
Description	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*
Source of data	Project activity site
Value(s) applied	To be reported in the specific CPA-DD
Measurement methods and procedures	Electricity meters
Monitoring frequency	Continuous measurement and at least monthly recording.
QA/QC procedures	-
Purpose of data	Calculation of project emissions
Additional comments	Applicable to hydro power project activities with a power density of the project activity (PD) greater than 4 W/m2 and less than or equal to 10 W/m2

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

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

SPECIFIC PARAMETERS FOR GEOTHERMAL CPAs

Data / Parameter	$w_{steam,CO2,y}$
Unit	tCO2/t steam
Description	Average mass fraction of carbon dioxide in the produced steam in year *y*
Source of data	Project activity site
Value(s) applied	To be reported in specific CPA-DD.
Measurement methods and procedures	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO2 and CH4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H2S) and carbon dioxide (CO2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH4. All alkanes concentrations are reported in terms of methane
Monitoring frequency	At least every 3 months and more frequently, if necessary
QA/QC procedures	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal CPAs

Data / Parameter	$w_{steam,CH4,y}$
Unit	tCH_4/t steam
Description	Average mass fraction of methane in the produced steam in year *y*
Source of data	Measurement at project activity site
Value(s) applied	To be reported in each specific CPA-DD
Measurement methods and procedures	Non-condensable gases sampling should be carried out in production wells and at the steam field-power plant interface using ASTM Standard Practice E1675 for Sampling 2-Phase Geothermal Fluid for Purposes of Chemical Analysis (as applicable to sampling single phase steam only). The CO2 and CH4 sampling and analysis procedure consists of collecting non-condensable gases samples from the main steam line with glass flasks, filled with sodium hydroxide solution and additional chemicals to prevent oxidation. Hydrogen sulphide (H2S) and carbon dioxide (CO2) dissolve in the solvent while the residual compounds remain in their gaseous phase. The gas portion is then analyzed using gas chromatography to determine the content of the residuals including CH4. All alkanes concentrations are reported in terms of methane.
Monitoring frequency	At least every 3 months and more frequently, if necessary.
QA/QC procedures	Sampling will be performed to correct specifications and re-sampled, should a sample be abnormal. Calibration certificates of the equipment used for the steam sample analysis will be available on-site for verification.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal CPAs

Data / Parameter	$M_{steam,y}$
Unit	t steam/yr
Description	Quantity of steam produced in year *y*
Source of data	Measurement at project activity site
Value(s) applied	To be reported by specific CPA-DD
Measurement methods and procedures	The steam quantity discharged from the geothermal wells should be measured with a venture flow meter (or other equipment with at least the same accuracy). Measurement of temperature and pressure upstream of the venture meter is required to define the steam properties. The calculation of steam quantities should be conducted on a continuous basis and should be based on international standards. The measurement results should be summarized transparently in regular production reports.
Monitoring frequency	Daily
QA/QC procedures	Data will be read continuously and logged daily. Data will be entered into CDM monitoring workbook every day and will be checked for consistency when entered. Meters will be maintained and periodically verified according to manufacturer specifications to ensure accurate readings; they will be recalibrated within the schedule recommended by the manufacturer.
Purpose of data	Calculation of project emissions
Additional comments	Applicable to geothermal CPAs

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

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

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

CPA implementing entity

CPA implementing entity will be responsible for the technical aspects related to on-site monitoring such as training of personnel, calibration and maintenance of equipment and physical reading, day-to-day handling and long-term storage of metered data.

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

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

Other parameters will be monitored depending on the technology used by the CPA:

Parameter	Description	Type of CPA
$EG_{BL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y*	All
TEG_Y	Total electricity produced by the project activity, including the electricity supplied to the grid and the electricity supplied to internal loads, in year *y*	Hydro CPAs
CAP_{PJ}	Installed capacity of the hydro power plant after the implementation of the project activity.	Hydro CPAs
A_{PJ}	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.	Hydro CPAs
$w_{steam,CO2,y}$	Average mass fraction of carbon dioxide in the produced steam in year *y*	Geothermal CPAs
$w_{steam,CH4,y}$	Average mass fraction of methane in the produced steam in year *y*	Geothermal CPAs
$M_{steam,y}$	Quantity of steam produced in year *y*	Geothermal CPAs

$FC_{i,j,y}$	Quantity of fuel type *i* combusted in process *j* during the year *y*	Geothermal CPAs using fossil fuels
$EF_{CO2,i,y}$	Weighted average CO_2 emission factor of fuel type *i* in year *y*	Geothermal CPAs using fossil fuels
$NCV_{i,y}$	Weighted average net calorific value of fuel type *i* in year *y*	Geothermal CPAs using fossil fuels

Standard Bank Plc - Coordinating/managing entity

Upon receipt of data and information from CPA implementing entity, the CME will carry out a quality assurance (QA) and quality control (QC).

If problems occur that may affect the quality of data, the CME will inform the project proponent and off taker of the need for corrective actions. For instance, metering equipment installed shall be inspected by an accredited inspection agency after the repair of all or part of meter caused by the failure of one or more parts to operate in accordance with the specifications. In the case that data quality problems result in uncertainty issues the CME will always use the more conservative value from an energy generation or emission factor standpoint in preparing calculations and monitoring data for verification.

Once the CME has carried out the QA/QC, the CME will store all data and information as received from the CPA entity (including supporting evidence) in an electronic database. Based on the data and information that is stored in the electronic database, the CME will prepare annually monitoring reports for each CPA separately which will be submitted to the DOE for verification.

All data and information will be archived for each CPA separately until at least two years after the end of the last crediting period.

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

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

In addition to collecting, processing and archiving data and information from the CPA entity, the CME will also be responsible for the collection, processing and archiving of data and information for the calculation of the grid emission factor. In this context, the CME will collect data on a regular basis from the relevant sources and will carry out the relevant QA/QC procedures. The grid emission factor will be calculated and be used for the calculation of the emission reductions achieved by each CPA.

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

Organization	Standard Bank Plc
Street/P.O. Box	20 Gresham Street
Building	-
City	London
State/Region	-
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Telephone	+44 20 31456890
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E-mail	Co2@standardbank.com
Website	www.standardbank.com
Contact person	Fenella Aouane
Title	Senior Manager – Carbon Sales and Trading
Salutation	Ms.
Last name	Aouane
Middle name	-
First name	Fenella
Department	-
Mobile	+44 78 24434777
Direct fax	-
Direct tel.	+44 20 3145 6890
Personal e-mail	Fenella.Aouane@standardbank.com

Appendix 2: Affirmation regarding public funding

No public funding involved in the project activity.

Appendix 3: Application of methodology(ies)

No additional information

Appendix 4: Further background information on ex ante calculation of emission reductions

The combined margin CO_2 emission factor for the South African grid ($EF_{grid,CM,y}$) was calculated using the *Tool to calculate the emission factor for an electricity system* (version 02.2.1). The following steps were taken:

Step 1. Identify the relevant electricity systems

For calculating the grid emission factor, the project activity has identified the South African national grid as the relevant project electricity system.

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

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

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

The project activity has selected Option I and only grid power plants were included in the calculation.

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

The *Tool to calculate the emission factor for an electricity system* provides for the following methods to determine the operating margin (OM):

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

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

- Coal used in South African power plants is a cheap resource compared to other technologies e.g. natural gas/kerosene because South Africa is the 6th largest producer of coal in the world with one of the lowest coal prices in the world.[22]
- Coal power plants in South Africa have an average capacity factor higher than 75%. In line with international common practice, power plants with a capacity factor higher than 75% are considered as base-load power plants which are usually dispatched independently of the daily or seasonal load. Furthermore, Eskom Holdings Annual Report 2011 defines most of the coal power plants as baseload plants.

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

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

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

The average OM emission factor ($EF_{grid,OM\text{-}ave,y}$), is calculated as the average emission rate of all power

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

plants serving the grid, using the methodological guidance as described under (a) for the simple OM, but also including the low-cost/must-run power plants in all equations.

The average OM emission factor is calculated using equation 1

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

Where:

$EF_{grid,OM-ave,y}$	=	Average operating margin CO_2 emission factor in year y (tCO2/MWh)
$EG_{m,y}$	=	Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
$EF_{EL,m,y}$	=	CO_2 emission factor of power unit m in year y (tCO_2/MWh)
m	=	All grid power units serving the grid in year y
y	=	The relevant year as per the data vintage chosen in Step 3

Determination of $EG_{m,y}$

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

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

Gourikwa	Gas/Diesel Oil	-	5,817.00	-
Gariep	Hydropower	-	-	-
Vanderkloof	Hydropower	-	-	-
Colleywobbles	Hydropower	-	-	-
First Falls	Hydropower	-	-	-
Second Falls	Hydropower	-	-	-
Ncora	Hydropower	-	-	-
Koeberg	Nuclear	13,004,000	12,806,000	12,099,000
Klipheuwel	Wind	2,000	1,000	2,000
PetroSA biogas to energy	CDM	23,286	23,286	23,286
Bethlehem Hydroelectric project	CDM	8,983	8,983	8,983
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	CDM	3,744	3,744	3,744
Durban landfill gas Bisasar Road project	CDM	23,792	31,723	31,723
Total		**224,756, 730**	**228,828,053**	**232,394,838**

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

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

Option A1:

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

Where:

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

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

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

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

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

m	=	All grid power units serving the grid in year *y*
i	=	All fossil fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

Option A2:

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

Where:

$EF_{EL,m,y}$	=	CO_2 emission factor of power unit *m* in year *y* (tCO_2/MWh)
$EF_{CO2,m,i,y}$	=	Average CO_2 emission factor of fossil fuel type *i* in power unit *m* in year *y* (tCO2/GJ)
$\eta_{m,y}$	=	Average net energy conversion efficiency of power unit *m* in year *y* (ratio)
m	=	All grid power units serving the grid in year *y*
i	=	All fossil fuel types combusted in power unit *m* in year *y*
y	=	The relevant year as per the data vintage chosen in Step 3

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

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

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

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

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

Type	***NCV (GJ/kg)***	$EF_{co2,i,y}$ ***(tCO2/GJ)***
Coal (Other bituminous coal)	0.0199	0.0895
Gas (Jet kerosene)	0.042	0.0697
Gas/Diesel Oil	0.0414	0.0726

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

	$EF_{CO2,m,i,y}$	$\eta_{m,y}$	$EF_{el,m,y}$
Acacia	0.0697	30%	0.84
Port Rex	0.0697	30%	0.84
Ankerlig	0.0726	39.5%	0.66
Gourikwa	0.0726	39.5%	0.66

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

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

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

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

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

Where:

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

The table below provides an overview of the power plants connected to the South African electricity system.

Number	Project Name	Type	Commissioning Date
1	Bethlehem hydroelectric project	Hydro	11/11/09
2	Durban landfill gas Bisasar Road project	Land Fill Project	03/01/08
3	PetroSA biogas to energy	Waste water	09/01/07
4	Gourikwa	Gas fuel	30/03/2007
5	Ankerlig	Gas fuel	29/03/2007
6	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	-
7	Klipheuwel	Wind	Aug-02
8	Majuba	Coal	01/04/1996
9	Kendal	Coal	01/10/1988
10	Palmiet	Pumped storage	18/04/1988
11	Matimba	Coal	04/12/1987
12	Lethabo	Coal	22/12/1985
13	Tutuka	Coal	01/06/1985
14	Colleywobbles	Hydropower	01/01/1985
15	Koeberg	Nuclear	21/07/1984
16	Ncora	Hydropower	01/03/1983
17	Drakensberg	Pumped storage	17/06/1981
18	Duvha	Coal	18/01/1980
19	Matla	Coal	29/09/1979

20	Second Falls	Hydropower	01/04/1979
21	First Falls	Hydropower	01/02/1979
22	Vanderkloof	Hydropower	01/01/1977
23	Port Rex	Gas fuel	30/09/1976
24	Acacia	Gas fuel	13/05/1976
25	Kriel	Coal	06/05/1976
26	Arnot	Coal	21/09/1971
27	Gariep	Hydropower	08/09/1971
28	Hendrina	Coal	12/05/1970
29	Grootvlei	Coal	30/06/1969
30	Camden	Coal	21/12/1966
31	Komati	Coal	06/11/1961

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

	Name	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,y (MWh/y)***
1	Gourikwa	Gas fuel	30/03/2007	0%	0
2	Ankerlig	Gas fuel	29/03/2007	0%	0
3	Klipheuwel	Wind	01/08/2002	0%	2,000
4	Majuba	Coal	01/04/1996	11%	24,632,585
5	Kendal	Coal	01/10/1988	22%	25,648,258
	Total				**50,282,843**

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

	Name	**Technology**	**Year of Commissioning**	**Cumulative %**	***EGm,y (MWh/y)***
1	Gourikwa	Gas fuel	30/03/2007	0.000%	0.00
2	Ankerlig	Gas fuel	29/03/2007	0.000%	0.00
3	Klipheuwel	Wind	01/08/2002	0.001%	2,000
CDM	Bethlehem hydroelectric project	Hydro	11/11/2009	0.005%	8,983
CDM	Durban landfill gas Bisasar Road project	Land Fill Project	01/03/2008	0.018%	31,723
CDM	PetroSA biogas to energy	Waste water	10/01/2008	0.028%	23,286
CDM	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project	-	0.030%	3,744
	Total	***AEG $SET_{sample\text{-}CDM}$***			***69,736***

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

Number	Name	Technology	Year of Commissioning	Cumulative %	*EGm,y (MWh/y)*
1	Gourikwa	Gas fuel	30/03/2007	0.00%	-
2	Ankerlig	Gas fuel	29/03/2007	0.00%	-
3	Klipheuwel	Wind	01/08/2002	0.00%	2,000.00
	Bethlehem hydroelectric project	Hydro	11/11/2009	0.00%	8,983.13
	Durban landfill gas Bisasar Road project	Land Fill Project	03/01/2008	0.02%	31,723.20
	PetroSA biogas to energy	Waste water	10/01/2007	0.03%	23,285.54
	Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land Fill Project		0.03%	3,744.00
4	Majuba	Coal	01/04/1996	10.63%	24,632,585
5	Kendal	Coal	01/10/1988	21.67%	25,648,258
	Total	***AEG $_{SETsample\text{-}CDM>10years}$***			***50,350,579***

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

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

Where:

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

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

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

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

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

Name	***Technology***	$EF_{el,m,y}$ ***(tCO2/MWh)***	$EG_{m,y}$ ***(MWh/y)***
Gourikwa	Gas fuel	0.66	-
Ankerlig	Gas fuel	0.66	-
Klipheuwel	Wind	-	2,000
Bethlehem hydroelectric project	Hydro	-	8983
Durban landfill gas Bisasar Road project	Land fill	-	31723
PetroSA biogas to energy	Waste water	-	23286
Durban Landfill-gas-to-electricity project – Mariannhill and La Mercy Landfills	Land fill	-	3744
Majuba	Coal	0.91	24,632,585
Kendal	Coal	0.91	25,648,258
Total	***AEG SETsample-CDM>10years***		***50,350,579***

Step 6: Calculate the combined margin emission factor

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

The combined margin emissions factor is calculated as follows:

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

Where:

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

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

- Wind and solar power generation project activities: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature) for the first crediting period and subsequent crediting periods;
- All other projects: $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

Appendix 5: Further background information on the monitoring plan

No additional information

Appendix 6: Further baseline information

Integrated Resource Plan 2010-2030

The following describes the forecasted generation scenario in a more detailed manner for every year until 2030.

	Committed build											New build options										
	RTS Capacity (coal)	Medupi (coal)	Kusile (coal)	Ingula (pumped storage)	DOE OCGT IPP (diesel)	Co-generation, own build	Wind	CSP	Landfill, hydro	Sere (wind)	Decommissioning	Coal (PF, FBC, Imports)	Gas CCGT (natural gas)	OCGT (diesel)	Import Hydro	Wind	Solar PV	CSP	Nuclear	Total new build	Total system capacity	Peak demand (net sent-out) forecast	Demand Side Management
	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
2010	380	0	0	0	0	260	0	0	0	0	0	0	0	0	0	0	0	0	0	640	44535	38885	252
2011	679	0	0	0	0	130	0	0	0	0	0	0	0	0	0	0	0	0	0	809	45344	39956	494
2012	303	0	0	0	0	0	300	0	100	100	0	0	0	0	0	0	300	0	0	1103	46447	40995	809
2013	101	722	0	333	1020	0	400	0	25	0	0	0	0	0	0	0	300	0	0	2901	49348	42416	1310
2014	0	722	0	999	0	0	0	100	0	0	0	500	0	0	0	400	300	0	0	3021	52369	43436	1966
2015	0	1444	0	0	0	0	0	100	0	0	-180	500	0	0	0	400	300	0	0	2564	54933	44865	2594
2016	0	722	0	0	0	0	0	0	0	0	-90	0	0	0	0	400	300	100	0	1432	56365	45786	3007
2017	0	722	1446	0	0	0	0	0	0	0	0	0	0	0	0	400	300	100	0	2968	59333	47870	3420
2018	0	0	723	0	0	0	0	0	0	0	0	0	0	0	0	400	300	100	0	1523	60856	49516	3420
2019	0	0	1446	0	0	0	0	0	0	0	0	250	237	0	0	400	300	100	0	2733	63589	51233	3420
2020	0	0	723	0	0	0	0	0	0	0	0	250	237	0	0	400	300	100	0	2010	65599	52719	3420
2021	0	0	0	0	0	0	0	0	0	0	-75	250	237	0	0	400	300	100	0	1212	66811	54326	3420
2022	0	0	0	0	0	0	0	0	0	0	-1870	250	0	805	1143	400	300	100	0	1128	67939	55734	3420
2023	0	0	0	0	0	0	0	0	0	0	-2280	250	0	805	1183	400	300	100	1600	2358	70297	57097	3420
2024	0	0	0	0	0	0	0	0	0	0	-909	250	0	0	283	800	300	100	1600	2424	72721	58340	3420
2025	0	0	0	0	0	0	0	0	0	0	-1520	250	0	805	0	1600	1000	100	1600	3835	76556	60150	3420
2026	0	0	0	0	0	0	0	0	0	0	0	1000	0	0	0	400	500	0	1600	3500	80056	61770	3420
2027	0	0	0	0	0	0	0	0	0	0	0	250	0	0	0	1600	500	0	0	2350	82406	63404	3420
2028	0	0	0	0	0	0	0	0	0	0	-2850	1000	474	690	0	0	500	0	1600	1414	83820	64867	3420
2029	0	0	0	0	0	0	0	0	0	0	-1128	250	237	805	0	0	1000	0	1600	2764	86584	66460	3420
2030	0	0	0	0	0	0	0	0	0	0	0	1000	948	0	0	0	1000	0	0	2948	89532	67809	3420
TOTAL	1463	4332	4338	1332	1020	390	700	200	125	100	-10902	6250	2370	3910	2609	8400	8400	1000	9600	45637			

Figure 16. Integrated Resource Plan 2010-2030

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History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the programme design document form for small-scale CDM programmes of activities" (EB 66, Annex 13).
01	EB33, Annex43 27 July 2007	Initial adoption.
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